Supporting the development of social-emotional competencies through technology

DISSERTATION

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by

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Erklärung zur Verfassung der Arbeit

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Published work

Elements of my PhD research have been published in the form of journal, conference, and extended abstract papers over the last 4 years. Starred papers are directly included or reworked as chapters in this thesis.

Journal publications:

*(1) **P. Slovák**, G. Fitzpatrick. Teaching and Developing Social and Emotional Skills with Technology. ACM Transactions on Computer-Human Interactions (TOCHI), 22, 4, Article 19 (June 2015), 34 pages. **Chapter 4**.

(2) H. Schnadelbäch, **P. Slovák**, G. Fitzpatrick, N. Jäger. The immersive effect of adaptive architecture. Pervasive and Mobile Computing, 2014, Elsevier.

* D. Murphy, **P. Slovák**, A. Thieme, P. Olivier, D. Jackson, and G. Fitzpatrick. Developing new technology to enhance learning helping skills in psychotherapy education. *In submission to the APA Training and Education in Professional Psychology journal.* **Chapter 8**.

Peer-reviewed conference publications:

*(3) **P. Slovák**, C. Frauenberger, G Fitzpatrick. Reflective Practicum: A Framework of Sensitising Concepts to Design for Transformative Reflection. Accepted to CHI'17. *Best paper nomination.* **Chapters 9 and 10**.

*(4) **P. Slovák**, K. Rowan, C. Frauenberger, R. Gilad-Bachrach, M. Doces, B. Smith, R. Kamb, G. Fitzpatrick. Scaffolding the scaffolding: Supporting children's social-emotional learning at home. CSCW'16, pages 1751-1765, ACM. **Chapter 6**

*(5) **P. Slovák**, R. Gilad-Bachrach, G. Fitzpatrick. Designing Social and Emotional Skills Training: The Challenges and Opportunities for Technology Support. CHI'15, pages 2797-2800, ACM. **Chapter 5**

*(6) **P. Slovák**, A. Thieme, P. Tennent, P. Olivier, G. Fitzpatrick. On Becoming a Counsellor: Challenges and Opportunities to Support Interpersonal Skills Training. CSCW'15, pages 1336-1347, ACM. **Chapter 7**

(7) **P. Slovák**, P. Tennent, S. Reeves, G. Fitzpatrick. Exploring Skin Conductance Synchronisation in Everyday Interactions. In NordiCHI'14, pages 511-520, ACM.

(8) **P. Slovák**, J. Janssen, and G. Fitzpatrick. Understanding heart rate sharing: towards unpacking physiosocial space. In CHI'12, pages 859-868, ACM.

Accepted workshop proposals:

(9) **P. Slovák**, G. Wadley, D. Coyle, A. Thieme, N. Yamashita, R. Lederman, S. Schutt, M. Doces, G. Fitzpatrick. Developing Skills for Social and Emotional Wellbeing. In CHI EA '15, pages 2397-2400, ACM.

(10) A. Thieme, J. Vines, J. Wallace, R. Clarke, **P. Slovák**, J. McCarthy, M. Massimi, A. Parker. Enabling Empathy In Health And Care: Design Methods And Challenges. Workshop at CHI EA '14, pages 139-142, ACM.

Peer-reviewed workshop papers:

(11) **P. Slovák**, R. Gilad-Bachrach, M. Doces, G. Fitzpatrick. Intervening for Wellbeing: Developing Social-Emotional Competencies with Technology. In CHI'16 Workshop on Computing and Mental Health Workshop.

(12) **P. Slovák**. Supporting Teaching And Learning Of Situational Empathy By Technology. In CHI'14 Doctoral Consorcium.

(13) **P. Slovák**, P. Tennent, G. Fitzpatrick. Supporting Empathetic Interactions Between Doctors and Patients. In CHI'13 Workshop on Patient-Clinician Communication.

(14) **P. Slovák**, P. Tennent, G. Fitzpatrick. Do Lab Effects Transfer into the Real-world? And Should We Care? In CHI'13 RepliCHI Workshop.

(15) **P. Slovák**, J. Janssen, and G. Fitzpatrick. Improving Social Connectedness: Sharing Physiological Signals. In CHI'12 Workshop on Interaction Design and Emotional Wellbeing.

Abstract

Social-emotional competencies—such as self-control, perseverance, or empathy—are a basic requirement for a happy and fulfilling life. This has been increasingly recognised by researchers, national governments including the UK and US, as well as international organisations such as OECD. This PhD research investigates the potential of technology in supporting development of such social-emotional competencies.

The HCI research on this topic has been limited so far and only very little is known about what are the key challenges involved in developing SE competencies, if and how technology could meaningfully help address these, and what would be the underlying learning mechanisms guiding development of such systems. In contrast, a burgeoning body of literature in Prevention Science and Educational Psychology is concerned with the psychological mechanisms underpinning the development of SE competencies.

To understand the opportunity for technology at the intersection of these fields, the presented research is grounded in two long-term case studies of existing SE programs:

(i) **universal prevention programs in primary schools**, where the students are taught basic life skills, such as self-awareness, self-regulation or relationship skills; and

(ii) a **masters counselling course**, where the future therapists are going through an in-depth, sophisticated training aimed to develop expert social-emotional competencies.

By investigating and developing technologies across two such diametrically different contexts in terms of student capabilities and the depth of SE competencies targeted, I aimed to understand what might be common challenges and mechanisms that are transferable across SEL contexts.

The thesis research contributes to the knowledge in HCI on two interrelated levels: First, it provides an in-depth understanding of the two learning contexts including in-the-wild deployments of proof-of-concept systems bringing the novel focus on facilitating social-emotional learning. Second, it draws out a conceptual framework that suggests potential strategies to designing SEL support systems more broadly. The basis for this framework is Schön's notion of reflective practicum, which is used as a sensitising concept to highlight the shared strategies and curricular components underpinning learning across the two contexts.

Kurzfassung

Sozial-emotionale Kompetenzen - wie Selbstbeherrschung, Beharrlichkeit oder Empathie - sind eine Grundvoraussetzung für ein glückliches und erfülltes Leben. Dies wurde zunehmend von Forschern, nationalen Regierungen einschließlich des Vereinigten Königreichs und der USA sowie von internationalen Organisationen wie der OECD anerkannt.

Diese Doktorarbeit untersucht das Potenzial der Technologie zur Unterstützung der Entwicklung solcher sozial-emotionalen Kompetenzen. Die HCI-Forschung zu diesem Thema ist immer noch begrenzt und man weiß nur sehr wenig darüber, was die Schlüsselherausforderungen bei der Entwicklung von SE-Kompetenzen sind, ob und wie die Technologie sinnvoll dazu beitragen könnte, und was würden die zugrundeliegenden Lernmechanismen sein, die die Entwicklung solcher Systeme leiten werden. Im Gegensatz dazu befasst sich viel Literatur in der Präventionswissenschaft und der Pädagogischen Psychologie mit den psychologischen Mechanismen, die die Entwicklung von SE-Kompetenzen unterstützen.

Um die Chance für Technologie am Schnittpunkt dieser Felder zu verstehen, basiert die vorliegende Arbeit auf zwei Langzeit-Fallstudien zu bestehenden SE-Programmen:

(i) **universelle Präventionsprogramme in Grundschulen**, wo die Studenten grundlegende Lebenskompetenzen wie Selbstbewusstsein, Selbstregulierung oder Beziehungsfähigkeit unterrichtet werden; und

(ii) a **Magister-Beratung-Kurs**, wo die zukünftigen Therapeuten durch eine tiefgehende, anspruchsvolle Ausbildung gehen, um fachliche sozial-emotionale Kompetenzen zu entwickeln.

Durch die Erforschung und Entwicklung von Technologien in zwei so unterschiedlichen Kontexten in Bezug auf die Fähigkeiten der Schüler und die Tiefe der SE-Kompetenzen zielte ich an die Verständnis, was gemeinsame Herausforderungen und Mechanismen sein könnten, die über SEL-Kontexte übertragbar sind.

Die Dissertationsforschung trägt zum Wissen in der HCI auf zwei miteinander verbundenen Ebenen bei: Erstens bietet sie ein tiefes Verständnis der beiden Lernkontexte, einschließlich der „in-the-wild" Implementierungen von „proof-of-concept" Systemen, die den neuen Schwerpunkt auf die Erleichterung des sozial-emotionalen Lernens bringen. Zweitens erarbeitet sie einen konzeptionellen Rahmen, der potenzielle Strategien für eine breitere Gestaltung von SEL-Unterstützungssystemen vorschlägt. Grundlage dieses Rahmens ist der Schön's Begriff des reflektierenden Praktikums, der als sensibilisierendes Konzept verwendet wird, um die gemeinsamen Strategien und die curricularen Komponenten zu unterstreichen, die das Lernen in den beiden Kontexten untermauern.

Acknowledgements

This research wouldn't be possible without the help and support of so many wonderful colleagues, friends, and mentors.

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Much of the research presented here draws on long-term international collaborations. In no specific order (and, no doubt, unwittingly omitting others), I am immensely grateful to David Murphy, Paul Tennent, Stuart Reeves, Holger Schnädelbach, Mary Czerwinski, Ran Gilad-Bachrach, Kael Rowan, Anja Thieme, Daniel Jackson, Patrick Olivier, David Coyle, Mia Doces, Brian Smith, Rachel Kamb, Paul Marshall, and Katie Salen. Each of the above mentioned individuals has generously shared their expertise to help me better understand their respective field as well as their research perspective more broadly.

I am also thankful to everyone at the HCI Group in Vienna for providing me such a friendly and vibrant place to work. I am particularly grateful to Chris Frauenberger for the energy and thoughtfulness he brought to any shared endeavour, as well as continually challenging and deepening my own thinking process during our lively discussions.

Last but not least, none of this would happen if it weren't for my family: to Radka, who has endured my long work hours—coupled with an occasional 3 months internship—with grace and was always happy to have me back; to my lovely daughter, who contributed to my sleep-is-overrated training and is such a joy to come home to; and to my parents for helping me find my own way but always being there to support me if anything went wrong.

Contents

Part I

Introductory chapters

CHAPTER 1

Introduction

Social-emotional competencies—such as self-control, perseverance, or empathy—are a basic requirement for a happy and fulfilling life. This has been increasingly recognised by Prevention Science researchers (e.g., Seligman et al. (2009); Durlak et al. (2011)), national governments (Weare and Nind, 2011; Durlak et al., 2015) as well as international organisations such as OECD (OECD, 2015). Indeed, failure to sufficiently develop these competencies early in life can lead to mental-health disorders (e.g., depression, anxiety) and risky behaviours such as substance abuse, delinquency (Adi et al., 2007). In contrast, well-developed social-emotional competencies are among drivers of important social outcomes, such as physical health, well-being, academic and work achievements, and civic engagement (OECD, 2015; Durlak et al., 2011).

This thesis investigates the potential of technology in supporting development of such social-emotional (SE) competencies. Despite the long history of supporting interpersonal interaction in HCI and CSCW, only very little is known about what are the key challenges involved in developing SE competencies, if and how technology could meaningfully help address these, and what would be the underlying learning mechanisms and design principles guiding development of such systems. In other words, while many existing HCI systems rely on the SE competencies users bring to the table, these are largely taken for granted. Only a few existing projects consider whether and how the development of these underlying skills could be supported through technology (see e.g., Pina et al. (2014); Bouchard et al. (2012); Hoque et al. (2013); Core et al. (2006) for recent exceptions).

In contrast, a burgeoning body of literature in Prevention Science and Educational Psychology is concerned with the psychological mechanisms underpinning the development of SE competencies. These theoretical approaches have also been transformed into evidence-based programs that support a broad set of social and emotional skills needed for adult life and are widely deployed. For example, 44% of a representative nation-wide sample of US teachers reported that a social-emotional program is taught on a school-wide, programmatic basis in their school (Bridgeland et al., 2013). However to date, very little if any technology is used in the current curricula.

There is a substantial (and under-researched) opportunity for technology at the intersection of these fields. To investigate this potential, the research in this thesis explores how SE competencies are taught in existing formal programs, what challenges the learners face, and how technology can be meaningfully brought in to support the learning in the real-world learning contexts. The empirical part of this thesis is grounded in two case studies of established curricula:

(i) **universal prevention programs in primary schools**, where the students are taught basic life skills, such as self-awareness, self-regulation or relationship skills (Slovák and Fitzpatrick, 2015; Slovák et al., 2015a, 2016); and

(ii) a **masters counselling course**, where future therapists are going through an in-depth, sophisticated training aimed at developing expert social-emotional competencies (Slovák et al., 2015b).

By investigating and developing technologies across two such diametrically different contexts in terms of student capabilities and the depth of SE competencies targeted, I am interested to understand what might be common challenges and mechanisms of learning that are transferable across SEL contexts. The goal of this research is then to contribute to HCI on two interrelated levels: First, it contributes in-depth understanding of the two learning contexts gained through long-term user-centred design processes, spanning observations, interviews, design workshops as well as technology probe deployments 'in-the-wild'. Second, it draws out a broader conceptual framework, grounded in the empirical data and experiential learning literature, that suggests potential strategies for designing technology-enabled SEL interventions.

The remainder of this chapter will start by motivating the real-world impact of social-emotional skills; state the problem, approach, and contributions of the research including

the inter-disciplinary context this research fits in; and finally outline what is to come in the rest of the dissertation.

1.1 Motivation

Social and emotional competencies refer to a variety of abilities that are crucial for our everyday life and wellbeing (Weare and Nind, 2011; Adi et al., 2007; Damon and Eisenberg, 2006), including skills such as those related to emotional intelligence, interpersonal and communication skills, but also skills such as self-control, mindfulness and empathy. Although we don't necessarily consciously think about it that way, these skills are something we develop throughout our life; and are also at the core of particular professions such as psychotherapy.

To illustrate the magnitude of effects social-emotional competencies can have on life outcomes, we describe the research around self-regulation as one example: Self-regulation denotes a cluster of psychological abilities that enable the individual to manage stress, control impulses, motivate themself, and set as well as work towards achieving personal goals. Low self-control is consistently associated with a variety of negative outcomes: it is seen as a central causal variable in crime theory, characterizing law-breakers (Buckner et al., 2003); it predicts unemployment, early mortality including suicidal tendencies (Pisani et al., 2013); academic under-achievement (Diamond et al., 2007); as well as psychiatric disorders, and unhealthy behaviors, such as overeating, smoking, unsafe sex, and drunk driving (Moffitt et al., 2011; de Ridder et al., 2012; Wyman et al., 2010). Already by the start of elementary school[1], children can differ markedly in their ability to self-regulate (Noble et al., 2007), and such early-onset differences are predictors for the later negative outcomes listed above (Moffitt et al., 2011; Buckner et al., 2003). In contrast, well-developed self-regulation is a substantial preventive factor against the negative effects above. For example, self-control is a defining characteristic of resilience for youth living in poverty (Buckner et al., 2003; Hackman et al., 2010), and is associated with improved

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[1]In addition, living in under-privileged conditions, such as in poverty, is a key risk factor for low self-regulation both in childhood and later in life (Diamond et al., 2007; Hackman et al., 2010). Already by kindergarten age, children from low socioeconomic status (SES) families are behind in self-control skills relative to middle-class peers, and fall progressively further behind over the school years (O'Shaughnessy et al., 2003; Shaw and Shelleby, 2014). Given the strong effects of self-regulation on a variety of life outcomes (cf., Moffitt et al. (2011)), such early-age differences in abilities can reinforce the accomplishment gap between middle and low-SES children, and facilitate a negative family spiral of staying in poverty across multiple generations (Buckner et al., 2003).

health and better coping strategies (Baumeister et al., 2007). In addition, self-control is instrumental in creating positive habits (Fujita, 2011), leading to greater psychological well-being, more academic success, and better interpersonal relations (de Ridder et al., 2012; Mischel et al., 1988; Moffitt et al., 2011).

While underdeveloped SE competencies are a strong risk-factor for a number of negative outcomes, they do not necessarily map out the life course. A body of literature in Psychology shows that social-emotional competencies including self-regulation are malleable: there are evidence-based interventions that can change people's ability to self-regulate (e.g., Wyman et al. (2010); Diamond et al. (2007); Webster-Stratton and Hammond (1997)); as well as develop SE competencies more broadly (e.g., Durlak et al. (2011)). Moreover, even small improvements in SE competencies in early life can lead to large positive differences in individual life outcomes for both at-risk and general populations (Moffitt et al., 2011), with accumulating impacts at the societal level (Belfield et al., 2006) across the lifespan.

Promoting the development of social-emotional competencies (including self-regulation) has thus become a priority for national governments (National Institute for Health and Clinical Excellence, 2008) and international organisations such as OECD (OECD, 2015) or WHO (Clarke et al., 2015). This is pertinent to both learning within early education (where the largest impacts might be achieved), as well as programs developing these competencies across the lifespan.

Drawing on the combination of research and policy level support, a number of school-based prevention programs have been designed and deployed with promising results in Randomised Control Trials (RCTs), showing long-term positive effects over decades (Durlak et al., 2011). As one example, the Perry Program focused on low-SES populations and found that the program group had only a third of the incarceration rates in comparison with a control group (6% vs. 17%), as well as substantially higher earnings, more stable family relationships, and better health 40 years after the intervention (Belfield et al., 2006; Muennig et al., 2009).

While effective, the existing social-emotional learning programs are however very resource intensive. As argued in more detail in the rest of this thesis, **a principal challenge for existing SEL programs in primary school and adult variants such as counselling training is to provide the learners with effective support**

for the necessary experiential learning in everyday contexts and beyond the in-person lessons (Bar-On et al., 2007; Jones and Bouffard, 2012; Patrikakou et al., 2005). In particular, learners must be provided with on-going, in-the-moment scaffolding to promote learning during suitable 'teachable moments' in order to transfer the new competencies into everyday life. This critical role is currently left to in-person coaching, making existing programs highly time- and resource-intensive and substantially limiting the scale and impact the SEL programs could have (Durlak et al., 2011; Jones and Bouffard, 2012; Slovák and Fitzpatrick, 2015).

Recent related work in HCI—such as in mental health settings (e.g., Coyle et al. (2007); Kientz et al. (2013)) as well as health behavioural change and Personal Informatics more broadly (e.g., Klasnja et al. (2011); Hekler et al. (2013); Matthews et al. (2014))—strongly suggest that digital technology has the potential to serve as a scalable method of intervention support applicable beyond in-class settings. However, very little if any technology has been directly designed to support SE development so far (Slovák et al., 2015a; Slovák and Fitzpatrick, 2015; Stern et al., 2015). In fact, this thesis research is—to best of our knowledge—the first in HCI to explore the emerging potential for technology-based support of social-emotional competencies (cf. Slovák and Fitzpatrick (2015)), developing a theoretical and practical understanding of the role digital technology can play in this space.

1.2 Research questions and approach

Given that little work in HCI has so far focused on how technology could contribute to developing social-emotional competencies, it is not clear what the needs, opportunities, and challenges for technology-based systems are in this space. Understanding these aspects is a crucial first step towards developing technology-enabled SE learning systems. However, it presents a challenging problem requiring a strongly interdisciplinary approach.

To address this gap, the research presented in this thesis builds on user-centred design methods from Human-Computer Interaction (HCI) to develop and deploy new computing applications in ways that are considerate and mindful of those using them; while drawing on social science disciplines, in particular Prevention Science and Educational Psychology, to provide the theoretical and foundational methods and mechanisms for developing social-emotional competencies. In doing so, the thesis research explores four overarching

research questions:

RQ1 *What are the underlying psychological principles that drive development of SE competencies within existing curricula, and how can these be interpreted for design?*

RQ2 *How are the learning situations for developing SE competencies orchestrated, and what are the general challenges that the learners face within existing curricula?*

RQ3 *Which of such existing challenges can plausibly be addressed by technology in real-world settings and how?*

RQ4 *Moving beyond the context of individual curricula, can we abstract a set of concepts guiding design of technology-enabled SEL systems more broadly?*

The answers to **RQ1-3** are predominantly grounded in the empirical part of the research (Part II, chapters 4-8), where we worked within two long term (24+ months) case studies: universal SEL programs in primary education, and a masters program in counselling. These were selected as providing two different angles on SE competencies development in terms of depth of the competencies taught as well as resources available: The SEL in education aims for basic life skills taught to whole school populations; while the counselling program develops expert master level competencies with highly selective entrance exams. We expected that such a contrast will help us identify the underlying learning mechanisms common across domains, as part of answering RQ4. In each of these two settings, we deployed user-centred design processes with a strong emphasis on understanding the *problem space* for that particular context by investigating the learning processes, existing challenges, and the opportunities for technology within the particular learning settings. These findings were then complemented by developing technology-probe artifacts that were deployed 'in-the-wild' to contribute to the initial considerations of the *design space*. In summary, the series of studies provides situated knowledge and design exemplars in its respective context and design context.

Building on such empirical data, we address **RQ4** by combining the findings from the two case studies with additional bodies of literature; drawing on Schön's notion of *reflective practicum* (Schön, 1983, 1987) in particular. We abstract key strategies and curricular components across the case studies with the aim of suggesting a conceptual framework to guide design of technology-based interventions (Part III, chapters 9 and 10). In doing so, we draw on the long history within HCI (cf., for example, Höök and Löwgren (2012); Stolterman and Wiberg (2010); Dalsgaard and Dindler (2014)) of triangulating existing theories, the designed technology, and empirical user studies *to abstract conceptual*

frameworks that go beyond the particular prototypes and can inform design of future systems.

1.3   Findings and contributions

This research contributes original ideas, knowledge, and practices to HCI on two different levels: first the situated design knowledge from the case studies; and second the abstracted conceptual framework to guide design of SEL technologies.

Level 1: Situated design knowledge as part of case studies (RQ1-3)

The empirical work identifies *localised learning mechanisms and the associated challenges* within each of the two case studies, with particular emphasis on *highlighting those that could be addressed by technology*. We briefly outline the results in each case study below:

SEL in education (Chapters 4-6)   The curricula depend mostly on in-class, scripted lessons delivered over longer periods of time (e.g., 20 minute lesson twice a week over the whole year). The learning strategies strongly rely on experiential role-plays, in-the-moment coaching from an adult such as the teacher, and 'mental tools' (Vygotsky, 1987). Through these methods, curricula aim to include extensive examples and opportunities for personal experience and practice, combined with feedback and opportunities for reflection on behaviour and progress.

The key challenge identified across the universal prevention programs lies in *the lack of scalable techniques to get beyond classroom-based learning and support the in-the-moment reinforcement and scaffolding of the learned strategies, that are needed for the competencies to be transferred from intervention to practice.* The critical role of providing this scaffolding and support is currently left to teachers and parents, requiring extensive face-to-face training to do so effectively (e.g., weekly workshop sessions over the period of at least 3 months).

The technology probe focussed on what was seen as a substantial current challenge by the SEL curricula developers: bridging the gap between classroom learning and at-home reinforcement of skills. In particular, it shows the potential to design technologies for facilitating both experiential engagement with an activity shared between the child and the parent, and 'scaffolding-the-scaffolding-role' of the parent. This includes helping the

parent to provide the necessary support for the child following best-practices within SEL, without the need for extensive training. In addition, our review work points to a number of other areas where technology could help address the challenges SEL curricula face, such as help learning identify teachable moments in everyday settings, promote reflection as well as provide safe-spaces for practice (cf., Slovák and Fitzpatrick (2015)).

SEL in counselling (Chapters 7-8)   The learning processes in counselling training had a strong experiential focus, emphasising the importance of designing the learning to help students directly experience what they learn about, and to deeply engage with and reach new insights about themselves through reflection. The program had very explicit strategies and tools to promote learning from experience, always closely tied to the particular teachable moment. It was also grounded in tutors' on-going modelling of counselling skills (e.g. being empathic, congruent, respectful to other's experiences) in all their interactions with the students.

The key challenge we identified in the counselling training program revolved around *supporting 'interpersonal reflection' in the context of practice counselling sessions*[2]. The reflection process is a complex, inherently social activity, where students need to deeply understand how their own actions have affected the client's thoughts and feelings, although these are generally not directly observable and need to be collaboratively established. However, access to clients' feedback beyond the practice session is difficult to achieve and the process lacks direct structural scaffolding to support reflection. This affects students' ability to 'close the reflection loops' quickly enough, hindering learning.

The technology probe focussed on supporting the reflection process through offering a custom-made annotation tool for students. Drawing on the user-centred design process, this revolved around making the reflection work tangible and directly tied with the underlying instances, offering the student options to request feedback from the client for specific moments, as well as to iteratively review and inquire into their previous engagement. It showcases how technology can be incorporated into a complex settings of existing learning practices, enhancing the opportunities for in-depth reflection on teachable moments. The resulting tool, mPath, is currently fully embedded in the

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[2]Practice counselling sessions were the crucial stage where counselling skills were developed in context. Such sessions took place in a 'triad', where three students took on the role of either a 'client', 'counsellor' or 'observer'. During the practice sessions, the student in the role of the 'client' was encouraged to talk about an existing issue they face, and the 'counsellor' would attempt to counsel him or her.

curriculum and deployed with the whole Masters cohort in Winter 2016 (this deployment is ongoing and as such, its results are not included in this thesis).

Level 2: Conceptual framework to guide design of SEL technologies (RQ4)

The results of this investigation highlight a number of shared learning mechanisms and challenges faced by SEL practitioners across different curricula, revolving around strategies to create meaningful teachable moments within the class settings, as well as appropriating such moments from naturally occurring everyday situations.

Drawing on the empirical data as well as learning literature within each of case studies, we argue that SE competencies development relies on **experiential learning** as one of the key learning principles. In essence, this is analogous to developing physical competencies, such as learning how to ride a bike: being told or shown people riding is not enough; one has to try it—repeatedly—oneself. Similarly, developing SE competencies depends on the learner experiencing meaningful 'teachable moments' while provided with in-the-moment support for reflection to turn these experiences into learning. The nature of SE competencies then necessitates these learning experiences to include either strong emotions or particular interaction with others (e.g., conflict).

To further elaborate the general emphasis on experiential learning, we argue that Schön's notion of 'reflective practicum' can serve as a useful sensitising concept (Blumer, 1954) to understand the underlying learning mechanisms in SEL curricula (Chapter 9). In particular, we discuss how the two key aspects of reflective practicum—the focus on understanding what constitutes 'right sort of' experience for the learners; and the interplay between different scaffolding structures within the learning program that then generate such experiences—can *help illuminate shared strategies and mechanisms underpinning the learning process that have not been identified within the empirical studies.* As such, the reflective practicum seems to provide a useful lens to highlight how the curricula across the two contexts draw on a broad set of evidence-based strategies and mechanisms to both generate meaningful 'teachable moments' and scaffold students' reflection on these; as well as help highlight the inherent challenges with developing SE competencies that are particular for the SE context—such as their intangibility, embeddedness in social interaction, and the role of (strong) emotions that disrupt reflection.

Moreover, this analysis suggests a path to *extend the concept of reflective practicum*

Characteristics of the 'right sort of' SEL experience	
Real enough	**But not too much**
The experience must be **meaningful for learning**:	The experience must be **available to be reflected with/on**:
In SEL this means eliciting actual emotions and/or interpersonal interaction for the learners.	This requires the opportunities for reflection-in/on-action, which includes the ability for safe exploration of alternative actions and thus 'closing of the reflective loop'.

Three components of SEL reflective practicum		
Explicit	**Social**	**Personal**
Approach: Explicit components directly re-structure or shape the experiences of the learners.	**Approach:** Social components provide supportive learning environment and a set of learning resources the learners draw on.	**Approach:** Personal components draw on learners' existing compentencies including ability to reflect and motivation to engage.
Methods: Provide specific tasks or tools to shape situations learners go through as well as directly scaffold the reflection process.	**Methods:** Providing access to peer support, expert in-the-moment feedback, as well as faciliating creation of social norms that promote learning.	**Methods:** Other aspects of the curriculum rely on expected personal competencies; or need to compensate lack of these with explicit and social components.
Examples: Role-plays, mental tools, specifically designed social situations (such as practice counselling sessions)	**Examples:** Learning contract in counselling, coaching by teachers or parent, mechanisms to promote peer support.	**Examples:** Reliance on students' strong reflective abilities in counselling, the lack of these and associated need for coaching in education.

Figure 1.1: Overview of the conceptual framework

Questions	
What constitutes a real-enough experience?	**How available are the experiences for reflection-in/on-action?**
Q1: What characteristics make the experience 'real-enough'?	Q4: Is emotional entanglement likely?
Q2: How 'real' should the experience feel?	Q5: How directly visible/tangible is the process of doing?
Q3: How much balancing support should be available?	Q6: How easy is it to close the reflection loops?
How are the experiences achieved -- generated or appropriated?	

Roles for technology	
Explicit components	R1: Generate emotional/interpersonal experiences
	R2: Appropriate the naturally occurring experiences
	R3: Directly scaffold the reflection process
Social components	R4: Scaffolding mentors' scaffolding role
	R5: Support establishing learning culture and peer support
Personal components	R6: Supporting motivation to engage

Figure 1.2: Guiding questions and suggested roles for technology

towards identifying appropriate roles of technology to support SE competency development (Chapter 10): We show how the identified curricular components (explicit, social, personal) point to possible roles that technology might play in scaffolding the selected experiences, suggesting how we might translate the strategies used in the (non-technological) curricular components into plausible directions for technology scaffolding. Figures 1.1 and 1.2 provide an overview of the full framework developed across chapters 9-10.

1.4 Overview of the dissertation

This is a cumulative thesis, whereby the empirical chapters are included in the form of peer-reviewed publications: these have been published in the TOCHI journal (1x), as

well as the CHI (2x) and CSCW (2x) conferences; in addition, one paper is under review for a psychology journal. The thesis is thus structured in three parts:

The **first part** includes this introductory chapter, followed by chapters focussing on Related Work (Chapter 2) and Methods (Chapter 3).

The **second part** of the thesis presents the published work. Chapter 4 starts by reviewing the basic concepts and approaches in SEL in education, with a particular emphasis on highlighting the existing gaps that could be meaningfully addressed by technology. Chapter 5 is based on an interview study with the developers of seven established, evidence-based SEL curricula, aiming to validate the literature review findings and identify challenges that SEL experts find particularly taxing. Chapter 6 then builds on these findings to design a technology probe addressing one such challenge, drawing on a participatory design process with expert SEL developers, and deployed in two different real-world settings.

Chapter 7 moves to the SEL in counselling context, describing a 2 year participatory design process through which we aimed to understand the challenges and mechanisms by which student counsellors develop their counselling skills. Chapter 8 then outlines an overview of the history and current use of technology in counselling training and then presents the final system that has been developed through the long-term participatory engagements.

The **final third part** of the thesis takes a step back to connect and analyse the findings across the two case studies. In Chapter 9, we compare the observations across the two case studies to identify learning mechanisms that seem to be operating within both case study contexts. In doing so, it draws on Schön's notion of reflective practicum, applying it as a sensitising concept that can serve as a useful lens to articulate such underlying mechanisms of learning. Chapter 10 then suggests a conceptual framework, extending the reflective practicum, to guide the design of technology-based systems for developing social-emotional competencies. The potential use of this framework is then illustrated in two contexts: first, focussing on follow-up projects arising from the research in this thesis; and second by showing how it can contribute to the current HCI debate around the ways to design for reflection. Chapter 11 summarises the thesis, drawing the main finding back to the four research questions outlined above, and discussing the broader implication of this work.

A survey of the literature

2.1 Introduction

Understanding how social and emotional skills are learned, and how this process can be supported by technology, is recently emerging area in HCI (cf., Slovák and Fitzpatrick (2015)). The growing interest in this topic is manifested by recent work around social skills learning in autism (Kientz et al., 2013), computerised Cognitive Behavioural Therapy (cCBT) (Coyle et al., 2007), positive computing (Calvo and Peters, 2014), as well as a number of individual systems aiming to affect particular instances of social behaviour such as discussion dominance or rapport during meetings (Balaam et al., 2011; Kim et al., 2008). Despite this growth over recent years, the existing body of work is still in early stages, and most of the research so far is limited in scope, focusing on specific disadvantaged populations such as people with autism. This leaves out other populations and settings where social and emotional skills learning is crucial – such as the two case study examples presented in this thesis.

In fact, to the best of our knowledge, only a handful of projects in HCI were specifically designed to develop social-emotional competencies for users beyond the mental health settings so far (see Section 2.2.2 for details). An important argument of this thesis is, however, that much of the existing HCI work is actually highly relevant and could fundamentally extend and enhance existing SE curricula. In particular, we argue that a substantial number of research projects in HCI have focused on aspects that could be

reinterpreted to scaffold development of social-emotional competencies, although this was not the original intention of the authors (see Slovák and Fitzpatrick (2015) in Chapter 4 and Chapters 9-10 for detailed arguments).

In what follows, the Related Work chapter will present an HCI-centric view, outlining what we know about technologies in support of SE competencies so far within the HCI field, and how the thesis focus fits into the landscape of HCI research more broadly. As the thesis develops, we will also bring in further substantial bodies of literature as part of the engagement with individual case-studies, as well as while combining the empirical data into a conceptual framework in the final part of the thesis. In particular, Chapter 4 provides an in-depth review of the existing (and potential) overlaps of SEL and HCI with a particular focus on school education (Slovák and Fitzpatrick, 2015). Chapters 7 and 8 ground the work in the context of counselling training in HCI (Slovák et al., 2015b) and psychology, respectively. Finally, Chapters 9 and 10 then connect the case study work by deeply drawing on theories of experiential learning, especially Schön's notion of reflective practicum (Slovak et al., 2017). This structure corresponds to the framing of the research in this thesis as understanding the problem space across multiple disciplines, arising from the thick descriptions in each of the two case studies.

Within the rest of this chapter we then address three HCI-related aspects: First, we start by discussing the existing HCI projects that aimed to support or facilitate SE development both within and beyond mental health settings, providing a starting point for the review paper in Chapter 4. Second, as the notion of technology-enabled reflection has turned out to be crucial within the two case studies, we briefly flag up the current discussions and gaps in knowledge around designing-for-reflection in HCI. These will be picked up again in Section 10.3.2. Finally, we position the focus on designing technology-enabled SEL systems within the recent 'turn to the wild' and 'third wave HCI' movements, preparing ground for the methodological implications discussed in Chapter 3.

2.2   Technology and social-emotional competencies

2.2.1   Supporting mental health therapies

A growing body of work has recently focused on technology support for both the process of therapy as well as the clients directly. For example, a number of projects have attempted

to provide an online-support for Cognitive Behavioural Therapy (CBT), with the aim to extend the *reach and engagement with* the therapeutic process (see e.g., Coyle et al. (2007); Doherty et al. (2012)). Similarly, technology is increasingly used in the area of autism interventions to target basic social and emotional competencies that are typically impaired in autism: for example, promoting basic collaboration (e.g., Piper et al. (2006)), core interpersonal acts such as eye-contact or turn taking (e.g., MOSOCO (Escobedo et al., 2012)), or self-reliance (e.g., Hong et al. (2012)). Here, the main motivation is that many people with autism have a natural affinity to the structured and predictable interactions technology can offer, thus reaching and engaging a population that is otherwise hard to reach and engage. Outside of the autism domain, researchers have for example looked at using Virtual Reality systems to support the training of people with anxieties such as Social Phobia (e.g., Klinger et al. (2005)), specific disorders such as bipolar disorder (e.g., Bardram et al. (2013)), and video-based training of interpersonal skills for parents of children with behavior problems (Kennedy et al., 2011).

The systems designed for mental health settings face specific challenges arising from the clinical contexts, such as the limited range of skills taught in autism interventions. The resulting systems are thus not directly applicable to more general populations and settings such as the universal prevention programs. The existing work in this domain however illustrates both the challenges and the potential of enhancing existing intervention programs through technology in real-world contexts, as well as the need to substantially re-interpret the existing approaches into technology-assisted interventions if they are to be successful (cf., Coyle et al. (2007)).

2.2.2 Technology enabled SE development

As outlined in detail in Chapter 4, the existing work on technology-enabled SE development is fragmented across multiple independent research streams, often driven by technological rather than educational agendas. This presents a disjointed mosaic of studies that are often limited to early prototypes, which have only rarely been deployed as (or as a part of) an existing training program. So although the areas outlined below can provide possible starting points for exploration of technology-enabled SEL development, we argue that *HCI still lacks a systematic understanding of how the core components of developing social-emotional competencies can be designed for and supported by technological means.* Here we review what we see as the most relevant directions, with Chapter 4 incorporating

these into the web of challenges and opportunities within SEL.

Responsive agents   Several studies within the responsive agents stream focused on developing agents to facilitate training situations relevant to socio-emotional competencies: For example, Johnsen et al. (2007) present an early exploration of opportunities offered by 'virtual humans' to augment the training of communication skills for medical students. The avatars took the role of standardized patients, used in medical education for both students' training and evaluation purposes. While multiple opportunities for use of the developed system were proposed, the research so far focused on validation of the technology (is the experience similar to a real standardized patient), but have not been deployed as an actual training tool (Johnsen et al., 2005, 2007). Similarly, Kim et al. (2009) developed a virtual human to support inter-cultural negotiation training for US Army soldiers deployed to Middle-East cultures. The system presented multiple scenarios, also incorporating in-the-moment coaching and post-session reflection, with preliminary tests showing improvements in knowledge for novice negotiators (Kim et al., 2009; Core et al., 2006). In all of these cases, the research focus seems to be on outlining the future potential of autonomous agents, and the dialogue AI underlying their behaviour, rather than on an in-depth understanding of the mechanisms through which technology could support SE competencies development.

Behaviour change and personal informatics   Research in the area of behaviour change and personal informatics has used sensors and other embedded technology to track relevant indicators (e.g., steps walked, time slept, or physiological indicators of stress) to *provide on-going feedback on real-world interactions that might otherwise be unavailable.* In terms of peoples' wellbeing and flourishing, the work has focused mostly on supporting physical factors, such as fitness (e.g., Consolvo et al. (2006)), diet (e.g., Hsu et al. (2014)), or sleep (e.g., Kay et al. (2012)) so far. However, a known limitation within this body of work is the lack of systematic understanding of how to scaffold the active reflection processes of the learner (cf., Baumer (2015)) that are core to social-emotional competency development — see also Section 2.3. These technologies pave the way for designing for change in everyday settings as well as approaches to utilise the emerging possibilities for on-going tracking and on-the-fly feedback.

Affective computing and bio-feedback A growing interest in automatically detecting socio-emotional aspects is manifested by the emergence of specific research sub-communities such as Affective Computing (AC) and Social Signal Processing (SSP). For example, Pina et al. (2014) developed an application providing in-the-moment support to parents of ADHD children when dealing with challenging parental situations. The system combined skin conductance measurements and machine learning to predict when a situation was likely to escalate, and then provided reminders of techniques the parents learnt as part of previous training[1]. Drawing on a similar approach of automated sensing and feedback, Hoque et al. (2013) developed and experimentally evaluated a system to improve non-verbal behavior during work interviews. Finally, in a rare example of a fully developed training program, Bouchard et al. (2012) explored the opportunities of a bio-feedback based self-regulation training for US soldiers, relying on a first-person shooter game to generate engagement and stress. Drawing on existing self-regulation strategies taught to soldiers, the bio-feedback was directly incorporated in the game, limiting the in-game field of view based on changes in arousal as measured by skin conductance. They provide evidence for how such a bio-feedback loop, together with calming exercises, helped soldiers not only to better manage their stress during the game, but also how these coping skills were transferred into real-world training situations: soldiers who have undergone such biofeedback training were significantly better than those trained by traditional techniques. These cases present the strong potential of technologies to sense and feedback novel biologically-based information to people, helping them interpret and reflect on their experiences. The effects are especially marked if such feedback is carefully designed as part of a broader training practice (cf., Bouchard et al. (2012)).

Emotional awareness A growing body of work has focused on developing systems to promote awareness of lived experiences (cf., Baumer et al. (2014); Fleck and Fitzpatrick (2009) for reviews). Such systems tend to incorporate sensors and other embedded technology to draw out patterns and information that usually stay hidden. For example, some studies have explored how an automated wearable camera device, SenseCam, can facilitate reflections on the day-to-day experiences (e.g., Fleck and Fitzpatrick

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[1]Interestingly, majority of the families still use the reminder system even without the bio-feedback component 2 years after the deployment (personal communication, Mary Czerwinski), suggesting that many of the benefits came from the situated reminders and embeddedness in the therapeutic regime rather the AC tracking.

(2009)); reminiscing on photo-diary entries (Isaacs et al., 2013); or exploring what can be interpreted from tapping into more visceral dimensions such as skin conductance and movement, together with mobile SMS, Bluetooth and pictures data (e.g., Stahl et al. (2008); McDuff et al. (2012); Sanches et al. (2010). Similarly, emerging work explored technology-mediated meditation and mindfulness practices (Vidyarthi et al., 2012; Thieme et al., 2013), as well as positive psychology exercises (Munson et al., 2010). Overall, these projects show the potential of technology to promote emotional self-awareness as well as to trigger some sort of reflective engagements with the presented data. However, the work again predominantly focuses on supporting particular instances of reflection, rather than deliberately developing emotional awareness or the ability to reflect as personal competencies.

Technology enabled learning (TEL)   An extensive literature has focused on technology-supported learning, with particular interest in Science, Technology, Engineering and Mathematics content (Pérez-Sanagustín et al., 2017; Boyle et al., 2016), but there are only very few examples of SEL related works. Some of the related directions include a long history of using games to learn higher-order cognitive skills, such as simulations in business games (e.g., Lisk et al. (2012)), project/game based learning that often includes focus on collaboration (Salen, 2008; Prensky, 2001), and also emerging interest in areas such as prevention of bullying (Rubin-Vaughan et al., 2011). Overall, the existing literature points to the strong potential of games and other interactive systems to design complex social and emotional experiences for learners, presented within (literally) virtual and likely safe space (cf., for example, Robertson and Howells (2008); Gee (2014); Jones et al. (2014); Isbister (2016)).

2.3   Designing for reflection in HCI

'Transformative reflection' – i.e., eliciting change in behaviour or mental schemas – will emerge as a crucial component of SEL training over the upcoming eight chapters. Furthermore, we will argue that scaffolding reflection is one of the main challenges we see technology as well positioned to address within the SEL context. As such, we now move on to provide a brief overview of the work around reflection in HCI so far, and the gaps in knowledge that still remain.

Over the last decade, HCI researchers have shown increasing interest in designing systems to support reflection. These have been fueled by the realisation of the key role that reflection plays in areas such as education (Fleck and Fitzpatrick, 2009), behavioural change (Consolvo et al., 2009), design for wellbeing (Sas and Dix, 2011; Thieme et al., 2013), personal informatics (Li et al., 2010), and reflective design (Sengers et al., 2005). These developments are further emphasised by a series of recent review papers (including at the Designing Interactive Systems (DIS) and Human Factors in Computing Systems (CHI) conferences), taking stock of the field (Baumer, 2015; Baumer et al., 2014; Fleck and Fitzpatrick, 2010). As such, we do not replicate their synthesising work in what follows, and instead directly build on their analyses to motivate and set the gap addressed in this thesis. The reviews show that although various conceptual and theoretical accounts of reflection co-exist across HCI work (cf., Baumer et al. (2014)), there is a shared understanding that reflection can take multiple forms differing in its 'depth': from simple 'revisiting' of an event to 'transformative' reflection that leads to a change in practice or an understanding of why and what happened (Moon, 1999; Fleck and Fitzpatrick, 2010; Baumer, 2015). Such a transformative effect—i.e., leading to a change in behaviour or an insight—is what makes reflection a key process for education (Kolb, 2014; Boud et al., 2013; Moon, 1999; Schön, 1987, 1983) as well as a crucial part of systems in behavioural change, personal informatics, and wellbeing.

Despite more than 75 HCI papers on reflection in the last 7 years (Baumer et al., 2014), there is still a lack of understanding of how transformative reflection can be supported through technology. In particular, although it was raised as an open question already by Fleck and Fitzpatrick (2010), supporting transformative reflection was still seen as *"the most difficult challenge for designers in 2015"* (Baumer, 2015, p591). As Baumer et al. (2014) point out, one possible explanation for this gap is that—for the majority of HCI projects—*"reflection was implicitly defined as something that would happen by providing the user with some type of information about a particular situation, and as a result the user would have a newfound awareness in the intervention's domain of interest"*. Kay (2014) goes even further to characterise the reflection strategy of many current systems as *"show the user a graph and hope"*. While there are exceptions within the body of prior work that do not conform to this trend of triggering reflection through presenting data (such as Mamykina et al. (2008); Parker (2014); Thieme et al. (2011) discussed later in Section 10.3.2), to the best of our knowledge there is little systematic understanding

in HCI about what transformative reflection entails, how it can be scaffolded, and how such a process could be meaningfully supported by technology.

In contrast, the educational literature has long acknowledged the importance of reflection (e.g., Dewey (1933)) and worked to develop practical approaches to promote transformative reflection for the purpose of learning (Moon, 1999); as also evidenced by the analysis of the learning contexts within the two case studies presented in the rest of this thesis. The examination of how transformative reflection is scaffolded within the case studies, as well as how it can be supported through technology, will appear in various guises throughout the thesis, culminating in the articulation of the reflective practicum framework in Chapter 10.

2.4 Positioning the focus on SEL within third-wave and the 'turn to the wild'

Although the specific focus on social-emotional competency development is emerging only very recently, it can be seen in the context of the broader shift towards 'third wave' HCI (Harrison et al., 2007; Bødker, 2006; Harrison et al., 2011; Kuutti and Bannon, 2014a; Rogers, 2012; Sellen and Harper, 2008). This shift of focus has been discussed by multiple authors—starting with Harrison et al. (2007) and Bødker (2006) in 2006-2007. These two seminal papers might differ in what is described as the 'baseline' e.g., 'second wave' participatory approaches outlined by Bødker (2006) vs. the 'second paradigm' cognitive revolution emphasised by Harrison et al. (2007)). What is crucial, though, is that they do agree on observing the current trend towards broadening the set of contexts and application types that fall within the remit of HCI, with the particular focus on situated use in everyday life, as well as the associated emphasis on broader sets of human values and foci points (cf., also Rogers et al. (2010)).

As Kuutti and Bannon (2014b) notes, this includes *"the emerging cluster of research topics [that are] historically grounded, shaped around complex real world problem spaces, and conceived as a response to these problems"*: such as the focus on sustainable HCI, education, healthcare, crisis informatics and technologies for development. The interest here is in designing technologies that support the situated activities within the real-world contexts, with particular emphasis on designing systems that 'fit' the social practices and interactions in that particular context: as Harrison et al. (2007) summarises, *"what goes on around systems is more interesting than what's happening at the interface."* Such 'in-the-wild' deployments then bring different sets of foci and methods to how technologies are conceptualised, designed, deployed, and evaluated to address such questions (cf., Rogers (2012)); as well as including considerations of what are the meaningful and appropriate roles of technology within the particular problem (Baumer and Silberman, 2011).

The research on technology-enabled SEL then draws on such shared focus in addressing real-world issues, deliberately working with the 'in-the-wild', messy research context, as well as associated the epistemology that underpins majority of the research presented in this thesis.

Methods

3.1 Introduction

The thesis research is grounded in the 'third wave' and 'in-the-wild' approaches insofar as the main focus is on understanding how technologies can be meaningfully designed for and appropriated by the participants in the real-world and can lead to change in existing practices (cf., Kuutti and Bannon (2014b)). As noted by Rogers et al. (2010, p.86), it is the shift towards questions like these that have led HCI research to increasingly rely on mixed methods, moving away from established disciplinary boundaries. In particular, Rogers points out the emergence of *"hybrid methodologies"* that *"combine previously incommensurable paradigms (such as running experiments and doing ethnography together); transcending disciplines and using collections of theories and their associated bodies of knowledge as and when deemed appropriate."* This fits very well with my personal affiliation towards pragmatist inquiry, seeing the conflicting ontologies of realism and constructivism as *"equally important claims about the nature of human experience"* (Morgan, 2014, p1084) whereby our actions and experiences are constrained by the natural world including the biological limits of our brains and bodies more broadly; while our interpretations of it are inherently constrained by socially constructed categories.

The research in this thesis illustrates such tensions: I needed a methodological approach that would allow for a combination of the findings coming from a post-positivist approach

in educational psychology, bringing emphasis to the underlying 'psychological principles of change' and evidence based curricula validated through Randomised Control Trials; and the constructivist, user-centred design research processes that strongly emphasise the importance of a holistic understanding of local context and social practices to develop systems that 'fit' and can work for those who use them. Moreover, in discussing whether or not we can abstract concepts or mechanisms (design-based or psychological) that might transfer across case studies, I felt the need to draw on a philosophical framework that allows discussion of what would it mean to say that a 'causal mechanism is at play' in the real-world settings (such as a particular mechanism of how SE competencies can be taught), acknowledging the importance of context and the active role the participants play in both putting the technology to use, but also in making the interventions work (Pawson, 2013).

In the rest of this chapter, I first refer to Nancy Cartwright's (Cartwright and Hardie, 2012) work in philosophy of science as representing one such account of causality, specifically crafted for understanding the effects of complex real-world interventions[1]; this provides an alternative to the deterministic, single factor causation predominant in natural and experimental sciences (Section 3.2). Working within this approach then provides a possibility to pragmatically marry both 'RCT-based' and interpretivist work as contributing different facets to identifying the mechanisms within (technology-enabled) interventions and whether they can 'transfer' between settings. This includes an emphasis on the importance of qualitative reasoning in developing such a 'causal explanation'. As such, Section 3.2 provides the philosophy-of-science backing for chapters 9 and 10, where I articulate a possible set of underlying mechanisms of SE competencies development that are then abstracted into a framework of sensitising concepts to guide future HCI work.

Section 3.3 then outlines what could be seen as two layers of methodology I am drawing on in this thesis: First, the 'outer' layer elaborates the case study methodology. Specifically, it discusses how purposeful case study sampling and comparison across cases might—as

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[1]I note the conceptual overlaps between Cartwright's work and the realist evaluation by Ray Pawson (although these two do not reference each other, to best of my knowledge). My choice to ground the thesis framing in Cartwright's rather than Pawson's work is based on exploratory nature of the work here: aiming to understand and suggest the learning processes and design opportunities through use of technology probes, rather than an evaluation of a fully-developed 'intervention'. However, I fully expect my work to closely align with realist evaluation as I move forward (see, e.g., Section 10.3 for two follow-up projects where realist evaluation is pertinent).

drawing on Cartwright—allow us to identify possible mechanisms underpinning the learning across domains, as well as to understand the necessary support factors within settings (RQ4). Second, the 'inner' layer addresses the actual research methods selected within each of the case studies. In some respect, the inner layer can be seen as the more traditional methods section, where we discuss the established HCI methods chosen to understand and design for particular contexts (RQ1-3). These especially draw on 'in-the-wild' methodologies grounded in the long-term user-centred design work relying on interviews, observations, design workshops, and technology probe deployments to lead to a contextually grounded exploration of current learning practices, challenges, and opportunities for technology. Finally, the Subsection 3.3.2 then provides an overview of the specific methods used within the case studies.

3.2 Unpacking 'cause' in real-world interventions

The concept of cause, and causation generally, is directly tied to the sense-making we do everyday, binding our own as well as others' actions to their (perceived) consequences. Although the word itself is commonly seen to have picked up a more specific meaning, tied closely to its use in natural sciences—as a deterministic, single factor causation within experimental research—the more general idea of 'something causing something else' is an intuitive, implicit concept. It is, for example, inherent in the verbs we use everyday (we influence, we teach, we contribute to...).

In the context of this thesis research, such a concept of causality is a key notion behind trying to answer questions such as *"What are the psychological principles (i.e., mechanisms) that positively contribute to developing a socio-emotional competency in a particular case?"* And *"Is it likely that any particular mechanism effective in one setting can similarly 'work' elsewhere? That is, can we expect similar consequences perhaps also for SEL programs in other settings, and if so, under what circumstances?"*

The main argument we take from Cartwright (and others such as Maxwell (2004) as well as Shadish et al. (2002)) is that answers to such causal questions in social contexts are relevant and possible; and are based on inherently qualitative argumentation that can in turn be grounded in a combination of qualitative and quantitative findings (Shadish et al., 2002; Cartwright and Hardie, 2012). It also does not understand causality as corresponding to 'generally true' statements, valid everywhere and for everyone (dissimilarly to causality

inherent to the 'natural laws' of physics), but as carefully scoped arguments about 'local causal principles', potentially pertinent for single cases only. Such specificity of causal explanation is key to understanding how and why something worked in particular context. However, such localised principles can then be seen as instantiations of more abstract mechanisms that can be applicable to multiple settings—that is, 'can travel'—in such generalised form, but then need to again be made concrete for the new local context. These arguments get unpacked in detail on pages 30-33.

Given the breadth of thought on causation within philosophy of science, and philosophy generally, I limit the discussion in this section to two main primary sources:

- Cartwright's work (Cartwright and Hardie, 2012) – as a contemporary philosopher of science and causation, with specific interest in detecting and using causation in social contexts (social policy and decision making).

- Shandish, Cook, Campbell (Shadish et al., 2002) – as a key traditional methodological text for experimental methods in social research, with a crucial focus on detecting causation.

The 'classical' approach – causality and experiments

To better understand how causality might be approached in social contexts, it is useful to briefly address the philosophical grounds on which the post-positivist, experimental approach to causality builds; and how this limits the understanding of causality as such — if only to have a basis we can later critique.

Post-positivism rests on the experimental method, which is in turn designed to detect 'causation', in the restricted, natural sciences meaning of the word (Orlikowski and Baroudi, 1991). Much of positivist and also post-positivist work draws on two key philosophical aspects of causation (e.g., Shadish et al. (2002, p. 5)): first is the regularity approach, due to Hume; and the second one is the notion of counterfactuals[2]. The *regularity approach* to causation stipulates that, in very simplified terms, we are never able to see causal relationships directly; and all we can hope to distinguish are regularities, i.e., repeating patterns we see between similar events. Further properties are then imposed

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[2]Note that there are key philosophical problems in conceptualising causality through regularity and counterfactuals, e.g. in showing counterintuitive results for carefully crafted examples even in simple situations (Mumford and Anjum, 2013). However, these still seem to be accepted as the key rationale within experimental sciences; perhaps because similar philosophical issues hold also for other competing accounts of causality – see Cartwright (2007), or Shadish et al. (2002, p. 35).

on such regularities, such as temporal precedence of the stipulated 'cause' from the 'effect', to distinguish causal regularities from regularities occurring by chance. This leads to the use of 'variance' methods in quantitative work (using the terms from Maxwell (2004)), i.e., approaches where one needs to compare many instances of the relationships of 'similar' events, under to specific conditions, to argue that these are causally linked[3].

One instantiation of the specific conditions can be, philosophically, drawn from the *counterfactual account*. A counterfactual is, again in simplified terms, the knowledge of what *would have happened*, should a particular action not have taken place. Intuitively, it is used to define the 'effect of change' induced by manipulating a particular factor (Shadish et al., 2002, p. 5); such as introducing a novel learning support system in a counselling course. This corresponds to the way experiments are usually taught — as a method whereby a single factor is varied, with all other things kept the same as possible ('*ceteris paribus*') for a set of cases, and a set 'control cases'; with randomisation and repeated measurements. This is exactly following the counterfactuals approach, where the factor manipulated is the stipulated cause, and the control group attempts to give an approximation of counterfactual. One then attempts to see regularities through repeated measurement, looking at the stipulated effect the factor has induced on the experimental group, comparing to the changes in the control group.

The 'fine print' of getting at causation in experiments

However, there are also potential problems that get often forgotten when researchers write/talk about experimental work or attempt to search for causation in the 'real-world'; despite such issues being explicitly highlighted by key experimental methodologists, such as Shadish et al. (2002).

These especially refer to the limits of what such variance-based methods can tell us. First, any causal links suggested (or not-falsified, to use Popper's terms) by experimentation are never supposed to be thought of as exact description of the world, but rather as a tool, possibly allowing us to thoughtfully simplify, and thus make sense of our experience; instead, these often get reified (Fox, 1997, p.1). Second, experimentation, by design, aims to detect mostly unidirectional causes, requiring the ability to dissect and manipulate

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[3]One important implication of this position—if taken up fully—is that qualitative *cannot* be seen as contributing to causal claims, as these are defined as invisible in individual situations and emerging only from regulaties across many cases.

factors without changing the causal mechanism in play for that particular situation. This might be possible in natural sciences, but, as Shandish et. al. emphasise themselves, is much less likely to be relevant for social sciences, especially not for aspects such as social policy, education; or systems built by HCI researchers for that matter. Importantly, they are *"not arguing that all causes must be manipulable [in such a way]—only that experimental causes must be so"* (Shadish et al., 2002, p. 8). Third, the theory of causation discusses manipulation of 'fundamental' factors – again something which is not possible in practice. This leads to the need to acknowledge that any change/intervention we make is always 'molar', i.e., a package of fundamental intertwined factors (Shadish et al., 2002, p. 54) Finally, and perhaps most importantly, even from within this framework, we are unable to argue about causal links with purely quantitative data only – *"causal inference, even in experiments, is fundamentally qualitative"* (Shadish et al., 2002, p. 5) and *"all the logical requirements for inferring cause apply as much to qualitative as to quantitative work"* (Shadish et al., 2002, p. 63).

Post-positivist authors also make the distinction between *causal description* (i.e., that a manipulation of a specific factor has led to observing a particular effect in a particular situation) and *causal explanation* (i.e., understanding how that effect occurred, what mechanisms might come to play here). As the authors say, *"experiments do less well in clarifying the mechanisms through which and the conditions under which that causal relationship holds"* (Shadish et al., 2002, p. 9). This is then closely related to whether or not results from a particular experiment can be 'generalisable' to other situations, especially in social contexts – which is exactly what Cartwright picks up on and critiques.

Key critique – social policy is based on 'local' causality

Despite the limitations raised by post-positivist methodologists themselves, Randomised Controlled Trials (RCTs), based on the regularity, counterfactual and manipulability assumptions, are now claimed as the gold standard for causal questions even in complex, social contexts, such as in social policy or education research (e.g., Cartwright and Hardie (2012); Craig et al. (2008)).

Cartwright is supportive of the benefits of reaching an understanding of causal descriptions of impacts of interventions (now again in the intuitive sense), and argues that such understanding is possible – to a certain extent. However, Cartwright critiques the

decision to use RCT trials data alone only to decide on 'effective' policies. In particular, she argues that the social policy world is hardly ever dissect-able, i.e., it is unlikely one can draw out and manipulate a single factor without changing the whole causal system, e.g., Cartwright and Hardie (2012, p. 45-49). However, such an ability to dissect the causal mechanisms in play is one of the assumptions of RCTs, if the results are to be generalised to any other group of users than those directly observed.

A implication of such non-dissectability is, as she argues, that there is little hope for principles, other than very localised ones, within social policy [p. 52]. This means that causal mechanisms around the intervention are extremely tightly bound with the context; something she calls *support factors* [p. 25; and also 61-75]. She strongly distinguishes supporting factors from the 'intervening variables', i.e., something that 'just' needs to be controlled for and 'all will be well'. The key difference she makes is to argue that such controlling is inherently not possible – as it is both the support factors *and* the intervention that are required for the intervention to 'work'. This contrasts with what she calls the hopes for 'clinching' (i.e., reaching very 'trustworthy' results, as per RCT), and 'magic bullet' approaches (i.e., aiming for general causal claims, valid everywhere) [p. 38], which are intuitively preferred by policy decision makers, and some researchers, as they would like things nice, simple and accountable.

Such localised causality, tied to support factors, has implications for the claims RCTs and similar studies can make, especially concerning the generalisability of findings. In particular, Cartwright maintains that, if they are possible to be implemented, RCTs are extremely good at showing that the intervention *can play a positive causal role for some individuals, in a specific location* [p. 34-36] – i.e., showing that the intervention has positively contributed to an observed effect for the tested population, at least for some individuals. This is a very important finding in itself, as it shows that the intervention indeed 'worked there'. However, there is a very little that an RCT study can tell us about whether or not that same intervention will work somewhere else or who it works for exactly. In other words, RCTs are still deemed as being very good at describing whether an effect occurred in a specific setting, but not at all good at explaining why, and whether it could happen elsewhere again.

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Localised causal principles and levels of abstraction

So does this mean there is nothing generalisable that we could take away from a particular study and context? Cartwright does not think so, as she maintains that, through qualitative work, *causal principles* may be inferred[4]. Intuitively, a causal principle *"lays out all the factors that [can] bring about the outcome in question in that situation and shows how these combine to produce it"* [p. 51-52]. In other words, causal principles are not universal and will be always based on observations from a particular context, intertwined with the support factors. However, she argues that it *might be possible to use such principles to identify a more general causal mechanism that 'might travel', that is, be applicable and relevant also to other settings.*

To illustrate this, an example Cartwright draws on is a policy that was designed and implemented in Tamil Nadu (India), aimed at reducing malnutrition of pregnant women and newborns, mainly by providing educational seminars for the new mothers as well as supplementary food. The policy was a great success, malnutrition fell; and the intervention also showed strong effects in a RCTs, suggesting that the education of mothers was the key causal aspect. However, when implemented in Bangladesh, the intervention did not work at all (malnutrition was still high), despite the fact that the mothers showed similar increases in education. Cartwright uses this example to show how, although an RCT was able to identify the localised cause in the particular setting of Tamil Nadu – "teach mothers about nutrition" – it did not 'travel'. The reason in this particular case was that while mothers were in control of food distribution within Tamil Nadu, mothers-in-law had this role in Bangladesh, and thus educating mothers could not influence food distribution practices. However, one can generalise the 'educate mothers' to 'educate those in control of food distribution' as the key causal factor on which this intervention rests; and, through qualitative understanding of the situation in Bangladesh, modify it accordingly. As Cartwright also highlights, the key issue is thus not only knowing what can be the abstracted causal principle that 'can travel', but also how it can be made concrete again in the setting where it should be transferred to, i.e., educating mothers-on-law in Bangladesh [p. 27-29; or also 80-88].

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[4]Note that this view implicitly rejects the regularity approach to causality, asserting that we are able to suggest causality directly, if in single cases. This observation is, for me, due to Maxwell (Maxwell, 2004), who also makes it the key argument in his paper supporting mixed methods, distinguishing between the interpretivist and regularitivist (humean) view. Also note the similarity between (the hierarchy of) causal principles and causal explanation, which also points to 'mechanisms' at play.

What this line of argumentation emphasises are two aspects: First is the reliance on in-depth qualitative understanding of the existing social practices (support factors) in local settings when articulating the local causal mechanisms; Second, there is a need to compare across cases to help identify the generalised causal principles (and the necessary support factors that might otherwise stay hidden).

Summary of Cartwright's approach

To summarise, Cartwright views RCTs, and experimental research generally, as great for 'that worked there' arguments, i.e., one strong option to showing that things did seem to contribute to a positive effect somewhere. However, she argues they are not able to help us judge whether or not this can transfer elsewhere – thus certainly insufficient alone. The key reason behind these statements is seeing the support factors not as 'intervening variables' but as inherent and needed aspects that work together with the intervention we bring, and are however outside of its 'control'.

Still, she does not claim that transferable claims would not be possible at all (at least on a pragmatic level), or that there would be no distinguishable causal mechanisms in play. Instead, she argues that while such principles cannot be reached by quantitative methods such as RCTs; they can be inferred by qualitative methods, based on deep understanding of the context, and the support factors at play across multiple locations[5].

Notion of causal explanation in constructivism

With the exception of social policy and education research (see below), very little work seems to address causation of the sort talked about here within the broad constructivist framework. The SAGE Handbook of qualitative research (Denzin and Lincoln, 2005), arguably based on a constructivist approach, mentions the word causal once, on page 7, as part of an argument against deterministic approaches of positivist methods. Orlikowski and Baroudi (1991) mention causality in a little more detail, but are still quite unclear:

> Interpretive researchers construct interpretations or explanations that account for the way that subjective meanings are created and sustained in a particular setting. [. . .] Such explanations are causal, but not in the positivists' uni-directional sense;

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[5]In my understanding, neither of this would mean that she would reify the casual principles either. These are aimed to serve more as the best available tool to help reach knowledge that 'fits' well enough (in the constructivist sense); to guide difficult decisions that need to be made.

neither are they sought for the same purpose. Interpretive researchers posit circular or reciprocally interacting models of causality, with the intention of understanding actors' views of their social world, and their role in it.

Would this then mean that the intuitive concept of cause and causation—when understood not as a uni-directional, deterministic mechanism, but as a contribution to an experienced outcome, i.e., a consequence of own/other's activity—does not hold any importance in constructivist thinking? I am hesitant to accept this to be the case, especially as causality in this sense seems so deeply inherent in concepts like responsibility and ethical action, highlighted by constructivist approaches.

Instead, I believe rather that establishing causality is not *problematised*[6] in constructivist thinking, as constructivist research often does not aim for a 'change' of a current state, but rather attempting to deeply understand it (Guba and Lincoln, 1994). Instead, the focus is on, for example, *"how practices and meaning are formed and informed by the language and tacit norms shared by humans working towards a shared goal"* (Orlikowski and Baroudi, 1991); and thus, if the concept of cause or consequence is studied, it might be more likely from the point of how people work with, and interpret, causality as a resource for their sense making, rather than what 'caused' them to interpret a particular situation the way they do.

Constructivist research looking at change

In contrast, when we are interested in explaining or designing for change, as is the case in my PhD research, causation is more likely to be discussed. Indeed, I did find constructivist work in policy or education domains that focuses on facilitating change of existing practices, and includes deep discussion about causation in relation to qualitative, interpretative work.

For example, Maxwell (2004) uses the concepts of causal description and causal explanation, arguing how the deep understanding of qualitative, interpretivist research is uniquely suited to provide causal explanation, and identify the mechanisms behind observed causal links. Similar to Cartwright's causal principles and support mechanisms, he argues for 'local causality' (p. 5-6), suggesting that

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[6]The idea of differences in what is 'problematised' by various groups of thinkers, i.e., considered as an issue worth highlighting and discussion, is inspired by an email discussion I had on this issue with Dr. Stuart Reeves from University of Nottingham.

> [The causal mechanism] always depends on the context within which it operates.
> This is not simply a claim that causal relationships vary across contexts; it is a
> more fundamental claim, that the context within which a causal process occurs
> is [...] intrinsically involved in that process, and cannot be 'controlled for' in a
> variance-theory sense without misrepresenting the causal mechanism.

Similarly, Lin (1998, p.163) draws a similar picture of interpretivist research as potentially
providing causal explanation, also arguing for the need to combine mixed methods.

> Positivist work can identify the existence of causal relationship that are present in
> data, with some degree of probability. What it cannot do is to explain how the
> mechanism implied by a particular causal relationship works. Interpretivist work, by
> contrast, can produce detailed examination of causal mechanisms in the specific case,
> explaining how particular variables interact. Without positivist work, however, one
> does not know how widespread the existence of similar cases might be – a question
> that often is of special interest to students of policy.

In summary, if change is taken up as the aim in constructivist research, then causal
questions, especially in terms of causal explanation, seem to become highly relevant; and
constructivist research is arguably well suited to provide valuable answers.

3.3 Methodological approach

The combination of arguments coming from Cartwright and Shandish, Cook and Campbell
provide a philosophy-of-science approach to identifying possible causal mechanisms that
underpin the learning of socio-emotional skills through qualitative inquiry.

In particular, such arguments led us to focus on two purposefully sampled case study
contexts, with the aim to deeply understand the local practices and mechanisms of
learning in each (Chapters 4 - 8). This allowed us to compare across the two case
studies—as well as draw on literature from other learning settings—with the aim to
identify a level of abstraction from which the localised training practices can be seen
as manifestations of the same causal mechanisms (Chapter 9). Overall, this two step
process led to an articulation of a conceptual framework to guide future HCI work in
this design space (Chapter 10).

The next section, 3.3.1 outlines the reasoning behind the purposeful sampling of the two case study context ('outer layer'). Section 3.3.2 then provides a brief overview of the traditional user-centred design methods used within each case study to understand the local practices and opportunities for technology ('inner layer').

3.3.1 'Outer layer' – purposeful case study sampling

Given the focus on understanding the processes through which SE competencies are developed, we chose to work in depth with two examples of established training programs. In doing so, we aimed to identify the localised causal mechanisms as well as the necessary support factors within each program, as well as the challenges and opportunities for technology within the existing learning practices.

This approach can be described as a 'collective case study' methodology (Stake, 1994, p237), i.e., an instrumental study extended to several cases. The cases comprising the collection are purposefully sampled: the *"individual cases in the collection may or may not be known in advance to manifest the common characteristic. They may be similar or dissimilar, with redundancy adding variety and each having voice. They are chosen because it is believed that understanding them will lead to better understanding, perhaps better theorizing, about a still larger collection of cases"* (ibid).

The sampling process has been conceptually grounded in a set of selection criteria but also pragmatic in terms of opportunistically working with contexts that were available. In particular, each case had to:

- be built around established and validated teaching curricula;

- aim to explicitly develop SE competencies of some sort;

- be substantially complex to provide a web of learning practices to explore and work with (e.g., a one-day workshop program would not be sufficient)

- be likely to allow in-depth long-term access to the curricular practices, the students, and the mentors.

The following two paragraphs briefly describe the two selected contexts: social-emotional learning curricula in primary education, and a masters counselling training program. We then highlight the similarities and differences between these that will be picked up again in Chapters 9 and 10.

SEL in education   We saw social and emotional learning in education as particularly interesting for a number of reasons: First, the SE competencies taught in school-based curricula are those that have been identified by psychologists and educators as crucial, not only to development in childhood and teenage years, but more importantly as key skills for adult life (Greenberg, 2010). Second, SEL has an extensive 20+ years' history of peer-reviewed programs that have already been deployed to tens of millions of pupils. As such, these programs need to be designed in ways that can scale and be successfully deployed on the level of schools. Third, very little if any technology has been used so far, despite many remaining challenges (cf., Chapter 4 and Stern et al. (2015)). Together, this suggests the potential for considerable real-world impact for any HCI technology implemented as part of a SEL program; as well as providing a wealth of evidence-based learning mechanisms.

SEL in counselling training   Social-emotional competencies are particularly important for mental health professionals such as counsellors and psychotherapists. In fact, it is the counsellors' SE competence—gained through education, training, and experience—that is considered one of the critical elements for the positive effects of therapeutic interventions (Duncan et al., 2010, p.29). With a long history of counsellor training, counselling curricula present a plausible context with well-developed mechanisms to teaching and developing SE competencies. Moreover, the need for very in-depth, expert training leads to traditionally selective programs, small class sizes, and intensive learning experiences. Finally, no prior work had explored how digital technology could support counselling education and the development of SE competencies of students.

Differences and similarities   The two case study contexts can be seen as being on the opposite spectrum of the 'depth' of competencies targeted: the SEL curricula in education aim for basic life skills, taught to whole school populations; in contrast, the SEL in counselling is developing expert skills, with complex learning experiences within a dedicated program and with a highly selective learner population. This brings interesting implications concerning the differences between the two case studies in terms of the intensity of the program, resources available (including the expertise of mentors), as well as students' expected competencies and motivation to partake in the training. We will see how these differences require the programs to draw on a varied set of strategies to achieve the learning goals. However, despite these differences (and unbeknown to us at the start

of this research), we will illustrate in chapters 9 and 10 how the underlying learning processes also present substantial similarities, suggesting shared causal mechanisms operating behind the scenes.

Access   By the end of the research work, we had full access to the largest SEL curriculum in the United States—Second Step—including initial joint projects (see Chapter 6). Similarly, we had a full access to the training at a particular masters counselling course at University of Nottingham. This included in-depth collaboration with the Head of the MA program, leading to whole cohort deployment of the developed system and the associated changes in curricular design (although this final deployment is still on-going and is not part of this thesis work).

3.3.2   'Inner layer': overview of methods within case studies

As each of the following chapters provides an in-depth discussion of the methodology used and rationale for its choice, this section will only briefly highlight the overarching approach and methods shared across much of the thesis research.

In both case studies, we relied on long-term engagement with particular communities, using a mix of established user-centred research methods such as semi-structured interviews, in-situ observations, and design workshops to understand the learning processes and practices, as well as uncover the existing challenges for which technology could be meaningfully employed. These were then followed by technology probe development (Hutchinson et al., 2003) with on-going input from the key stakeholders to further test our understanding of the design context and explore possible designs. As such, the 'success' of the deployment was not aimed at showing the system leads to strong behaviour change but rather helping us validate and further elaborate on the understanding of the learning practices and available design directions.

The resulting data were analysed by thematic analysis (Braun and Clarke, 2006) to uncover the core themes within each case study when writing up the respective publications. We then returned to all of the data anew while writing the discussion part of this thesis (chapters 9 and 10) to look for themes across the case studies as part of exploring the possible causal explanations. Figure 3.1 and Figure 3.2 outline the research studies contributing to this thesis as well as the specific methods used in each of the papers.

Appendix A then provides specific illustrations of the research process (such as interview guides, consent forms, or snapshots of the thematic analysis process).

Ethics

Ethics approval was gained for every step of the research process that involved human participants. In the absence of institutionalised procedures at TU Wien, the ethics procedures were based on the principles of the Framework for Research Ethics, published by the Economic and Social Research Council UK (`http://www.esrc.ac.uk/about-esrc/information/research-ethics.aspx`). Moreover, I took advantage of an informal ethics 'sounding board' available at our institute[7]. To further ensure the appropriateness of methods used, all the studies reported here also went through approval within other collaborating institutions: The interview study and technology probe deployment in the US was approved by the Microsoft Research ethics committee. The research stream within counselling was approved by the Nottingham School of Education ethics.

Partnerships

The research presented in this thesis benefited from a number of international partnerships, many of these long term (i.e., longer than 12 months). In particular, the SEL in education case study drew on collaborations with Mary Czerwinski's group at Microsoft Research Redmond as well as SEL experts at Committee for Children. The counselling case study then built on in-depth collaboration with the School of Education and Mixed Reality Lab at the University of Nottingham as well as Patrick Olivier's Culture Lab group at Newcastle University. All of these collaboration were informal in the sense that none of the other parties has received any external funding to take part in the research: their participation was grounded in their interest in the topics explored and overlaps with, or extensions of, their own research agendas.

Overall, I had been driving and conceptualising all projects described within this thesis; and have also been the first author on all but one publications (Chapter 8). The introductory page for each of the published chapters details the collaboration arrangements and my contribution in the context of the respective study.

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[7]The board members are Geraldine Fitzpatrick, Marjo Rauhala and Christopher Frauenberger – see `https://igw.tuwien.ac.at/ethics/board` for more detail

	Research Phase	Methods	Participants and activities
CHAPTER 4		Literature review across HCI and SEL domains	**Activities:** Systematic analysis of 34 SEL programs: • available academic literature for each (altogether 66 papers); • 5 SEL academic books; • qualitative exploration of existing links to HCI literature and projects. **Aims:** First, introduce the basic concepts and approaches in SEL in education, providing an overview of how the existing programs work. Second, identify gaps within existing SEL programs that technology could meaningfully address.
CHAPTER 5	Phase 1	Semi-structured interviews	**Participants:** 9 expert SEL developers and 5 trainers from 7 different curricula. Expertise of median 18 and average of 20.4 years in the field. **Activities:** In-depth phone or in-person interviews to identify the participants' understanding of the challenges the learners, parents, teachers and curricula developers face as of now. **Aims:** Identify areas that the SEL experts find problematic and validate findings from the literature review study.
	Phase 2	Ideation workshop Discussion of design prompts	**Participants:** 2 groups of SEL experts from the PATHS and Second Step curriculum. **Activities:** Series of two workshops to understand SEL experts' vision of possible technology involvement in their curricula. **Aims:** Refine design considerations.
CHAPTER 6	Phase 1	Participatory design with SEL experts	**Activities:** • Two weeks of on-site work, with daily meetings and discussions. • Weekly check-ins and feedback sessions over the following 6 months period. **Aims:** Design a technology addressing a key concern of SEL experts: bridging the school-home gap.
	Phase 2	In-the-wild deployment of the technology probe	**Participants:** 4 classes at Seattle elementary school: approximately 100 families, 4 teachers. **Activities:** • Technology probe deployed in each class by the teacher. • Interviews with teachers and school counsellors. • Focus groups with subset of children. • Usage data logged. **Aims:** Understand if and how similar technology could serve as an engaging delivery channel.
	Phase 3	Mturk deployment	**Participants:** 25 parent-child pairs recruited over mTurk. **Activities:** • The parent-child pairs engaged with the activity on their phone while their screen, camera and audio were recorded. • The parents then answered a series of on-screen prompts about their experience. **Aims:** Understanding if and how the technology probe can facilitate emotional experiences and help parents scaffold appropriate learning context for the children.

Figure 3.1: Overview of methods used in the SEL in education case study

	Research Phase	Methods	Participants and activities	Length Demographics
UNDERSTANDING THE LEARNING PROCESSES	**Phase 1**	Semi-structured interview	**Participants:** 5 counselling students **Activities:** • Discussed the main issues students encounter as part of learning • Identified areas to explore in next stages -- practice counselling sessions, and facilitating feedback **Aims:** Design inspiration; understand the basics of the learning process and the key challenges	4 females 1 male Length 45 min
	Phase 2	Observation	**Participants:** 4 expert counsellors, 8 counselling students **Activities:** • Observed practice counselling sessions led by expert counsellor • Observed (and recorded) reflection practices of both student client and expert therapist after the session **Aims:** Design inspiration; understand the practice counselling sessions, and students' reflective abilities	10 females 2 males Length 60 min
	Phase 3	Semi-structured interview Design prompts	**Participants:** 3 members of staff, 3 counselling students **Activities:** • Discussed how learning is scaffolded in class, particularly around practice counselling sessions • Followed by design prompts to envision potential of novel sensing and feedback support technologies **Aims:** Refine design considerations.	5 females 1 male Length 60 min
	Development of the design prompt for Phase 4			
DESIGN EXPLORATION	**Phase 4 part 1**	Practice counselling session Semi-structured interview	**Participants:** 6 students (3 pairs), each participating in both parts **Activities:** • Practice counselling sessions -- each student took part once as the client and once as the counsellor. • Observe and explore students' reflection practices on recorded counselling session. • Review and critique of the design concept presented through WoZ **Aims:** Confirm identified challenges and design confiderations	5 females 1 male Length 90 + 90 min
	Phase 4 part 2	Wizard of Oz Semi-structured interview		

Figure 3.2: Overview of methods used in the counselling case study

Part II

Published papers

CHAPTER 4

TOCHI – SEL in education review

The first paper is a literature review with two main contributions to the thesis argument: First, to introduce the basic concepts and approaches in SEL in education, providing an overview of how the existing programs work; second, and more importantly, to identify the existing high-level gaps that we saw across the surveyed SEL curricula, with a particular emphasis on those that could be plausible addressed by technology. As such, this chapter provides a review of related work of the SEL and HCI areas individually, but does the additional conceptual step of highlighting the possible overlaps within these—so far distinct—areas.

Overall, the work in this chapter contributes to research questions RQ1-RQ3 on the level of SEL curricula broadly: it outlines the key concerns that can be drawn from combining existing literature and theories across the two domains, and provides conceptual grounding for the follow-up work in next chapters.

Contributions   The paper has two co-authors, Prof. Fitzpatrick and myself. I have driven the literature review, argumentation flow as well as write up of the paper, benefiting from on-going support and discussions with Prof. Fitzpatrick (and kind TOCHI reviewers).

Reference to the original paper:

P. Slovák, G. Fitzpatrick. Teaching and Developing Social and Emotional Skills with Technology. ACM Transactions on Computer-Human Interactions (TOCHI), 22, 4, Article 19 (June 2015), 34 pages.

Teaching and Developing Social and Emotional Skills with Technology

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Supporting social interactions is a long-term focus for Human Computer Interaction (HCI) and Computer Supported Cooperative Work (CSCW). However, understanding how social and emotional skills are learned, and how this process can be supported by technology, is an important but underresearched area in HCI so far. To address this gap, we review existing approaches to social and emotions skills learning (SEL) in other fields, with a specific focus on SEL in education, in which a large number of evidence-based programs is widely deployed. In doing so, the primary aim of this article is to provide a foundation and set an agenda for future research on the design of technology that would support, and help teach, social and emotional skills. We identify the key challenges to successful learning shared by SEL programs in education—such as embedding skills learned in class also into everyday situations, promoting reflection, and providing additional opportunities for practice—and outline how these could be addressed by digital technology. Overall, our key argument is that much existing HCI work could be used in support of social and emotional skills learning in education, and possibly other domains, but that the topic has not been explored so far. We also highlight how the focus on supporting SEL would bring novel opportunities and challenges for HCI, as well as provide a basis for a strong HCI research agenda in this space.

1. INTRODUCTION

Social and emotional skills refer to a variety of skills that are crucial for our everyday life and healthy development [Adi et al. 2007a; Damon and Eisenberg 2006; Weare and Nind 2011], including skills such as those related to emotional intelligence, interpersonal, and communication skills, but also skills such as mindfulness, self-control, and empathy. Understanding how such social and emotional skills are learned, and how this learning process can be supported by technology, is an emerging area of research within HCI (cf. also Slovák et al. [2015a, 2015b]).

The growing interest in this topic is manifested by recent work around social skills learning in autism [Kientz et al. 2013], computerised Cognitive Behavioural Therapy

[Coyle et al. 2007], positive computing [Calvo and Peters 2014], as well as a number of individual systems aiming to affect particular social behaviour such as discussion dominance or rapport [Balaam et al. 2011; Kim et al. 2008]. Despite this impressive growth over recent years, the existing body of work is still in early stages, with two important limitations: First, most of the research so far is limited in scope, focusing on specific disadvantaged populations, especially the support for people with autism. This leaves out other populations and settings in which social and emotional skills learning is crucial. Second, the majority of the existing work has provided only limited evidence to show the effect of training in real-world situations over a longer term (cf. Kientz et al. [2013, pp. 108–109] for a summary of autism-related research), with projects often focusing on exploratory short-term pilot deployments and preliminary evaluations only.

In contrast, a number of interventions and courses have been developed outside of HCI to specifically support social and emotional skill learning (SEL) in everyday settings, and for a wide range of users across many diverse domains such as school education, clinical settings, and leadership [Barth and Lannen 2011; Bono et al. 2009; Greenberg 2010; Stepien and Baernstein 2006]. In particular, *SEL in school education* draws on 20+ years of history in teaching social and emotional skills through carefully designed, evidence-based programs that support a broad set of social and emotional skills needed for adult life. Moreover, the wide-scale deployments of these programs[1] build on established methodologies to evaluate the effect of such curricula on learners' behaviour, with data showing that such skills are teachable and that the programs can lead to measurable improvements [Durlak et al. 2011; Weare and Nind 2011]. However to date, very little technology—if any at all—is used in the current curricula.

The contribution of this article is to review the SEL curricula used in education and, through this, to point to the unique opportunity for cooperation and mutual enrichment of SEL and HCI research, drawing on the overlap of complementary interests and knowledge around social and emotional learning. From the HCI side, our review of SEL curricula highlights a number of challenges faced by SEL practitioners—such as the lack of support for students' learning outside of SEL training lessons and in everyday situations—that could be addressed by technology. We argue that although much of the existing HCI work has not, so far, been connected to social skills training, it is actually highly relevant and could be further adapted and targeted to support existing SEL curricula. From the SEL side, we show how the knowledge base and existing curricula structure of SEL could support and guide HCI research around social and emotional learning. For example, SEL in education is likely to prove a good test-bed for cutting-edge HCI systems. SEL curricula offer a wide range of well-defined skills to be supported, a controlled real-life context to deploy in, various levels of pre-existing scaffolding to drive learning, and well-established evaluations methods to assess the effects of interventions—all aspects that HCI designers can benefit from when developing, deploying, and evaluating novel technology. Moreover, a focus on SEL challenges can help HCI researchers to decide on what skills, and in which order, we should aim in the first place to support through technology, as well as how best to do so. Overall, this article aims to contribute towards defining a systematic programme of research for HCI in support of social and emotional learning through technology.

The remainder of this article is divided into seven sections. We first focus on SEL in schools as the exemplary domain (Section 2), given its longest history of both academic research and practical applications, and the widest range of life skills. The following three sections form the core of this article by linking the SEL literature in education to examples of, and opportunities for, HCI research. We first identify the key challenges

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[1] For example, 44% of a representative nation-wide sample of US teachers reported that SEL is taught on a school-wide, programmatic basis in their school [Bridgeland et al. 2013].

across the existing social and emotional skill curricula from an HCI perspective and point to initial HCI work suggesting how these could be addressed by technology (Section 3). We continue by outlining how such a focus on SEL would raise interesting research opportunities for HCI (Section 4) and suggest the next steps HCI community could make to engage with supporting SEL learning (Section 5). Section 6 steps away from SEL in education to highlight several other domains in which learning of social and emotional skills is crucial (therapeutic, medical, workplace, and everyday life settings). We provide a brief overview of SEL methods and topics within each domain to inspire and guide future work, before summarising and concluding the article (Section 7).

2. LIFE SKILLS COURSES' CONTENTS WITHIN EDUCATION

We start by reviewing the methods, topics, and approaches used by SEL curricula in education to teach social and emotional skills. This provides grounding for the next three sections that link the existing SEL practices and challenges to HCI work.

2.1. SEL in Schools as an Exemplary Domain

Social and emotional learning in education is a mature field, with numerous well-researched and evidence-based approaches, and is particularly interesting for a number of reasons.

First, skills taught in school-based curricula are those that have been identified by psychologists and educators as crucial, not only to development in childhood and teenage years, but more importantly as key skills for adult life [Greenberg 2010]. As such, school-based SEL encompasses the core set of skills needed for all domains of life and into adulthood. They also focus on a large span of ages, from kindergarten to high-school education.

Second, SEL has an extensive 20+ years' history of peer-reviewed programs that have already been deployed to tens of millions of pupils. This suggests the potential for considerable real-world impact for any HCI technology implemented as part of an SEL program. For example, Durlak et al. [2011] review 213 program intervention studies encompassing more than 270,000 students of all ages, with the interventions conducted over several years. Some studies have their effects tracked for even longer periods of time, as is the case for Muennig et al. [2009], who recently presented a 37-year follow-up study on the results of a randomised controlled trial of High/Scope Perry Preschool Program conducted in 1962. Moreover, federal programs support further uptake of such curricula in the United States [CASEL 2013].

Third, recent academic reviews have analysed the evidence base for the effectiveness of SEL programs and find measurable and significant positive effects of SEL in randomised trials, for example, Durlak et al. [2011], Greenberg [2010], and Weare and Nind [2011]. In particular, the social and emotional skills curricula lead to improvements in academic performance and the taught skills areas. For example, Durlak et al. [2011] report an average of 11% improvement in academic performance, and 25% improvement in social and emotional skills, and there is evidence for positive impacts on many other aspects of behaviour such as mental health [Adi et al. 2007a], violence prevention [Adi et al. 2007b; Mytton et al. 2006], conflict resolution [Garrard and Lipsey 2007], and reduction in bullying [Vreeman and Carroll 2007].

2.2. Literature Review Methodology

A large number of systematic reviews of SEL literature already exist, mainly with the focus on meta-analyses of measurable effects and long-term impacts of the curricula (e.g., Adi et al. [2007a], Durlak et al. [2011], Elbertson et al. [2009], Greenberg [2010], Payton et al. [2008], and Weare and Nind [2011]). We build on these and approach

the topic with a complementary HCI perspective in mind, aiming to identify the SEL challenges that could be addressed by technology.

As such, we analysed the contents of selected curricula, in addition to following references cited by the academic reviews mentioned earlier. This analysis was done by first creating summaries of individual curricula, collating these in mindmaps to draw out related topics, methods, and approaches, and finally iteratively identifying the common aspects across curricula and domains. Given the large number of available curricula for the educational domain, we based our review on a set of curricula selected by the "Collaboratory for Academic, Social and Emotional Learning" (CASEL)[2]. CASEL[3] is a nonprofit organisation supporting research and application of social and emotional learning in education, cofounded by leading figures in the academic field.

In particular, we drew on curricula identified in two CASEL "guides": the CASEL [2003] guide reviews 80 SEL programs selected by a rigorous procedure, highlighting 22 of these as particularly well designed. Each of the 80 programs is described, rated on 15 aspects, and linked to academic literature evaluating its effects. The newer version of the guide, CASEL [2013], focuses primarily on preschool and elementary school programs, recommending 23 programs. We first systematically analysed the descriptions of all programs in both guides, and continued with more detailed examination of the programs highlighted in either version of the guide (i.e., 34 programs altogether[4]), as well as the academic literature available for each of these programs as referenced in the guides, as long as it was accessible through the libraries of three major universities (yielding 66 academic articles altogether). We also included any course materials and descriptions of the programs that were available on the internet. Finally, we included a number of books on creating SEL curricula in the context of education [Bar-On et al. 2007; Elias et al. 1997; Pasi 2001; Patrikakou et al. 2005; Zins et al. 2004].

2.3. Methods for Teaching SEL in Education—Experiential Learning

All curricula share an understanding of social and emotional skills as highly complex abilities, drawing also on subconscious processing [Ambady 2010; Lieberman 2000]. As such, social and emotional skills are based on *procedural* rather than declarative knowledge [Kruglanski and Higgins 2007, p. 288]. Moreover, the key focus of most social and emotional skills is to be able to react appropriately even within "hot" moments, that is, situations when the learner is overwhelmed with emotions, and/or the importance of the situation, or just has a very short time to react (e.g., heated conflict). During such moments, the ability of conscious, analytical thought is often diminished [LeDoux 1998; Wyman et al. 2010], emphasising the need for learning skills that operate on a procedural basis.

The core of most curricula is a set of SEL focused, structured classroom lessons [Jones and Bouffard 2012], usually 25–40min long and administered once a week throughout the whole school year (or multiple years). During these lessons, curricula use predominantly active instructional techniques drawing on skill-based and experiential approaches. They employ a wide range of methods such as modelling, role play, performance feedback, dialoguing, positive reinforcement, vignettes, play and games; as well as other approaches such as portfolios, expressive arts, exhibitions, and group projects—see Figure 1 for an extended list. Through these methods, curricula aim to include extensive examples and opportunities for personal experience and practice,

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[2]For another set of education-oriented interventions that are however out of scope for this review, see the *Journal of Positive Behavior Interventions* (http://pbi.sagepub.com).

[3]http://www.casel.org/.

[4]Eleven programs selected in the CASEL 2013 guide were already selected in the 2003 edition, leaving 12 newly described ones, leading to 34 programs altogether (22+12).

Instructional methods		
audiotapes	homework assignments	scripts
brainstorming	**modeling**	**simulations**
community service	outside activities	**videotapes**
cooperative learning	**posters**	workbooks
direct instruction	**rehearsal and practice**	worksheets
guest speakers	**role play**	

Fig. 1. A list of instructional methods used in SEL courses, with those used most widely marked as bold text (modified from Elias et al. [1997, p. 109]).

combined with feedback and opportunities for reflection on behaviour and progress. When teaching a complex interpersonal skill such as conflict resolution, curricula break the skill down into less complex subskills and focus first on simple model situations. These can be explored by role play (e.g., specific situations such as asking permission to join a game), slowly building up to more complex, but scaffolded situations (e.g., in-class, teacher-facilitated resolution of a peer conflict), and eventually to encouraging learners to apply the skills out of the classroom in everyday situations. Repeated practice and extensive feedback from the trainer and peers are critical components in every step of the process in the classroom.

Once a skill is mastered within the lessons, the key emphasis is then on its *transfer* out of the classroom into everyday contexts to promote maintenance and generalisation [Bar-On et al. 2007; Elias et al. 1997; Pasi 2001]. This is however one of the current *critical challenges* SEL curricula face, and also one of the main areas in which HCI could support SEL (cf. Section 3.1). Although curricula highlight the need to support opportunities for the learners to practise their new skills in real-life situations outside of the classroom, they have very limited strategies to do so, especially as the scaffolding offered by the teacher in class is no longer available. The current methods used in curricula to support transfer are mainly various activities to increase awareness and remind learners about their skills on the school grounds (e.g., posters around the school), and attempts to enlist the help of their social networks outside of the learning environment such as their parents and other school personnel (e.g., through organising workshops, or sending letters to parents with suggestions how they can reinforce the learning at home). Providing students with activities and exercises to attend to at home or other locations is also common. Overall, however, the curricula struggle to find ways in which to deliver direct support for students outside of the immediate SEL lessons [Bar-On et al. 2007; Jones and Bouffard 2012].

Curricula are clear that the methods used must be developmentally appropriate for the age of the children, and the skills learned. For example, fantasy play or puppets as role models and curricula protagonists have been very successful methods for younger children (e.g., kindergarten to K-3), who can relate to them easily [Webster-Stratton and Reid 2004]. In contrast, group discussions, journal writing, and workshop activities are more commonly used with older children and teenagers [DeJong 1994]. However, specific key methods such as role-playing, modelling, positive reinforcement, and direct and indirect instruction are used throughout in various guises.

2.3.1. Common Theoretical Models. There is no single theoretical model that would be universally agreed on by the existing SEL curricula to ground the learning process [Payton et al. 2000]. Instead, curricula build on several complementary

theories that each have robust evidence of positive effects[5]. Some of the most prevalent theoretical approaches are: (i) systems theory, which views SEL learning as embedded in the broader community and aims to systematically create a comprehensive climate for teaching SEL, not only in the class but also in the school and local communities more broadly; (ii) psychoanalytic theory, which works with how conscious as well as unconscious (unrecognised) emotions shape how we act or learn, and who we are; and (iii) cognitive behavioural theory as a base for primary prevention and the core skill-based techniques such as modelling or role play [Bar-On et al. 2007, p. 65]).

However, despite different theoretical groundings, there is still a considerable overlap among these models in the competencies to be learned (as described in the next section), and a shared set of guidelines on what makes curricula effective. In particular, curricula should take a wide scope both in terms of methods and skills learned, build on a clear theoretical framework, use a comprehensive approach that integrates affective, cognitive, and behavioural dimensions, and promote generalisation of skills [Elias et al. 1997, p. 119]. Additionally, the literature highlights that piecemeal program efforts, such as one-off workshops, are much less likely to be effective [Zins et al. 2004, p. 13] than comprehensive programs.

2.4. Goals of SEL Learning

A set of five core competencies is widely accepted within the educational community [CASEL 2003, 2013; Zins and Elias 2007; Durlak et al. 2011] as a good description of the general goals shared by most of the existing curricula, regardless of underlying theories. We quote these competencies and their brief descriptions as per Durlak et al. [2011]:

—**Self-awareness:** The ability to accurately recognise one's emotions and thoughts and their influence on behaviour. This includes accurately assessing one's strengths and limitations and possessing a well-grounded sense of confidence and optimism.
—**Self-management:** The ability to regulate one's emotions, thoughts, and behaviours effectively in different situations. This includes managing stress, controlling impulses, motivating oneself, and setting and working towards achieving personal and academic goals.
—**Social awareness:** The ability to take the perspective of and empathise with others from diverse backgrounds and cultures, to understand social and ethical norms for behaviour, and to recognise family, school, and community resources and supports.
—**Relationship skills:** The ability to establish and maintain healthy and rewarding relationships with diverse individuals and groups. This includes communicating clearly, listening actively, cooperating, resisting inappropriate social pressure, negotiating conflict constructively, and seeking and offering help when needed.
—**Responsible decision making:** The ability to make constructive and respectful choices about personal behaviour and social interactions based on consideration of ethical standards, safety concerns, social norms, the realistic evaluation of consequences of various actions, and the well-being of self and others.

However, these core competencies comprise complex, interrelated abilities and it is not possible to teach any of the competencies directly—see Figure 2 for examples of the range of skills related to individual competencies. Instead, each curricula helps learners progressively develop these competencies, building up from sets of less complex skills.

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[5]This is similar to psychotherapy domain, in which a number of schools co-exist in parallel, each building on different theoretical groundings.

Self-awareness	Label and recognise own and others' emotions. Identify what triggers own emotions. Analyse emotions and how they affect others. Accurately recognise own strengths and limitations. Identify own needs and values. Possess self-efficacy and self-esteem.
Self-management	Set plans and work toward goals. Overcome obstacles and create strategies for more long-term goals. Monitor progress toward personal and academic short- and long-term goals. Regulate emotions such as impulses, aggression, and self-destructive behaviour. Manage personal and interpersonal stress. Attention control (maintain optimal work performance). Use feedback constructively. Exhibit positive motivation, hope, and optimism. Seek help when needed. Display grit, determination, or perseverance. Advocate for oneself.
Social awareness	Identify social cues (verbal, physical) to determine how others feel. Predict others' feelings and reactions. Evaluate others' emotional reactions. Respect others (e.g., listen carefully and accurately). Understand other points of view and perspectives. Appreciate diversity (recognise individual nad group similarities and differences). Identify and use resources of family, school, and community.
Relationship skills	Demonstrate capacity to make friends. Exhibit cooperative learning and working toward group goals. Evaluate own skills to communicate with others. Manage and express emotional in relationships, respecting diverse viewpoints. Communicate effectively. Cultivate relationships with those who can be resources when help is needed. Provide help to those who need it. Demonstate leadership skills when necessary, being assertive and persuasive. Prevent interpersonal conflict, but manage and resolve it when does occur. Resist inappropriate social pressures.
Responsible decision making	Identify decisions one makes at school. Discuss strategies used to resist peer pressure. Reflect on how current choices affect one's future. Identify problems when making decisions, and generate alternatives. Implement problem-solving skills when making decisions, when appropriate. Become self-reflective and self-evaluative. Make decisions based on moral, personal, and ethical standards. Make responsible decisions that affect the individual, school, and community. Negotiate fairly.

Fig. 2. Exemplary list of skills relevant to individual competencies (from http://www.gtlcenter.org/sel-school).
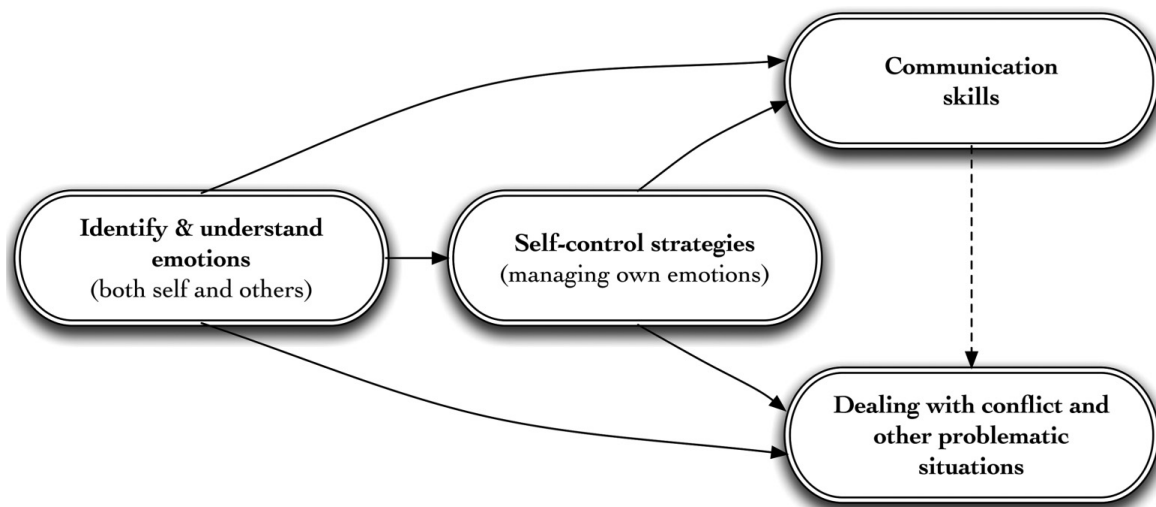
Fig. 3.   Summary of the identified key topics in SEL in education and their dependencies.

2.5. How Are the Competencies Taught

We identified four sets of skills that consistently appear in most of the curricula, and across all age ranges. Our goal is twofold: to provide an initial "feel" for progression and topics taught in SEL, and to set up explicit examples that can be used in later sections to tie some of the existing HCI research to the approaches presented here:

(1) identifying and understanding emotions (own and of others);
(2) managing own emotions;
(3) developing communication and relationship skills;
(4) dealing with conflicts and problematic situations.

Each set thus subsumes a number of simple situations or skills (e.g., being able to identify becoming angry) and ways to train these (e.g., training learners to notice physical changes in their bodies, such as associated with feeling angry). Moreover, these topics build on each other in a sequential manner: The ability to identify and understand emotions is a key prerequisite for managing own emotions (without knowing one's own emotions, one cannot control them), which is in turn needed for keeping relationships (appreciating the perspective of another, not jumping to conclusions) and so on. As such, they are taught in the order as shown in Figure 3. We describe each topic in more detail in a respective section later, illustrating the descriptions with examples of specific activities from selected curricula. Figure 4 then maps how the four topics contribute to the core competencies.

2.5.1. Identifying and Understanding Emotions. The ability to identify and understand own and others' emotions is a prerequisite of most other social and emotional skills. A key goal is developing the emotional awareness of learners, which is the ability to differentiate, name, and notice subtle changes of emotions. Curricula[6] aim to train a practice of internal reflection, leading to continuous exploration of how they and others feel. Emphasis is also placed on making the distinction between acknowledging a feeling, and acting on that feeling/urge.

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[6]Curricula including content on identifying and understanding emotions are Caring School Community, I can problem solve, Life Skills Training, PATHS, Peace Works, Quest (Violence Prevention Series), Open Circle, RIPP, Responsive Classroom, Second Step, SOAR, Social Decision Making and Problem Solving Program, 4Rs, Competent Kids, The Incredible Years Series, Michigan Model for Health, MindUP, RULER, Social decision making, Steps to respect, Too Good For Violence—21 in total.
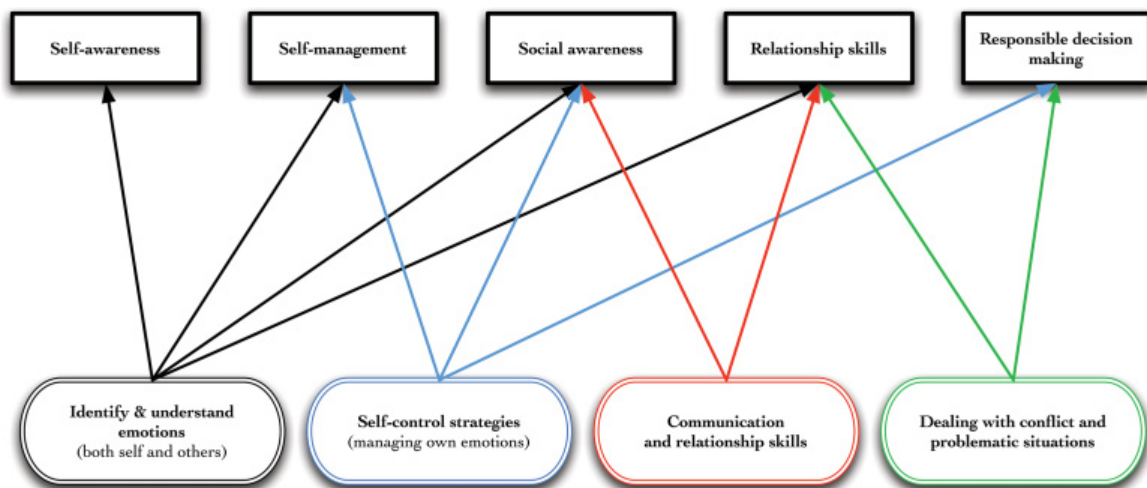
Fig. 4. Mapping of topics to core competencies.

In particular, some of the curricula build on language usage, and especially on how use of language affects our thinking processes. Various exercises focus on developing the ability to identify emotions in both oneself and others, helping learners to become more reflexive and self-aware. As an example, the PATHS curriculum includes physical "Feeling Faces" cards, which the child learners use to signal their current emotional state throughout the day [Domitrovich et al. 2007; Kam et al. 2004]. Similarly, the RULER curriculum uses popular stories to exemplify particular emotions, and to draw out distinctions among subtle variants of a specific one [Reyes et al. 2012]. Another approach aims to support self-reflection by exploring and understanding how our bodies are affected by experiencing particular emotions. For example, children are helped to recognise their own feelings by checking their bodies and faces for "tight" or relaxed muscles, frowns, smiles, and sensations in other parts of their bodies such as butterflies in their stomachs. Matching the facial expressions and body postures shown on cue cards helps the children to recognise the cues from their own bodies and associate a word with these feelings [Webster-Stratton and Reid 2004]. Emotions of others are explored through the ways in which they affect the tone of voice, body language and the like. This is often incorporated as a game, for example, developing the "detective skills" to find out how others feel. Repeated use of similar activities aims to help learners think more often about how they, and others, might feel in various situations.

2.5.2. Self-Control Strategies. Self-control and management of own emotions is a key aspect of many curricula[7] and the techniques used to develop self-control build on emotional awareness.

Various strategies and exercises aim to help participants to relax and/or calm down once a strong feeling is recognised. These are often based on various physical exercises such as muscle stretching and deep breathing techniques. Other strategies draw on verbal labelling, building on psychology and neuroscience findings showing that the act of consciously labelling an emotion by name (rather than "just" being aware of it) facilitates higher cognitive control over the emotional state [Greenberg 2006; Reyes et al. 2012]. Exercises training explicit acknowledgement of emotions, as well as

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[7]Life Skills Training, Lion's Quest, PATHS, Peace Works, Productive Conflict Resolution Program, Quest (Violence Prevention Series), Open Circle, RCCP, RIPP, Responsive Classroom, Second Step, SOAR, Social Decision Making and Problem Solving Program, Teenage Health teaching Modules, 4Rs, Al's Pals, Competent Kids, The Incredible Years Series, MindUP, Positive Action, RULER, Steps to respect, Too Good For Violence—24 in total.

thinking about what could be their cause, are often used. Specific strategies for anger management are particularly common, often combining both verbal labelling and physical relaxation exercises. An example is the "Turtle technique" [Robin et al. 1976], which is still used in a number of curricula (e.g., Incredible Years or PATHS). In this technique, children are taught to "withdraw into their shell" (by pulling their arms and legs close their body and closing their eyes) at specified occasions such as when they feel increasingly angry. This is followed by a relaxation phase, in which specific muscle groups are tensed and released. Once this technique is mastered, children discuss appropriate alternative strategies for dealing with stressful situations, now that they are able to consciously reflect and react to them.

2.5.3. Communication Skills. Another set of activities focuses on building good communication skills and supporting positive interactions with others[8]. The skills taught here are aimed at supporting respectful empathic communication and thus implicitly facilitating friendship relationships, and an ability to collaborate and avoid conflicts that could otherwise occur through misunderstanding.

The emphasis is on teaching active listening, which is then used to facilitate teaching empathy. Other teaching strategies also focus on training of specific communication skills (e.g., giving and accepting compliments). Exercises can include games to induce collaborative activities; practise active listening, for example, through listening to someone telling a story and then trying to rephrase it with as many details as possible, and disagree respectfully. These can include ways to subtly reframe a message into a form which is not threatening, such as in Aber et al. [1998], in which students are taught to acknowledge the potential mismatch between their and the other's perception of the situation (e.g., preferably saying "It seems to me you are not listening now," rather than "Why aren't you listening to me!").

2.5.4. Dealing with Conflicts and Problematic Situations. Problem-solving strategies and conflict management are the final topics of the most curricula[9]. Violence prevention is commonly an important additional goal, as many of these curricula are designed for all schools, including those with a high prevalence of aggression and weapon use.

Students are often taught a particular structure of reacting to a problematic situation or a conflict. A key approach is to help students process the situation on a cognitive level, despite the fact that conflicts tend to ignite strong emotions. For example, the PATHS curriculum includes a "semaphore," in which the sequence of red–yellow–green indicates a "stop-think-proceed" process [Domitrovich et al. 2007; Kam et al. 2004]. Such structured sequences always include and emphasise a goal setting and evaluation phase. Moreover, curricula aim to teach children and teenagers to recognise which conflicts might have arisen from misunderstanding, with perspective-taking exercises forming the core approach. An example is exploring win–win negotiation (e.g., in RCCP) in a workshop format and providing suggested sequences for steps to take during disagreements (e.g., in Incredible Years).

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[8]Although implicit in many others, this aspect is explicitly highlighted within the following curricula: Michigan Model for Comprehensive School Health Education, Peace Works, Open Circle, RCCP, Responsive Classroom, Second Step, SOAR, Tribes, Al's Pals, The Incredible Years Series, MindUP, Positive Action, Steps to respect curricula—13 in total.

[9]Michigan Model for Comprehensive School health Education, PATHS, Peace Works, Productive Conflict Resolution Program, Quest (Violence Prevention Series), Open Circle, RCCP, RIPP, Responsive Classroom, Second Step, SOAR, Social Decision Making and Problem Solving Program, Tribes, 4Rs, Al's Pals, I Can Problem Solve, Competent Kids, The Incredible Years Series, Positive Action, Social decision making, Steps to respect, Too Good For Violence—22 in total.

2.5.5. Differences Across Grades. Curricula exercises are designed for specific grades/age levels, keeping in mind the developmental changes in abilities of the learners. For example, curricula for K1 students can aim to help the learners label and identify basic emotions such as fear or happiness, K4 students might focus on more complex emotions such as jealousy or embarrassment, and high-school students would be taught to draw on their more nuanced self-awareness to motivate goal-setting and critically assess their behaviour. Curricula also particularly highlight the increasing integration of cognitive, emotional, and behavioural aspects that can be expected of students as they grow older. See, for example, Elias et al. [1997, pp. 133–138] for more detailed information on the progression and detailed changes in skills foci.

3. SEL CHALLENGES AND OPPORTUNITIES FOR TECHNOLOGY SUPPORT

Despite the success of curricula in promoting learning of social and emotional skills to some extent (cf. Section 2.1), the review of SEL literature also highlights areas in which novel approaches are needed, or further improvements are possible. In the rest of this section, we outline three such exemplary topics—embedding of skills into everyday settings, promoting reflection, and providing mixed spaces for practice. Our choice of highlighting these particular areas was motivated by the extent of related HCI work that exists for each of these. This allows us to exemplify the potential for collaboration of HCI and SEL, and specifically point to the existing HCI work that suggests how incorporating digital technology may help address crucial needs in, as well as open new opportunities for, SEL in education.

3.1. Embedding of Learnt Skills into Other Settings

We start with what the SEL literature highlights as one of the key issues with the existing SEL curricula—that is, the lack of support for transfer and "embedding" of the skills students learn in SEL classes into their other real-world interactions, be that still within school (other classes, playground) or everyday behaviour within family and peer groups [Bar-On et al. 2007; Elias et al. 1997; Jones and Bouffard 2012; Patrikakou et al. 2005]. Although such transfer of learned skills is the ultimate goal of all curricula, the current approaches are limited in scope and effectiveness. This leaves teachers (and curricula designers) struggling to directly influence the embedding of skills outside of the SEL learning sessions, be that in other classes, or outside of school completely. For example, Jones and Bouffard [2012] summarise the situation as follows:

"Perhaps most important, and often overlooked, is the fact that SEL programs are rarely integrated into classrooms and schools in ways that are meaningful, sustained, and embedded in the day-to-day interactions of students, educators, and school staff [...] Most SEL programs focus solely or primarily on what goes on in the classroom, but SEL skills are also needed on playgrounds, in lunchrooms, in hallways and bathrooms – in short, everywhere. These non-classroom contexts provide vital opportunities for students to practice their SEL skills."

Bar-On et al. [2007, pp. 70–71] further highlight the critical role of adults, both in and out of school, in the success of SEL training for students:

"Many SEL efforts fail because long-term, coordinated plans and school-home partnerships are not developed. [...] [T]he efforts of school-based practice falter because educators are not committed to being ongoing, vital SEL role models. SEL involves not just the students in schools but also the adults in their lives: teachers, parents and the wider community. If these adults lack social and emotional competency, children will quickly notice the discrepancy between behaviors that the adults advocate for children and the actions that the adults take themselves."

We argue that digital technology could support these efforts in at least two ways: first, by extending the learning support and scaffolding for learners beyond the SEL lessons, for example, utilising mobile and sensor-based technology; second, through facilitating a wider community of support for learning of social skills, including the involvement of parents and teachers—not only by connecting them to the learning content in the classroom, but also enabling vicarious learning so that they develop their own social and emotional skills. We outline each in more detail in the following section.

3.1.1. Supporting the Learners—Transitioning the Skills Out of the SEL Lessons. When SEL skills are to be transferred beyond the SEL classroom lessons, the learners can no longer take the advantage of the direct scaffolding normally provided by the teacher and the lesson structure. This brings several difficulties for the learners to reinforce and apply their skills outside of direct SEL training. We particularly highlight the difficulties with (i) identifying moments when the newly learnt social and emotional skills could applicable, (ii) the lack of scaffolding and support to do so, and (iii) the need for "space" to reflect and learn from the experience afterwards.

Identification of teachable moments. When interacting during breaks, other classes, or outside of school completely, the learners encounter many occasions that are relevant to their SEL skills learning. However, the learners may not recognise such opportunities and instead revert to previous, negative behaviours (e.g., an angry outburst rather than a self-controlled reaction), especially if emotions are strong and no external guidance is available [Elias et al. 1997, p. 56]. In such situations, it is thus not only difficult for the learner to apply the skills they have learned, but even to perceive these as such "teachable moments." This is one of the key differences to the SEL class setting, where it is the role of the teacher to facilitate and point out situations in which students could use their (new) SEL skills; helping students reinforce the learnt skills in the process. Curricula designers therefore suggest that all school personnel should *"play an important role in actively encouraging and reinforcing the use of skills and attitudes they see displayed"* (e.g., Elias et al. [1997, p. 56]). This however requires the (possibly untrained) teachers to constantly strengthen and actively encourage use of SEL skills in addition to all their other duties. More critically, there is little opportunity for supporting the learners when the teaching staff are not around (and thus also making the students fully dependent on external guidance, e.g., from parents).

This points to the benefits of (and the need for) technology that could support the learners themselves in noticing and reacting to the relevant situations. For example, learning self-control is one of the key aspects of SEL; it relies strongly on identifying a problematic situation and then to calm down before it is "too late" and emotions are already running high. One opportunity for technology in this setting can draw on the maturing HCI research on in-the-wild stress detection drawing on physiological data or speech prosody, for example, Hernandez et al. [2011], Poh et al. [2010], Pina et al. [2014], Zeng et al. [2009], and Ertin et al. [2011]. We envision that such data could be used to support the learners in becoming aware of their heightened arousal (e.g., through a private tactile reminder such as FitBit wrist vibration), which can serve as a cue to start the self-calming/self-control mechanisms taught in class. Earlier research in HCI suggests that providing such ongoing subtle cues for facilitating awareness, and triggers that remind users to attend to intended activities, can be useful to help users modify their existing behaviours [Consolvo et al. 2009; Obermair et al. 2008]. Moreover, SEL designers have deep understanding of how best to work with such cues and triggers once these are identified. An example of initial work in this direction is Pina et al. [2014], who designed a system for parents of Attention Deficit Hyperactivity Disorder (ADHD) children, delivering in-the-moment cues and strategies to manage stress during everyday activities. Overall, the initial studies point to the potential of

such technologies, but also point to many practical issues to be addressed, including whether such systems are robust and precise enough for immediate inclusion into the SEL curricula, and how could these be best embedded in the existing programs to most appropriately exploit this potential.

Scaffolding and structure to support training of skills. Learning of skills is scaffolded in many ways within SEL training sessions: (i) the scaffolding inherent in the activity itself, such as a prepared scenario for a role play that highlights a particular aspect to focus on; (ii) the teachers' presence and input into the activity, such as prompts guiding the development of the role-play, and feedback to students on their behaviour; and (iii) also the fact that this is a SEL training session, which brings a particular set of foci for the students including the explicit attention paid to SEL skills development. However, much of this scaffolding disappears outside of the SEL learning, even if the situation is still within a class setting (e.g., during a lesson in a different subject).

This points to the opportunities for technology to provide just-in-time prompts, reminders and structuring, for example, through mobile devices, to support the scaffolding of activities and help learners focus attention on SEL skills in play. Examples of such direct scaffolding methods that can be useful out of SEL classes include problem-solving strategies such as the "stop-think-proceed" semaphore in the PATHS program and the sequence of steps to resolve disagreements in the RCCP program, in which each person is invited to share their perspective on the situation in turn. Within HCI, several projects have explored technology support for similar structuring as part of autism therapies. For example, the MOSOCO project [Escobedo et al. 2012; Tentori and Hayes 2010] exemplifies how mobile phones can help children on the autistic spectrum structure, but also their neurotypical peers, to structure and practise their social skills outside of lessons, and how the system can help elicit feedback from their peers. Similarly, HygieneHelper [Hayes and Hosaflook 2013] and SocialMirror [Hong et al. 2012] help scaffold everyday activities for people with autism. Although the social aspects supported in these systems are relatively basic when compared to the full range of skills taught as part of SEL, they nonetheless raise the question about whether similar approaches might be possible for more complex behaviours. Initial work has, for example, explored the use of similar technology to deliver personalised strategies for coping with stress in everyday life for a general population [Paredes et al. 2014], and Mamykina et al. [2008] designed MAHI, a mobile-based scaffolding system for newly diagnosed diabetes patients that extends the in-class lessons by facilitating participants' ability to track, reflect on, and analyse their everyday experiences with diabetes, leading to improved feeling of control over the disease.

Another example for possible scaffolding through technology is the crucial importance that the initial phases in all curricula place on the ability to be aware, acknowledge, and importantly also label emotional experiences over time. We saw curricula using methods such as FaceCards while in class (PATHS), or even structuring the whole curriculum around this skill (RULER). The power of mobile technology to prompt and collect such emotional reflection on-the-go presents opportunities to further extend such emotional awareness into other settings, and a number of projects have already explored related techniques in various contexts in the existing HCI work. In one such example, Matthews and Doherty [2011] developed a ubiquitous application to support emotional awareness training for psychotherapy clients, using mobile phones to elicit and support reflection on current emotional state regularly over the course of the day. As part of other initial work, Munson et al. [2010] integrated the Three Good Things, a well-known positive psychology intervention, into a social networking site, meshing it with users' daily habits around these sites, and thus facilitating social and emotional awareness through technology. Although these projects did not focus on the specifics of emotional training in SEL (e.g., distinguishing between a particular set of emotions

depending on age, or exploring the set of activities that led to that particular state), the design mechanisms behind these applications could likely well be transferable to the SEL settings.

Support opportunities to stop-and-learn from experience. Providing opportunities for post hoc reflection on one's own behaviour is a crucial part of experiential learning, helping learners make sense of their experiences [Cohen 2001; Moon 1999]. As such, SEL class-based activities include explicit time to reflect on own experiences, for example, in the form of a debriefing or discussion after a role play. However, such post hoc reflection might be difficult for situations outside of the SEL training scenarios, in which the teachable moment is intertwined with other continuing activities that may prevent immediate reflection (e.g., resolving a conflict around what game to play during recess, which once finished, leads into the game right away). Students may end up not reflecting at all, or, if they do, find it difficult to recall the situation and their own reactions well (e.g., Pasi [2001, p. 55]).

Although only limited work exists in HCI around supporting such processes for social and emotional learning specifically, the growing focus in HCI on supporting reminiscence and reflection in other contexts suggests ways in which technology could support learners in collecting traces of aspects of their experiences to ground later reflection, for example, [Fleck and Fitzpatrick 2009], [Isaacs et al. 2013], [Marcu et al. 2012], [Sanches et al. 2010], and [McDuff et al. 2012]. SEL sessions in current curricula already include discussions around SEL-related issues that students experienced in the meantime[10] and such collected data could be incorporated to ground the discussion and learning. Although we provide a more detailed discussion of other HCI work around supporting reflection in Section 3.2, one direct example of using such recorded data to support SEL learning comes from the literature around Video Interaction Guidance (VIG) framework. A number of studies provides evidence of how guided, post hoc reflection of micro-moments, selected from video clips of everyday activities, can promote social skills learning (see, e.g., Kennedy et al. [2011] for a summary). Although primarily developed to support parents of children with behavioural issues, it has since been applied to promote learning for various groups, such as teachers, psychologists, and counsellors, and might be a valuable addition to the existing curricula. Importantly, novel systems could draw on and extend the VIG framework to support the learners themselves in capturing such micromoments for their later reflection and analysis.

3.1.2. Social Support—Community Building. Literature around SEL curricula highlights the importance of a supportive atmosphere, not only in the school but also at home, which is crucial to successful learning [Bar-On et al. 2007; Pasi 2001; Patrikakou et al. 2005]. Support from the parents as well as learners' peers is thus needed, but difficult to promote in the existing curricula. Although there is only limited work in HCI that addresses supporting such links between school and home, we argue later that the extensive knowledge HCI has gained in other settings around promoting the development of support networks [Barak et al. 2008; Massimi 2013; Skeels et al. 2010] and local communities [Ganglbauer et al. 2014; Lewis and Lewis 2012; López and Butler 2013; Massung et al. 2013] makes it plausible that HCI will be able to contribute here as well.

Peer support. Interaction with, and perceived support from, peers are both crucial for school-age learners, especially when they are in their teenage years. Systems

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[10]For example, the teachers following the PATHS curricula keep a "Problem box" on their table. During the day, students experiencing problems can write them down and place the note into the box. The resulting issues are used once or twice a week to seed problem-solving meetings [Kam et al. 2004].

utilising the learners' broader social network could help motivate and engage participants to keep up with their SEL goals. Although the existing HCI research has looked at leveraging such social influence in other contexts, such as sustainability [Gustafsson et al. 2009; Thieme et al. 2012] or physical activity [Gasser et al. 2006; Lin et al. 2006], similar approaches might also be successful in the contexts of SEL learning. Social support can also be facilitated for peers outside of the immediate social network, as is the case with online social networks and support groups. These have been extensively studied and used [Barak et al. 2008; Newman et al. 2011], especially in the context of patients with life-altering diseases such as cancer [Skeels et al. 2010], and those undergoing other stressful periods in life (e.g., smoking cessation [Ploderer et al. 2013]). Such work points to the potential of online support groups to provide emotional and information support. However, social support groups have so far mainly been used for high-stress situations, in which users come to discuss their issues and share information and experiences with others. As such, sharing of experiences and support is also understood to be an important part of learning in the SEL curricula, it is possible that similar methods for promoting social support and encouragement are also viable for (parts of) social and emotional skills learning.

Parental involvement. Facilitating parental involvement constitutes another critical issue for the existing SEL curricula [Patrikakou et al. 2005]. The teachers implementing the SEL curricula experience similar difficulties with lack of opportunities to directly support, influence, and collaborate with parents, making it a major unmet need within SEL. Although some curricula organise specific workshops and training activities for the parents to help them undertake their SEL support role outside of the classroom, it is often difficult for parents to get involved for a variety of reasons: the sessions take place face-to-face at a specific time/location, and require specific travel, scheduling, and other overheads for the parents as well as for the teachers; parents often report time limitations [Bender et al. 2011]; and there is also often a lack of perceived value and interest [Lewin and Luckin 2010].

This points to the opportunity to design systems that allow parents to engage and support the SEL learning of their children without necessarily having to attend specific sessions, for example, through games or other scaffolded interactions. Although there is limited work in HCI on support for parents around social and emotional learning, there is an example of similar support for a traditional academic subject, maths, in which Luckin [2008] developed the Homework system to link between the school lessons, teachers, and parents and so facilitated the involvement of the parents in learning activities with their children that continued the learning from the class. Future work looking at facilitating parents' involvement with SEL might also draw on the existing research around supporting shared play activities, for example, Raffle et al. [2010]. In the scope of autism-related systems, Hong et al. [2012] present another example, exploring how a social network can support a person with autism in drawing on advice, help, and interactions with an extended network of close others, rather than relying on a single primary care-giver and/or the trainer, and Kientz et al. [2009] deployed a system to support tracking infants' social behaviour, supporting early detection of possibly autism-related disorders. Such systems exemplify how digital technology might be designed to promote sharing of the expert role of the SEL teacher with parents and the extended family in the home context.

Moreover, given the importance of providing appropriate role models, the parents themselves would at times benefit from developing particular aspects of social and emotional skills. Such vicarious learning for parents might be designed as part of the parent–children interaction described in the previous paragraph. Alternatively, work by Pina et al. [2014] and Paredes et al. [2014] suggests short, mobile-phone-delivered interventions as a potential option. Finally, as already mentioned before, the

VIG framework (see, e.g., Kennedy et al. [2011] for a summary) provides experimental evidence of how guided reflection of micromoments can promote parents' social skills learning. Although this method is so far focused mainly on face-to-face interventions with a trained VIG guide, the relatively short span of time needed for the intervention (3–4 guided reflections) suggests that similar approaches might possibly to be incorporated into the curricula, especially, if similar interaction could be supported remotely, for example, as part of the curricular homework assignments.

3.2. Promoting Reflective Skills

The ability to reflect on own and others' emotions, thoughts, and behaviour is the foundation for experiential learning [Moon 1999]. It underpins all skills taught in SEL [Bar-On et al. 2007; CASEL 2013; Cohen 2001, 2006; Pasi 2001] and is also recognised as one of the protective factors against later maladjustments [Zins et al. 2004]. As such, learning how to be reflective is a necessary core skill for the students, and one that is generalisable across settings and situations.

Although existing SEL learning processes are successful in helping students develop their reflective abilities to some extent, prior work on supporting reflection in HCI suggests that digital technology has the potential to further extend and augment such training (cf. [Baumer 2015]). As already discussed in Section 3.1, providing the learners with previously unavailable cues around, and feedback on, their behaviour could promote, elicit, and scaffold reflection. In the rest of this section, we showcase the possible connections between HCI and SEL by selecting three topics—support for emotional awareness, mindfulness and relaxation, and communication skills—as exemplary areas in which initial HCI work has already explored supporting reflection on aspects directly relevant for SEL learning. Altogether, most of the systems referenced later provide indications that they can support and deepen reflection around *specific* emotional or social experiences for the users. However, this also opens questions around if and how similar approaches can be utilised to support the *development of reflective abilities* more generally, with the aim of promoting a lasting change that stays even after the technology is taken away.

Emotional awareness. Developing emotional awareness is the foundation of all SEL curricula, with specific focus on helping students identify and label their emotions. A number of HCI research projects demonstrated how digital technology can open novel pathways for people to explore and deepen their understanding of their own emotional experience. As one option, researchers have argued for the value of presenting ambiguous cues, which can nudge people to engage, interpret, and reflect on their experiences (e.g., Boehner et al. [2005], Gaver et al. [2003]). For example, AffectiveDiary [Höök et al. 2008; Sengers et al. 2007; Stahl et al. 2008] inspired users' reflection by presenting cues based on a combination of sensor data, and other projects use movement to explore emotional experiences [Mentis et al. 2014]. Early HCI work also suggests that systems could draw on sensor data to track and visualise users' emotional changes over time (as inferred from the sensor data), possibly helping the users draw out patterns that they may not notice otherwise. One example is AffectAura [McDuff et al. 2012], tracking multiple devices to offer users information on their emotional state as an aid to support post hoc recall. Overall, similar systems could support the learners in the early steps of each SEL curricula, when the reflection on emotional states is a crucial and necessary step before moving on to further topics.

Mindfulness and relaxation. An increasing number of curricula incorporate mindfulness techniques, as well as other approaches to support students in greater awareness of their body. These include calming and relaxation exercises (such as those related to

the Turtle technique), but also aspects such as "checking for tense muscles" as part of raising emotional awareness (e.g., Incredible Years [Webster-Stratton and Reid 2004]). Initial work in HCI has drawn on the opportunities of technology to highlight bodily changes, supporting self-awareness in the moment. For example, Moraveji et al. [2011] support greater awareness of one's own breathing, helping the user to maintain a calm and relaxed state. Similarly, Sonic Cradle maps respiration to changes in sound to encourage the participants to reach a state resembling mindfulness, and guiding them through the process, and Thieme et al. [2013] report on a design exploration of technology to support mindfulness for individuals with severe mental health issues. Each of these examples points to ways in which technology can help guide and motivate users to pay close attention to the present moment and become aware of their bodily changes. The external support and scaffolding such technologies could bring to SEL curricula is likely to benefit particularly those learners who would otherwise encounter greatest difficulties in reaching such levels of attention and self-awareness.

Communication skills. Many curricula teach particular communication skills and interaction strategies, drawing on exercises to support attentive listening, perspective taking and collaboration. Prior work in HCI suggests ways in which technology might again provide novel cues for students' reflection on such activities. In particular, a number of papers show how relevant aspects of interaction might be tracked in real time, and how providing feedback on these can positively affect an interaction. For example, DiMicco et al. [2007] and Kim et al. [2008] explore how increased awareness of speaking behaviour within an interaction (e.g., through a visualisation) can affect and shape group dynamics. There are also indications that even subtler elements of interpersonal interaction may be addressed. For example, Balaam et al. [2011] show how feedback based on nonverbal behaviour can affect and increase perceptions of rapport. Although Balaam et al. [2011] used Wizard of Oz techniques to select the indicators, there are already several systems that aim to automate similar tracking [Hagad et al. 2011; Sun et al. 2011]. Similarly, Daily [2010] uses physiological data to provide a posteriori feedback on group discussion in classes, suggesting that such feedback can deepen reflection of the shared experience and empathy. Together, these projects highlight the opportunities to track and provide relevant aspects of social interaction to learners as cues to trigger further reflection and learning around communication skills.

3.3. Mixed Spaces for Practice

As Elias et al. [1997, p. 55] notes, although repeated rehearsal provides benefits to any learning,

> "there is one main difference between SEL and many academic subjects. While SEL entails the learning of many new skills, it may also require the unlearning of habitual patterns of thought and behavior. For instance, students rarely come to class having repeatedly practiced an incorrect version of the multiplication table, but they may have become well schooled in not waiting their turn or not listening carefully to others."

Providing extensive opportunities for practice using many different instructional modalities (cf. Figure 1) and in as many contexts as possible is thus fundamental for SEL curricula. Drawing on earlier HCI research around games, augmented reality, and VR, we provide several examples of how technology could bring novel opportunities to enhance and improve the training.

In particular, we point to the opportunities to create "mixed spaces" through technology for practice—environments that combine the safety and scaffolding inherent

in existing class-based activities (e.g., a role-play scaffolded by the teacher), but with increased autonomy for the learners, and allowing students to practise social and emotional skills in a wide range of novel model situations. We outline next several SEL topics in which initial work in HCI exists.

Self-control. As one option, the existing work suggests how the combination of physiological sensors and a computer game could support the practice and learning of self-control and calming down skills. For example, Bouchard et al. [2012] explored a combination of a first-person shooter game and short biofeedback training that limited the field of view in the game based on changes in arousal as measured by skin conductance. They provide evidence for how such a biofeedback loop, together with calming exercises, helped soldiers not only to better manage their stress during the game, but also how these coping skills were better able to be transferred into real-world training situations; soldiers who have undergone such biofeedback training were significantly better than those trained by traditional techniques. Similarly, Mandryk et al. [2013] used an analogous biofeedback-driven graphical overlay on existing games to support learning by children with a Fetal Alcohol Spectrum Disorder. Although the system has not been fully evaluated yet, the team reported a sustained engagement from the learners over a 12-week deployment. Overall, these and similar examples suggest how including such game-based self-control training into SEL curricula can take advantage of the strong engagement and controlled stressors that computer games can offer, while allowing learners to explore their reactions in a safe space and fail without serious consequences.

Promoting perspective taking. Perspective taking is one of the key relationship skills that curricula teach, especially as a way to support effective conflict resolution or prevention of bullying. Initial work on "serious" games suggests that game environments could help develop such perspective taking across a broad range of contexts, and do so in an engaging way. For example, Hailpern et al. [2010] designed an instant messaging system to support the relatives and friends of patients with aphasia in understanding the distortions of speech induced by this disorder, showing that interaction through such a system can increase empathy for the experiences of those suffering from aphasia [Hailpern et al. 2011]. Taking a more design-oriented approach, Rusch [2012] aimed to facilitate a similar understanding of depression, and Rubin-Vaughan et al. [2011] developed and deployed an online interaction consisting of a series of games that help children practise their social skills, including perspective taking or making friends, with a specific focus on bullying prevention exercises. Although still in initial stages, the existing work suggests that similar approaches could be incorporated into the curricula, allowing students to experience situations from perspectives they would not have access to otherwise.

Communication skills and collaboration. The existing research also points to several areas in which computer-mediated experiences could support communication and collaboration skills. For example, initial work suggests utilising the recent advances of embodied, interactive agents to support practicing of particular skills, such as negotiation across cultures [Core et al. 2006], medical communication skills [Johnsen et al. 2005], or preparing for a job interview [Hoque et al. 2013]. In both of these, the learner interacts with an agent in a pre-prepared scenario, and is given feedback on their behaviour (e.g., nonverbal behaviour such as smiles or speech prosodics) to support further reflection and learning. Ulgado et al. [2013] present a similar system aimed at supporting practice for learners on the Autism Spectrum. Each of these provides novel support for practice on specific skills that SEL curricula teach. They benefit the students in offering additional external feedback and support that can be accessed

without the need for direct involvement of teachers, parents or peers, and that happen in "safe" simulated spaces.

Prior research has also looked at the possibilities of novel interfaces such as multi-touch tabletops to scaffold cooperation and communication behaviours through placing constraints on available activities (e.g., Yuill and Rogers [2012]). Although most of the work aiming at supporting the learning of such skills looks at augmenting the therapeutic approaches with autistic children (e.g., Piper et al. [2006], or [Zarin and Fallman 2011]), initial work suggests that similar approaches might translate also to interactions of neurotypical children (e.g., [Antle et al. 2013; Cao et al. 2010; Hinske et al. 2009; Kharrufa et al. 2010]) and the more complex cooperative behaviours that the SEL curricula aim for there.

4. SEL-ENABLED OPPORTUNITIES FOR HCI

The previous section highlighted areas in which digital technology could be particularly helpful in supporting social and emotional learning in education, suggesting specific opportunities to support SEL through the appropriation and adaptation of the existing HCI work with the SEL contexts.

We now move on to argue that a focus on SEL also presents HCI researchers with a unique opportunity to jump-start the research on technology for supporting social and emotional interaction more broadly. In particular, although we have seen many examples of how HCI work may support SEL learning, most of the mentioned systems are (i) still in the stage of research prototypes with little empirical evidence of them leading to actual lasting effects and (ii) have been mostly designed as isolated, one-off solutions rather than as part of an integrated program that is needed for sustained change [Zins et al. 2004, p. 13]. Cooperation with SEL programs could help address both these limitations. In the rest of this section, we first outline how the structure inherent to SEL curricula can provide HCI with a "test-bed" to develop, test, and deploy novel technology supporting social and emotional interactions. Second, we discuss how building on the existing knowledge within the SEL community can further guide HCI researchers in this space.

4.1. SEL Training as a Test-bed for Novel Technology

HCI researchers can draw on the evidence-based, structured learning processes within SEL curricula as an excellent context for deployment of emerging HCI technologies. The SEL curricula bring a wealth of carefully designed SEL content in which novel HCI systems can be embedded, thus offloading a crucial aspect that can otherwise make or break the system and/or limit the uptake. HCI researchers can also build on a continuum of activities and contexts with various levels of scaffolding, starting from highly structured activities in class with the teacher present, to completely unstructured, in-the-wild settings in the playground or out of school. Finally, designing to support SEL curricula offers the opportunity of large impact and scale. Successful technologies can utilise existing distribution channels to thousands of schools, as well as the large-scale evaluation practices common in the SEL community.

For example, the in-class context of an SEL lesson is likely to be particularly well suited for initial technology exploration, as it allows us to develop for real-world scenarios, but within a relatively constrained and manageable environment. Novel systems can thus utilise (or be directly designed for) the tightly scaffolded interactions in class, such as exercises and skills learning progressions, as well as assume a specific use of space (e.g., a dedicated part of the classroom), and a teacher facilitating the interaction between students and technology. Moreover, such settings also point to particular user roles the system can support, such as the trainer's expert role (augmenting and enhancing rather than replacing their skills), the students' learner role (directly supporting

the individual learners), and/or the peer role (e.g., facilitating peer feedback or group reflection on examples).

SEL curricula also provide a strong motivation for a number of other, more challenging contexts, with increasing demands on the robustness of developed technology. One such step can be extending SEL into the school environment more generally. This can be by supporting in-class learning in other academic subjects or students' interaction during the breaks. In both cases, there is still a fixed, controlled space in which to deploy the technology and in which a teacher can lead the scaffolding to some extent, but already supporting behaviour not tied to specific exercises. Moreover, one can utilise the fact that all interactions take place on the school grounds, allowing additional technology to be deployed at strategic points (such as in a main hall, in the playground, and so on), or invite students to use a specific technology as part of their learning process (such as providing each student with a Sociometer-like badge [Kim et al. 2008]). The support for embedding learned skills can also be extended to the home and other out-of-school contexts in which making assumptions about the other interactants, roles, or locations is more difficult, but in which the support for reinforcement of SEL learning is even more crucial. Such lack of structure makes it a particularly challenging design space for thinking about how to support the embedding of SEL skills. Across all of these different outside-of-SEL-class contexts, the challenge is not only how to support the learner in the moment, but also how to close the loop so that experiences from out-of-class interactions can be brought back into the SEL class to facilitate further reflection and learning.

Overall, the lessons learned from developing systems targeted at SEL curricula can likely be transferable to domains other than education, inspiring novel HCI applications in additional areas in which supporting social and emotional interactions is relevant, such as workplace collaboration, family communication, or CSCW in general (see also Section 6).

4.2. SEL to Guide HCI Focus and Agenda Around Social and Emotional Skills Technologies

HCI, as a domain, has currently only an emerging understanding of how technology can be best used in support of the learning and teaching of social and emotional skills. In contrast, the SEL literature offers a large body of knowledge, including a wide range of well-defined skills to be progressively learned and supported, as well as established methods for evaluating skills acquisition on the part of the learner, or the overall effectiveness of the (technology) intervention. Cooperation with SEL experts will thus help orient HCI researchers to those aspects of social and emotional interaction that can most likely benefit from technology support and plausibly deliver significant positive impacts for learners, teachers, and parents, creating the basis for a strong HCI research agenda in this space.

For example, in the context of Affective Computing (AC) and Social Signal Processing (SSP) fields, researchers can utilise SEL curricula as a significant real-world application domain, with a large set of challenges that could be tackled by novel AC/SSP technology. The importance that SEL training places on tracking and feedback of emotional and social aspects for the learners, and the difficulty to do so without the scaffolding of the teacher, presents one such example. Research in this direction could draw on the existing SEL knowledge to identify those social and emotional aspects that are relevant to detect in this context, as well as how best to present them to learners, leading to clear and well-motivated AC/SSP research questions around if and how such aspects can be sensed and interpreted with technology. Work along these lines is likely to also contribute to the existing debate within HCI as to where should such sense-making happen and by whom [Boehner et al. 2007; Sengers et al. 2007]. This continuum can range from leaving the sense-making entirely to the user and/or the facilitator,

possibly cued with nonprocessed sensor data (e.g., as per SenseCam systems [Fleck and Fitzpatrick 2009]), to providing full interpretation by the system (e.g., as in arousal detection for people with autism [Picard 2009]). In particular, even if some aspects cannot be reliably and fully interpreted by technology, it might still be possible and in many cases actually preferable (cf. [Boehner et al. 2005; Mentis et al. 2014]) to support the users by providing "reasonably" preprocessed data they can view, interpret, and explore. Again, although such research questions will be inspired by the work with SEL, they are likely to have wider repercussions also in other areas such as HCI than those directly focused on social and emotional learning.

5. NEXT STEPS—HOW CAN WE DESIGN FOR EXPERIENTIAL LEARNING IN SEL?

This section identifies several significant open issues that designing technologies for SEL will likely encounter. These provide pointers to possible next steps that the HCI community can take to start engaging with support for SEL learning.

5.1. What Challenges do Learners Face?

Although there is a large body of literature in HCI examining the needs of learners and teachers for classic academic subjects (e.g., maths, sciences, language learning) to inform design, there is little understanding about what specific issues students, teachers, and parents face around SEL curricula, that is, what is the everyday work to practically put SEL curricula to work, what is easy/hard to teach/learn, what are the practical strategies people have evolved that could be exploited for design, and so on. Although the majority of SEL curricula provide training workshops as part of curricula deployment in new schools, and have trained thousands of teachers, presumably imparting some of this as practical practitioner knowledge, none of the SEL academic papers, online resources, or books we reviewed addressed this issue deeply enough to allow us to identify specific challenges that could be translated to guidelines for technology design. The history of CSCW research in particular points to the critical importance of deeply understanding the reality of everyday situated practices, not just relying on the procedure manual version, to inform design decisions (e.g., in relation to technology support for healthcare [Forsythe 1999; Fitzpatrick and Ellingsen 2012]).

So although the SEL literature can suggest broad areas in which technology could address existing challenges that curricula designers struggle with—such as the embedding of skills and developing reflective abilities, as outlined here—there is a clear need for ethnographically informed and/or participatory studies to unpack the specific issues that students, teachers, and parents face during the learning process. As a practical strategy, for example, it could be interesting to collaborate with a school that is just about to deploy a new SEL curricula and to conduct deep qualitative (and even action research) studies of the process following the perspectives of the various stakeholders and participants. It could also be beneficial to conduct interviews and participant observations with the training departments of established curricula[11] who can share their experiences from across multiple school contexts.

Once an understanding emerges of the practical situated issues, or even as part of this understanding process, there might be a role for technology (or cultural) probes to help explore the possibilities of technology in this context, helping to better ground, and articulate the opportunities of technology when communicating with students, teachers, parents, and curricula designers (e.g., [Balaam et al. 2010; Hutchinson et al. 2003; Kjeldskov et al. 2007; Lewin and Luckin 2010; Marcu et al. 2012; Vetere et al. 2005]). However, this would need to be carefully handled because of the sensitivity of the

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[11]For example, CASEL website or guides [CASEL 2003, 2013] can provide contact details to highly rated curricula.

skills concerned and that teachers have little capacity for additional work. Participatory design processes directly involving children (cf. Druin [2002], Walsh et al. [2010], and Yip et al. [2013]) are also likely to be a particularly effective approach in this space.

5.2. Tentative Design Factors

Accepting that there is still much to understand, we can still offer some tentative principles that can help guide initial studies and design thinking for technologies to support SEL learning. We do so drawing on our understanding of the SEL literature, and the experiential learning literature more broadly [Fleck and Fitzpatrick 2010; Griffith and Frieden 2000; Kolb et al. 2001; Moon 1999].

Design to empower self-driven learning. Finding ways of empowering learners to explore various facets of their behaviour is likely to be a crucial design consideration for many systems. This can, for example, include promoting the feeling of safety to be self-critical and positively learn from their own mistakes, while encouraging self-esteem and confidence in their own development. Such exploration will likely also involve supporting learners to collaboratively discuss and cocreate interpretations of the social interaction, with a specific focus on sharing their perceptions of the others' behaviour. In addition, other aspects of SEL (such as skills around self-control) point to the importance of personal devices that balance providing cues for the learner and not openly giving away information about their emotional state without their control. Wearable devices that offer opportunities for private feedback (e.g., the subtle vibration of FitBit wrist bands) could exemplify one possible way to do so. Designers will also need to consider age constraints and the related differences in learning goals (cf. Section 2.5.5), particularly the extent to which learners can be fully independent in their exploration or if stronger scaffolding will be needed, for example, from parents for younger learners.

Design to "teach and disappear." Although formal SEL curricula may span long time periods, it is a progressive learning process with the ultimate aim to facilitate the development of new skills that persist even after the course is finished. The aim of much of the SEL technology will likely be similar: to scaffold and help the learning of skills during the curriculum program and so that they will also persist *after* the technology is taken away. This provides interesting challenges to design, such as designing for support that can be phased out in structured ways, that is, for technology that gradually recedes into the background as the learner becomes more capable herself.

To our knowledge, there is only limited work in HCI so far that would explicitly aim to promote such progressive *learning of skills*, by a short-term scaffolding that is later taken away (see MACH [Hoque et al. 2013; Pina et al. 2014], or [Bouchard et al. 2012] for several exceptions), as opposed to providing continuous support of specific activities (e.g., MeetingMediator [Kim et al. 2008]) that may affect interaction at a particular meeting, but not necessarily lead to skills development, or long-term changes once the technology is no longer available. Further research is thus needed to understand how we can more systematically design for such "teach and disappear" technologies, implying a core quality of technologies that can be adapted in structured ways over time; this is a topic in which we could likely learn from the existing SEL knowledge, at least in terms of how the content/support focus should evolve.

Design to support engagement. Finally, facilitating engagement and supporting motivation of the learners is important across all learning, whether in SEL or core academic topics. A large body of literature in HCI shows the potential of technology and design to enhance users' engagement with a wide range of aspects, including education for children (e.g., Bers [2010] and Connolly et al. [2012] and the many papers from the

Interaction Design and Children conference). However, there is less literature on promoting the parents' engagement with their child's learning (see, e.g., Lewin and Luckin [2010] for an exception, or Raffle et al. [2010] for work on shared play). Given the importance SEL curricula place on such support from parents, and especially as the parents might need to develop and improve selected social and emotional skills themselves, strategies to make the system engaging to parents and children alike will likely pose challenges to designers.

5.3. Roles for HCI

We expect that a close cooperation between HCI researchers and curricula designers, teachers and learners will be crucial for successful design and development of supportive technologies in the domain of SEL, at least in the early stages when key challenges are set and goals defined. This is similar to the research around autism therapy support [Kientz et al. 2013] and online Cognitive Behavioural Therapies [Porayska-Pomsta et al. 2011], which exemplifies a fruitful collaboration between the respective domain and HCI experts. As an example of such a possible mode of collaboration, Coyle et al. [2007] suggest a two-stage process in the area of talk-based therapies, in which the first exploratory part is led by HCI with cooperation from experts from the other domain, aiming to iteratively develop and run initial evaluations of promising systems to the point "where they are shown to be usable by the target end users, are agreed to have clinical validity and are predicted to have therapeutic benefits." Stage 2 then focuses on larger scale evaluations and the roles exchange: the lead is assumed by the curricula experts with HCI researchers in a collaborating role, and receiving feedback on the system's use in real-world practice. This brings a continuum of research approaches, starting with nonrobust research prototypes deployed for exploration of feasibility and preliminary efficacy with small participant numbers, and eventually leading to real-world deployment—cf. Kientz et al. [2013, pp. 105–106] for an analogous discussion of technology for autism support.

In terms of HCI engagement with SEL, we suggest a combination of the Coyle et al. [2007] model of multistage cooperation with curricula designers, complemented with another stream of more independent, smaller, exploratory studies that try to push the boundaries of what might be possible to do with technology in the first place. In other words, we can see benefit in parallel research on two areas: (i) aiming for large scale, real-world impact with technologies/ideas that are already matured in HCI, in close cooperation with curricula designers, and large interdisciplinary projects; and (ii) a more exploratory HCI process, that draws on the existing curricula and the challenges, bringing novel, untested technology, and exploring a broad range of viable approaches that eventually feed into the first stream.

6. BROADER IMPLICATIONS—SEL IN OTHER DOMAINS

This review has focused primarily on SEL in education and argued that the established and evidence-based curricula and constrained learning contexts of SEL in education provide a good focus for HCI to explore SEL technology support. However, social and emotional skills are also key in a number of adult domains such as talk-based therapy, medicine, business, and everyday settings. The core underlying social and emotional skills needed in these domains are similar to those we identified for SEL in education for young learners, and are also often the focus for targeted training and support programs. In particular, such programs share similar approaches in drawing on experiential learning, presence of an expert facilitator who provides a structured program to varying degrees, and targeting analogous core competencies such as emotional regulation, reflection, or communication skills; although these might be taught in specific ways, as relevant to respective domains. Finally, and also similar to SEL in education,

the existing courses again use little-to-no technology to support the training. As such, it is plausible that technologies could support some of the key challenges here as well, and that technologies developed for SEL in education might well be transferable to these other settings.

To inspire and seed future work that would explore these possibilities, we briefly introduce some exemplar noneducation domains. The associated online appendix then provides additional details, outlining the broad impacts achieved through SEL training, commonly used methods, and key topic areas.

Talk-based therapeutic settings. A crucial part of talk-based psychotherapy aims to support the development of social and life skills, often for clients disadvantaged by cognitive or emotional deficits or going through difficult life situations at the time. The literature in this domain focuses on two main aspects. First is the psychotherapy itself, that is, strategies to support learning and improvement on the part of the clients (e.g., Duncan et al. [2010]). The second aspect concerns the training and development of the skills needed by the therapists/counsellors themselves, with the emphasis on supporting the learning process for the trainees leading to sophisticated combinations of class-based learning and practice with real clients (under supervision of an experienced therapist) [Asay and Lambert 1999]. See Coyle et al. [2007] for a succinct review of the most common psychotherapy schools and links to further resources; Hill and Lent [2006] for a review existing literature on teaching counselling and psychotherapy students, showing significant positive effects of particular training methods; and Slovák et al. [2015b] for an example of supporting counselling skills development by technology.

Clinical settings. Social skills, such as communication skills and empathy, are increasingly recognised as core clinical skills in the medical community [Barth and Lannen 2011; Kalet et al. 2004; Makoul and Curry 2007; Rider and Keefer 2006]. Improvements in such skills have been shown to enhance patient satisfaction, increase adherence to therapy, and promote patient willingness to divulge sensitive information that may assist diagnosis as well as reduce the risk of subsequent litigations [Brown 2008; Stewart 1995]. Most curricula focus on one of three areas: (i) university courses for medical students [Satterfield and Hughes 2007; Stepien and Baernstein 2006]; (ii) general courses and support for practising medical personnel [Rao et al. 2007]; and (iii) specialised courses for specific groups of medical personnel, such as in cancer care or end-of-life care, in which specific skills related to empathy and communication are even more important (e.g., when giving bad news to patient) [Barth and Lannen 2011]. Most of the courses are available for doctors, with courses also offered for nurses and other health professionals. Peer-reviewed evidence exists for the effectiveness of many of the interventions in this domain for improving the targeted skills (see the online appendix for more detail).

Workplace- and business-related settings. A focus on emotional and social skills teaching also has a long history in the workplace, for example, Bailey and Butcher [1983a, 1983b], appearing under a wide range of labels such as interpersonal skills, soft-skills, or, more recently, emotional intelligence and developmental workplace coaching. Social and emotional skills training is included as part of professional educational programmes such as for MBA and undergraduate business students; it is also offered as part of ongoing professional development in the workplace, for example, many companies offer soft-skills courses or coaching to their executives and increasingly also to other staff. Academic literature shows positive effects of such training (such as improved leadership, team-building, or self-management skills), but the existing evidence is not as strong as for SEL in education. Some of the reasons are that the training programs have often been developed on a purely commercial basis and outside

of the academic community and detailed information about the content of the programs is often not available for intellectual property and/or competitive advantage reasons [Clarke 2006; Riggio et al. 2003; Walter et al. 2011].

Everyday life skills. Everyday life skills courses comprise a wide range of fragmented topics and methods. As such, we only briefly point to several illustrative examples in which social and emotional intelligence skills are taught in, and for, everyday life settings. These are often framed as various life skills courses for the general population such as interventions supporting interpersonal skills (e.g., improving empathy for couples [Angera and Long 2006; Long et al. 1999]) or interventions based on meditation, yoga, and more recently Mindfulness Based Stress Reduction [Kabat-Zinn 2003], all aiming to support and improve personal well-being (e.g., Grossman et al. [2004] and Marchand [2012]). Moreover, the growth of life coaching (e.g., Green et al. [2006]) and consultation services, most commercially based, as well as the wide usage of self-help books, point to the increased recognition by people of the value of positive self-driven change, and interpersonal and emotional regulation skills. Altogether, these examples draw out the large scope of everyday life skills learning, and the value people place on them.

7. CONCLUSIONS

This article points to the potential of mutual cooperation between HCI and social and emotional skills learning (SEL), beginning with education, and benefiting both disciplines. We outlined the key challenges for current SEL approaches, including the lack of support for transfer and "embedding" of skills from the SEL lessons into students' interaction, encouraging parental involvement, as well as enhancing the support for development of reflective abilities and novel environments for practice. The review of the existing HCI research shows there are strong indications that technology could help address many of these challenges. We drew on the existing HCI work in a wide range of areas such as ubiquitous computing, emotional awareness and reflection, sensor-based tracking, social networks, design, and (serious) games. As such, HCI involvement in this space has the potential for strong, real-world impacts, especially given the wide (and ever increasing) penetration of SEL programs in our schools, workplaces, and everyday life. We also highlighted how the focus on SEL provides new challenges for HCI, as well as a structure to further guide and support HCI research around social and emotional interactions—both as a "test-bed" to develop cutting-edge technology in, but also as a "knowledge base" we can build and learn from as we shape this emerging research area for HCI. Overall, this article suggests that social and emotional learning points to a novel, complex, intriguing research space, which has a high potential to enrich HCI research and practice.

AUTHORS' STATEMENT

This work is not, and has not been, submitted for a review in any other venue. No part of this work was previously published or has any direct relationship to our existing/submitted papers.

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1. ONLINE APPENDIX – SEL IN OTHER DOMAINS

This main body of the review has focussed primarily on SEL in education and argued that the established and evidence-based curricula and constrained learning contexts of SEL in education provides a good focus for HCI to explore SEL technology support. This appendix extends the Section 6 of the review, and introduces more detail for other domains where SEL is key, including talk-based therapy, medical settings, and workplace programs. For each of these, we outline the broad impacts achieved through SEL training, commonly used methods, key topic areas, and also provide pointers to selected reviews where more details can be found.

1.1. Talk-based therapeutic settings

A crucial part of talk-based psychotherapy aims to support the development of social and life skills, often for clients disadvantaged by cognitive or emotional deficits or going through difficult life situations at the time. The literature in this domain focuses on two main aspects. First is the psychotherapy itself, i.e., strategies to support learning and improvement on the part of the clients. The second aspect concerns the training and development of the skills needed by the therapists/counsellors themselves, with the emphasis on supporting the learning process for the trainees leading to sophisticated combinations of class based learning and practice with real clients (under supervision of an experienced therapist).

Methods. The methods used to work with clients during the therapeutic process differ depending on the psychotherapy approach chosen by the therapist. These can range from very specific training situations and exercises such as exposure therapy in Cognitive Behavioural Therapies (CBT) or social skills training for people with autism, to unstructured exploration of personal experience in humanistic approaches. See, e.g., Coyle et al. [2007] for a succinct review of the most common psychotherapy schools and links to further resources; and [Kientz et al. 2013] for an in-depth review of technologies developed to support autism therapy. Skills development for students and novice therapists builds on a mix of lectures on the theoretical background and how to put these into practice. This is done initially with peer students who role-play clients and share and discuss their (real) problems; later in the learning process this also involves real-clients, where the students lead the psychotherapy under close supervision of an experienced therapist. The emphasis on supervision is high, with the majority of schools/colleges requiring student therapists to enroll into psychotherapy for themselves while studying.

Topics. In terms of supporting the client directly in the psychotherapy process, the topics differ substantially depending on the clients' issues or disorder, and personalisation is crucial. As such therapies can, for example, aim to help clients to achieve better self-awareness, to develop better self-control, decision making processes, and interpersonal skills, and to help change deeply set negative thinking patterns. Therapist training is most concerned with very detailed self-awareness on the part of the therapist, and mastering the techniques and approaches of the studied psychotherapy approach. The ability to empathise and fully listen to the clients is particularly emphasised as a key therapeutic skill. The aim of all these social and emotional skills is to help develop a good working relationship with clients, which is seen as one of the main aspects of successful psychotherapy [Asay and Lambert 1999].

Reviews. Therapeutic settings have already generated considerable research within HCI, looking at using technology to extend and improve the psychotherapy process. The work so far focused mostly on autism related systems (e.g., [Escobedo et al. 2012; Picard 2009; Hayes 2011; Porayska-Pomsta et al. 2011; Hong et al. 2012] and many

others), and cognitive-behavioural therapies (e.g., [Coyle et al. 2011; Matthews and Doherty 2011]). Coyle et al. [2007] in particular gives an overview of the use of technology in psychotherapy, the potential for HCI involvement, and a solid introduction to most common psychotherapy styles. In addition, Hill and Lent [2006] review existing literature on teaching counselling and psychotherapy students, showing significant positive effects of particular training methods. The book edited by Duncan et al. [2010] provides a detailed review of the factors common across various therapeutic approaches, including the large positive effect sizes of most therapies, and the key role of the therapeutic relationship.

1.2. Medical settings

Social skills, such as communication skills and empathy, are increasingly recognised as core clinical skills in the medical community [Rider and Keefer 2006; Barth and Lannen 2011; Makoul and Curry 2007; Kalet et al. 2004]. Improvements in such skills have been shown to enhance patient satisfaction, increase adherence to therapy, and promote patient willingness to divulge sensitive information that may assist diagnosis as well as reduce the risk of subsequent litigations [Stewart 1995; Brown 2008]. Most curricula focus on one of three areas: (i) university courses for medical students; (ii) general courses and support for practising medical personnel; and (iii) specialised courses for specific groups of medical personnel, such as in cancer care or end-of-life care, where specific skills related to empathy and communication are even more important (e.g., when giving bad news to patient). Most of the courses are available for doctors, with courses also offered for nurses and other health professionals. Peer-reviewed evidence exists for the effectiveness of many of the interventions in this domain for improving the targeted skills (see reviews below).

Methods. A popular method in medical settings is the use of role play both with peers and using trained actors [Stepien and Baernstein 2006; Stiefel et al. 2010; Kalet et al. 2004; Barth and Lannen 2011], as well as facilitator or peer based feedback [Rao et al. 2007]. Courses also include workshops, lectures, and discussions of case studies. Many courses that aim at general communication skills include role plays with scripted exchanges or examples to practise on.

Topics. Curricula focus both on self-oriented emotional skills for medical personnel as well as a wide range of interpersonal interaction skills. Courses on self-oriented emotional skills include aspects such as personal reflection, self-awareness mindfulness, and stress management training [Shapiro et al. 2000; Epstein 1999; Satterfield and Hughes 2007]. This also incorporates the growing emphasis on the importance of teaching medical students and healthcare practitioners to manage their own well being, for example through teaching mindfulness techniques and lifestyle management [Hassed et al. 2009]. Courses on interpersonal skills aim to support generic patient-clinician interaction. The emphasis is on the ability to inquire for diagnosis related information and to clearly communicate test results and offer treatment suggestions (e.g., see [Kalet et al. 2004; Barth and Lannen 2011] for examples and review); related techniques, such as motivational interviewing [Miller and Rollnick 2002], focus on skilful framing of questions with the aim of empowering clients to take responsibility for their own behaviours and decisions.

Empathy is understood as another crucial component of successful and caring interactions between the patient and doctors, nurses and other health professionals. Empathy is particularly important in interactions communicating deeply emotional and life-changing information, e.g., in oncology, and to a lesser extent also in other general practice [Barth and Lannen 2011]. For example, doctors often tend to ignore patients' emotions during difficult moments (e.g., having to communicate a critical diagnosis)

and concentrate on the pragmatics, leading to negative consequences for treatment adherence and psychological functioning of patients. The training involves aspects such as sensitive responding to emotions from patients and improved understanding of the patients' psychosocial issues, concerns and needs as well as methods to do so while protecting the emotional well-being of the clinician or nurse.

Reviews. Rao et al. [2007] present a systematic review of interventions designed to enhance communication behaviours between patients and doctors, and Barth and Lannen [2011] systematically review communication courses specialised for oncology personnel (e.g., doctors, nurses, social workers). Both found statistically significant positive effects of skills training, such as improvements in patient-centered communication skills as well as higher ratings from the patients. Emotional skills training for medical students is reviewed by [Satterfield and Hughes 2007] and shows positive effects of the interventions. Pedersen [2009] and Stepien and Baernstein [2006] review training courses that specifically aim to increase empathetic skills of students or practitioners. There have also been some successful initial studies on including technology into the teaching process, e.g., Tulsky et al. [2011] shows the benefits of combining lectures with tailored video-recording of the doctors' own interactions for later reflection.

1.3. Workplace and business related settings

A focus on emotional and social skills teaching also has a long history in the workplace, e.g., [Bailey and Butcher 1983b; 1983a], appearing under a wide range of labels such as interpersonal skills, soft-skills or, more recently, emotional intelligence and developmental workplace coaching. Social and emotional skills training is included as part of professional educational programmes such as for MBA and undergraduate business students; it is also offered as part of ongoing professional development in the workplace, e.g., many companies offer soft-skills courses or coaching to their executives and increasingly also to other staff. Academic literature shows positive effects of such training (such as improved leadership, team-building or self-management skills), but the existing evidence is not as strong as for SEL in education. Some of the reasons are that training programs have often been developed on a purely commercial basis and outside of the academic community and detailed information about the content of the programs is often not available for intellectual property and/or competitive advantage reasons [Walter et al. 2011; Clarke 2006; Riggio et al. 2003].

Methods. The majority of courses follows similar strategies: role-play as a key approach to teaching the skills, together with discussion of fictional and real life cases, demonstrations and modeling. The emphasis is again placed on procedural learning and the opportunity to practise and embed skills so that they become automated. Time-frames differ from a few hours to multi-day courses, and to longer-term learning relationships (e.g., as in coaching).

Topics. A key focus is on developing aspects of emotional intelligence (EI), which can be defined as "the ability to carry out accurate reasoning focused on emotions and the ability to use emotions and emotional knowledge to enhance thought" [Mayer et al. 2008]. Such training might, for example, develop communication and cooperation skills, as well as increase self-awareness of the employees. Specific leadership programs focussing on SEL skills in the workplace designed for executives are often aimed at relationship skills (such as conflict management and interviewing) and self-management (e.g., dealing with stress or time-planning and goal setting). Executives are often expected not only to learn these skills themselves, but also to be able to teach them to others later on. Coaching is often used as a way to help executives (and increasingly other employees) develop EI skills [Bono et al. 2009]. It is inherently

client-focussed, with the goals agreed depending on the situation, and emphasises accountability to the coaching relationship, honest feedback, supported reflection and accepting responsibility for own decisions.

Reviews. Arthur et al. [2003] provides a general overview of the effectiveness of training within organisations, including training of interpersonal skills, and discusses the effects of various training designs. Their meta analysis reveals medium to large positive effect sizes (d around 0.60) for organisational training courses. Mayer et al. [2008] gives a thorough review of the 'emotional intelligence' concept, including connections between emotional intelligence and better real-world performance. Feldman and Lankau [2005] and Bono et al. [2009] summarise the practices and processes used in executive coaching by practitioners, and Carey et al. [2011] provides a rigorous review of academic literature on work-place based coaching for leadership.

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CHI'15 – SEL in education experts interviews

The study presented in this chapter directly follows-up the TOCHI literature review: our aim was to validate the findings we saw in the SEL literature directly with the researchers, developers, and trainers from 9 evidence-based SEL curricula (which, together, are used in more than ~40% of US schools).

Beyond such validation, these findings complement the review by stepping from the analysis of literature to providing more specific challenges that particular SEL developers see as crucial. This allowed us to better understand how the curricula work in real-world settings, as well as suggest example HCI solutions to each of the identified challenges based on design workshops with SEL developers. Overall, the work in this chapter contributes predominantly to RQ2-RQ3.

Contributions   The paper has three co-authors, Ran Gilad-Bachrach (Microsoft Research), Prof. Fitzpatrick and myself. I have driven the interviews, argumentation flow as well as write up of the paper, benefiting from on-going support and discussions with Dr. Bachrach and Prof. Fitzpatrick.

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Designing Social and Emotional Skills Training: The Challenges and Opportunities for Technology Support

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ABSTRACT

Social and emotional skills are crucial for all aspects of our everyday life. However, understanding how digital technology can facilitate the development and learning of such skills is yet an under-researched area in HCI. To start addressing this gap, this paper reports on a series of interviews and design workshops with the leading researchers and developers of 'Social and Emotional Learning' (SEL) curricula. SEL is a subfield of educational psychology with a long history of teaching such skills, and a range of evidence based curricula that are widely deployed in primary and secondary schools. We identify the shared challenges across existing curricula that digital technology might help address: the support for out-of-session learning, scaffolding for parental engagement, and feedback for the curricula developers. We argue how this presents an opportunity for mutually beneficial collaborations, with the potential for significant real-world impact of novel HCI systems, and can inform HCI work on supporting social and emotional skills development in other domains.

AUTHOR KEYWORDS

Social and Emotional Skills, SEL, Education.

ACM CLASSIFICATION KEYWORDS

H.5.m. Information interfaces and presentation

INTRODUCTION

The importance of social and emotional skills in our everyday life is widely acknowledged [11, 15]. Such skills predict success at work and academic accomplishments [5, 6], as well as personal well-being and sustained close relationships [7]. Recent HCI work strongly suggests the potential for technology to play a key role in supporting the development of such interpersonal and self-regulation skills (e.g., [8, 12]), and a number of systems have been developed in support of specific disadvantaged populations, such as people with autism spectrum disorders [11], or those in cognitive behavioral therapy [4]. However, understanding how such skills are taught and learned by the general population, and how technology can play a role in this, is yet an under-researched area in HCI.

To start addressing this gap, this paper presents findings from interviews and participatory workshops with key researchers and developers of 'Social and Emotional Learning' (SEL) curricula in educational psychology — a field that has now more than 25 years of history in developing SEL curricula as part of prevention programs for general and at-risk student populations in primary and secondary schools [6, 7]; and a wide range of curricula deployed across US and elsewhere [5, 15]. Through these engagements, we identify what the SEL experts consider to be the key challenges and opportunities where technology could be of use, setting up an initial agenda for future HCI work in this space (cf. also [14]).

In the rest of this paper, we begin with an overview of how technology has been previously used to support emotional and interpersonal skills as part of HCI research, and then outline the goals, methods and real-world impact of existing SEL curricula. Following our recruitment and methodology process, we present the three key challenges identified from the interview and workshop data: the *need to facilitate practice and learning out-of-the-classroom, scaffold parental support and engagement with SEL curricula*, and *provide feedback on use for curricula developers*. Each of these challenges is also complemented with an example of a prospective HCI project that was identified and elaborated on together with our workshops participants.

Overall, this paper contributes the first empirical discussion of the challenges and opportunities for technology support of social and emotional learning in the setting of SEL curricula. This highlights the importance of social and emotional skills learning for non-disadvantaged populations, and identifies SEL as an area with complementary interests and challenges to HCI. We also emphasize how the SEL contexts can provide an excellent test-bed for emerging HCI technologies.

RELATED WORK

Technology and interpersonal training in other settings

While existing work suggests the potential of technology support for developing social and emotional skills, the research is still in its beginning. A growing body of work has recently focused on technology support for social skills training for disadvantaged populations. Most of this work supported people with autism spectrum disorders (see review [11]), or those undergoing talk-based therapy (e.g., [4]). In contrast, design and research around supporting the development of social and emotional skills for non-challenged populations has so far received only limited attention within HCI. Existing work includes early explorations in a diverse set of topics such as

using mobile sensing to emotional regulation for parents of ADHD children [12], and exploring the opportunities offered by virtual agents to augment the training of communication skills for medical students [9], US Army soldiers [3], or during work interviews [8]. However, all of these systems embrace only single, isolated aspects rather than the full complexity of social and emotional skills that are needed and developed within the SEL curricula (cf. [14]).

SEL curricula - history, goals, and methods

Social and emotional learning in education is a mature field, with 25+ years' history of peer-reviewed curricula that have already been deployed to millions of pupils. This suggests the potential for considerable real-world impact for any HCI technology deployed in support of a SEL program. Moreover, hundreds of randomized control trial studies find measurable and significant positive effects of SEL curricula, such as the improvements in academic performance [5, 7], or mental health and violence prevention [15].

The skills taught in SEL curricula are those that have been identified by psychologists and educators as crucial not only to development in childhood and teenage years, but more importantly as key skills for adult life, such as self-awareness, self-management, social awareness, relationship skills, and responsible decision making [7]. The core of most curricula is a set of SEL focused, structured classroom lessons [10], usually 25-40 minutes long and administered once a week throughout the whole school year (or multiple years). The lessons use predominantly experiential, active approaches, such as role-play and modeling, to support learning. Such an experiential approach is key as social and emotional skills integrate both cognitive and non-cognitive aspects. The learners thus need extensive examples and opportunities for personal experience and practice, complemented by feedback and opportunities for self-reflection on progress. All curricula aim to develop skills that 'transfer' to situations out of the lesson, i.e., that the learners are able to apply and use the new skills in their everyday life.

As outlined in the Findings section, curricula still face significant challenges (e.g., effectively supporting out-of-classroom learning and reinforcement), and there is no work so far that would explore how incorporating digital technology may address these. Moreover, the sustained reliance on experiential, often non-cognitive learning is what sets SEL apart from learning of traditional academic subjects such as math or literature, and brings unique challenges to supporting learning of social and emotional skills with technology. These issues raise different requirements, needs, and challenges for designing technology in support of SEL training that go beyond the existing work on academic learning within HCI.

METHODOLOGY

The present study builds on a literature review [14] that drew on a wide sample of SEL literature including 5 books, 66 academic articles, and 34 SEL programs. One gap identified in existing work was little or no discussion of the opportunities for technology support of SEL programs. Our aim was thus to identify the areas of SEL training that are challenging and for which HCI technologies are likely to have high impact.

Participants: We recruited SEL curricula developers and their key trainer(s) from seven established SEL curricula. This allowed us to tap into their unique overview of the challenges 'on-the-ground', gained from directly supporting and training the school personnel implementing their curricula in real-world settings. Both developers and trainers also possess the analytical skills and experience to identify the areas they perceive as most challenging for teachers or students. Overall, we interviewed 14 SEL experts – 9 developers, 5 trainers, with SEL experience of median 18 and average 20.8 years. Participants were reimbursed $100 for their time.

Interview topics and analysis: The semi-structured interview aimed to identify the participants' understanding of the challenges the learners, parents, teachers and curricula developers face as of now. We also inquired about what they perceive as the key components of the program, and which aspects are most difficult to learn or teach. The recorded interviews (53-75 min long) were conducted in person or over phone. Each interview was audio recorded, annotated in the software package InqScribe, partially transcribed, and thematically analyzed as per the 6 steps process outlined in [2].

Workshops: Two groups of SEL experts (2 and 4 people) also took part in a series of two workshops each (four workshops altogether). The first workshop was four hours long. We started by presenting four areas of possible technology support (reminders and data collection on-the-go; sensing and feedback of nonverbal emotional cues; supporting communities; games and augmented reality), selected on the basis of the literature review [14] and the interviews. We followed with an extended discussion on how these or similar systems might be relevant to SEL. We aimed to inspire the SEL experts to think about new possibilities, and open up the design space. We then asked the SEL experts to identify 8-10 challenges they perceive as most important for their curriculum. These challenges served as input into the second workshop conducted several days later, where we discussed technology support for two selected challenges in more detail.

IDENTIFIED CHALLENGES AND OPPORTUNITIES

A number of challenges appeared consistently across different curricula and were prioritized by developers and trainers alike. We highlight three areas that our interviewees perceived as most promising for technology support, and complement each with a short description of a possible HCI project, identified as part of the workshops. We end with a list of the other challenges emphasized by our interviewees.

Facilitate practice and learning beyond SEL lesson

Generalization of taught skills to situations beyond the SEL lesson is the core objective of all SEL programs, and a key recurring challenge appearing across all interviews. The social and emotional situations in which students are expected to apply the learnt skills cannot be fully replicated in class. The skills are thus practised in situations that progressively resemble real-world setting, but then need to be reinforced in actual, out-of-class situations (on the playground, at home, in other lessons etc.). Curricula however face several challenges in this regard, as the learners generally find it very difficult to practice skills without external support. As such,

out-of-lesson learning is still strongly dependent on coaching by an adult (teacher, school staff or parent), who provides the on-going cues, prompts and reminders needed by learners. This limits the effectiveness of the training, and does not empower the learners to depend on their own resources or to practise/learn independently. Our participants highlighted the potential of wearable and mobile technology to support out-of-lesson learning, both in terms of providing the in-situ, just-in-time coaching support (as per, e.g., [12]), or in facilitating novel training situations that could reinforce and support the generalization of skills.

Exemplary project: Emotional regulation, e.g., the ability to calm down when stressed or angry, was highlighted by the majority of developers and trainers as the key skill that is required for any other learning to take place. It is however also one of the most difficult skills for the learners to learn and transfer. As one opportunity, the participants in both workshops envisioned how combining a computer game (which can be used to elicit strong emotions) with bio-feedback of bodily stress (providing the just-in-time cues and prompts to trigger the calming down strategies taught by SEL courses) could provide the learners with valuable novel opportunities for practice. Previous work in other settings, e.g., [1], suggests that such systems could also be effective in SEL. As the strong emotions elicited by a game are naturally felt (as opposed to role-played interactions), the curricula developers hypothesized that such practice would be more likely transfer to other settings.

Provide tools to scaffold parents engagement with SEL

Parents are overwhelmingly understood as the one of the key agents of change by all SEL curricula, especially given the importance that adult modeling of skills plays for young learners. While most curricula have a wealth of content to support the parental role (e.g., in the form of workshops, or paper documents sent home with children), they lack the tools to distribute it effectively and struggle to engage parents to support SEL at home. For example, the workshops are costly for schools, parental turn-out is often low, and the materials sent home are rarely read or acted on. This is a serious problem, especially as many parents could themselves benefit from SEL concepts (e.g., anger management, or emotional self-awareness), and might be reinforcing unhelpful habits otherwise. As exemplified in the project suggestion below, our interviewees were optimistic about the opportunities for mobile technology to support parents' engagement with SEL learning and to scaffold reinforcement of crucial SEL concepts through playful interactions with their children.

Exemplary project: The workshop participants discussed how digital technology could help infuse SEL concepts into everyday parent-child interactions, such as bed-time reading for pre-K to K2 learners, effectively scaffolding reinforcement of SEL curricula in engaging and playful ways. Building on the existing HCI research on facilitating parent-child interaction with technology, such as Family Story Play [13], an interesting design challenge for HCI is exploring the potential that digital technology may offer beyond what can be accomplished with a non-digital book. Our participants were particularly excited about the opportunities of infusing the stories with interactive prompts, cues, and activities that would better scaffold discussions around key SEL concepts for both parent and child. Examples might be a focus on problem solving (e.g., show different story outcomes based on the child's choice), or perspective taking and awareness of emotions (e.g., 'what might Mary feel now?'). Moreover, the curricula developers envisioned that such scaffolded interactions can also be designed to promote the parents coaching abilities around SEL concepts. For example, being able to formulate how one feels is an important aspect of many curricula, but something that parents often struggle to support. The scaffolding designed into the interactive book might make such interaction more accessible even for parents who would otherwise find such topics uncomfortable.

Feedback for curricula developers

While all curricula undergo extensive piloting and rigorous randomized controlled trials to gauge their outcome, they are still mostly distributed in printed form. Once sent out, the curricula developers then do not necessarily get feedback from teachers or parents to provide support for fidelity of deployment, identify aspects of curricula (e.g., specific activities) that are in need of further improvements, or allow for rapid innovation and change (e.g., A/B testing of new activities across schools). Incorporating digital technology could help address all these challenges as well as promote a sense of ownership for the teachers, parents, and learners.

Exemplary project: Although most curricula have documents and activities that are sent to support parent involvement, curricula designers receive very little feedback about whether and how these are used by parents. Our participants were excited about providing the family with a physical object that serves as a portal to an underlying digital content, e.g., a QR link on a fridge magnet or a digital frame. Such an object could then be incorporated into homework exercises, serve as an ambient reminder of SEL concepts (e.g., constantly visible on the fridge door), and also facilitate collecting the needed feedback from the parents and children, or even empowering the users to create and share new content. Moreover, curricula designers could work with dynamic content updates (e.g., a machine learning based tailoring), as well as large scale comparisons of effectiveness of different activities across broad populations.

Additional challenges

Our participants mentioned a number of additional challenges that were shared across the curricula. These included support for online, but still experiential training (to lower costs for participating schools' budgets), as well as the lack of tools to create, support and maintain supportive peer networks for parents and staff taking part in SEL programs. A prevalent issue is also the lack of time on the part of the teachers, further encumbered by their wish to, understandably, co-create and own the lessons they teach, despite having little time to do so. Finally, most of the existing curricula focus mainly on elementary and early middle-school, as engaging older students brings different dynamics and developmental challenges. Our interviewees were however optimistic about the potential of mobile technology (widely used in this population) to promote novel curricula design and ways of learning.

DISCUSSION

The interviews and workshops with SEL experts helped us identify some of the key SEL challenges that digital technology is likely to be well-suited to address, pointing toward plausible agenda for future work. As supporting SEL in education has not been addressed in HCI so far, this study provides the first step into this significant but under-researched area; and orients HCI research to the importance of social and emotional skills learning for non-disadvantaged populations.

We argue that HCI involvement with SEL has the potential to not only address some of the key SEL challenges, but can also advance HCI research beyond the focus on HCI in education (see also [14]). SEL brings the knowledge of techniques and methods to teach and support interpersonal aspects that are then likely to translate to other HCI contexts such as workplace or everyday life. In particular, each of the exemplary projects show-cases such possibility of extending the HCI research, which provides new tools and opportunities for the learners, with the SEL domain knowledge on how the development of skills can be scaffolded.

Moreover, SEL in education provides an excellent context for exploring applications of emerging HCI technologies, such as social signals processing or affective computing systems. In particular, the existing curricular structure provides the detailed content and learning context (e.g., weekly lessons) in which novel HCI systems can be embedded, thus offloading a crucial aspect that can otherwise make or break the system and/or limit the uptake. SEL curricula also provide well motivated challenges for technology that, together with the long history of SEL learning, can guide HCI community to focus on most beneficial social and emotional aspects to detect and support. Finally, designing to support SEL curricula offers the opportunity of large impact and scale, allowing successful technologies to build on such existing distribution channels, as well as the large-scale evaluation practices common in SEL community.

CONCLUSIONS

This paper points to the complementary interests of SEL and HCI fields, highlighting the potential for mutually beneficial collaborations. As the first step, we draw on interviews and participatory workshops with leading curricula designers, identify the opportunity to address some of the key challenges in SEL curricula with digital technology, and illustrate these with three exemplary projects. We hope this paper can inspire future work in this complex and intriguing research space.

ACKNOWLEDGEMENTS

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CHAPTER 6

CSCW'16 – SEL in education technology probe deployment

Based on the findings from the previous two chapters, this study focused on a particular proof-of-concept issue: bridging the home-school gap to facilitate parental support. Through on-going work with a particular SEL program—Second Step—we iteratively explored the design (and problem) space, leading to a technology probe deployed with four classrooms as well as 25 families over mTurk.

Developing a specific technology artifact served as a catalyst to unpack many of the subtleties around experiential learning and actual 'on-the-ground' processes of SE training that were previously kept hidden. As such, it helped us articulate, and provide instantiations of, concepts such as the importance 'scaffolding the scaffolding role' of parents, as well as explorations of how interactive technology could actively engage parents and children at home.

Overall, the research in this chapter contributed to answering primarily RQ2 and RQ3, but also contributed some clarification to the details of the psychological principles underlying learning (RQ1).

Contributions The paper is a result of a joint project between TU Wien, Microsoft Research, and Committee for Children (developers of Second Step). I have played a leading role in conceptualising the project as well as in all of the empirical work, including

design of the probe and deployment studies. Kael Rowan developed the technological framework in which the designed content was presented to participants. Ran Gilad-Bachrach, Geraldine Fitzpatrick provided on-going support and discussion. The SEL experts answered questions and provided feedback on an on-going basis.

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Scaffolding the scaffolding: Supporting children's social-emotional learning at home

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ABSTRACT
The development of strong social and emotional skills is central to personal wellbeing. Increasingly, these skills are being taught in schools through well researched curricula. Such social-emotional learning (SEL) curricula are most effective if reinforced by parents, thus transferring the skills into everyday contexts. Traditional SEL programs have however had limited success in engaging parents, and we argue that technology might be able to help bridge this school-home divide. Through interviews with SEL experts we identified central design considerations for technology and SEL content: the reliance on experiential learning and the need to scaffold the parents in scaffolding the interaction for their children. This informed the design of a technology probe comprising a magnet card and online SEL activities, deployed in a school and via Mturk. The results provide a nuanced understanding of how technology-based interventions could bridge the school-home gap in real-world settings and support at-home reinforcement of children's social-emotional skills.

AUTHOR KEYWORDS
Social-emotional skills; SEL; Education; Children; Home.

ACM CLASSIFICATION KEYWORDS
H.5.m. [Information interfaces and presentation]: Miscellaneous.

INTRODUCTION
Social-emotional skills—such as the ability to be aware of own emotions, self-regulate or be empathic to others—are essential to personal wellbeing as well as interpersonal relationships [26, 47]. These skills are increasingly taught in schools across the US and many other countries as part of formal programs [19], drawing on experiential learning methods such as in-class role-plays or coaching (see [43] for a review). Such social-emotional learning (SEL) curricula have been shown to produce positive effects on children's academic and personal accomplishments in the classroom (cf. [12, 47]) and are

already deployed at scale: for example, 44% of US teachers have indicated that their school uses a school-wide SEL program in a representative US survey [6].

Developing social-emotional skills requires a collaboration between the school and home as two of the key social contexts within which SE skills are developed. However, the SEL programs report limited success with engaging parents through traditional means such as face-to-face workshops and sending documents home. A key challenge is then how to support the reinforcement of SEL learning beyond the classroom and in the homes of the learners [34]. Recent work has strongly suggested the potential of digital technology to play a key role in addressing this issue [43, 44], but to date there has been very little research in CSCW, HCI, and related fields that explores the use of technology to link the school and home to support the development or reinforcement of social-emotional skills learning.

To start addressing this gap, the main aim of this work is to explore how technology-based interventions could bridge the school-home barrier in the context of SEL programs; and, once in the home, how technology might support the parents in reinforcing the social-emotional learning of their children. In what follows, we report on a sequence of three studies.

The *first study* aimed to better understand the difficulties in connecting the classroom and the home and the key aspects that need to be supported for the SEL reinforcement process to take place. We interviewed SEL experts and trainers representing nine major SEL curricula in the US, whose programs together reach more than 35% of all US schools. We identified three key principles that any technology-based intervention would need to support, from the SEL experts' perspective. These are centred around: (i) the need for *experiential engagement* with SE concepts for parents and children; (ii) the need for *scaffolding the scaffolding* for parents: i.e., that children learn through parent-scaffolded activities, but support for parents on how such scaffolding can be done should be designed into the activity; and (iii) the lack of effective *delivery channels* that bridge the home-school gap. These principles then guided the design of a technology probe (cf., [22]) with the aim to further explore and deepen our understanding of the design space and promising directions.

In the *second and third study*, we deployed the probe in two different contexts: an in-the-wild study with 4 classrooms (∼100 families) at a US school; and a more con-

trolled deployment with 25 parent-child pairs, recruited through MTurk, whose interactions with the probe were recorded. These varied contexts allowed us to collect multi-faceted data, developing an in-depth understanding of how technology-based interventions might bridge the school-home gap in real-world settings; as well the detailed considerations of how to design interactive content that might support experiential learning and the scaffolding role of the parent.

This paper makes two important contributions. First, we provide insights into the challenges in bridging classroom and home in the context of SEL programs (as seen by the SEL experts) as well the key learning principles that need to be supported for SEL reinforcement to take place in the home. Second, we present a case study of the design and deployment of a technology probe, instantiating these principles, and thus providing empirically grounded design suggestions for technologies supporting parent-child interactions that could reinforce social-emotional skills learning at home. In doing so, this paper contributes to an important but so far under-researched area in CSCW and HCI, with the potential for a large scale, real-world impact.

BACKGROUND

Social and emotional learning in education is a mature field, with 25+ years' history of peer-reviewed curricula that have already been deployed to millions of pupils [12, 19, 35]. SEL curricula teach a broad range of skills, commonly grouped into a set of 5 core competencies: self-awareness, self-regulation, social awareness, relationship skills, and responsible decision making. The core of most curricula is a set of structured classroom lessons [23], usually 25-40 minutes long and delivered once a week throughout the whole school year (and over multiple years).

Experiential learning as core principle for SEL
Teaching of social-emotional skills is predominantly based on *active experiential learning* [2,13,49], with process similar to the Kolb's [28] experiential learning cycle. This reflects the understanding that both conscious *and* non-conscious components are fundamental for any social-emotional behaviour [3]. There are two underlying psychological mechanisms at play (cf., [51]): First is the difference between *declarative* and *procedural* memory systems [45]. The declarative system stores what a person consciously knows, such as the names of capital cities, or a memorised sequence of steps to start a computer game. In contrast, procedural memory stores the behaviours as they become progressively automatised and thus not necessarily consciously known; such as 'knowing' how to ride a bike, or drive a car (cf., Schön [41] for experts' reliance on procedural knowledge). The second psychological mechanism describes the changes within our cognitive processes in 'hot' moments, i.e., situations with high emotional activation, such as when one is in the middle of a heated argument. These cognitive changes reduce the availability of declarative knowledge and strengthen the use of procedural knowledge. As social-emotional skills are tightly interwoven with emotional activation, this mechanism explains why *procedural knowledge is fundamental* in SE skills learning.

Developing procedural skills requires repeated practice and students' own experiential learning within 'hot' situations. It is for this reason that all social-emotional learning heavily relies on a progression of carefully structured social situations: starting from 'cold' moments, such as introducing a series of 'calming down steps' that are practised out of context; to 'warm' situations such as role-plays or stories enacted with puppets, where the learner is experiencing a low-intensity but still emotional situation; and finally 'hot' moments when the learner is coached through a real issue they are experiencing at that moment. In each of these, it is the scaffolded subjective experience with emotional content that makes the social-emotional learning effective; in addition to the cognitive understanding of 'what one should do'.

The main challenge compared to other experiential learning situations (e.g., physical skills such as riding a bike) is the difficulty in creating situations where meaningful practice or reinforcement can occur. To do so, one needs to facilitate 'appropriately hot' experiences for learner as well as scaffold their involvement, as otherwise little is learned. In addition, a crucial pragmatic issue is also that many of the such 'appropriately hot' situations require an inherent involvement of others: for example, when learning to self-regulate during conflicts, the learner needs to experience a conflict situation; and thus would normally require other people to role-play (or actually have) a conflict with.

Current SEL challenges – areas in need of design
The requirement of scaffolded experiential learning leads to a number of challenges common across all SEL curricula, which technology support might be particularly well suited to address. However, to date, little or no technology is used as part of SEL curricula. See review by Slovak & Fitzpatrick [43] for more details.

The key identified challenge for SEL is in *embedding the learning and reinforcement processes into everyday life*, complementing the in-class settings that the SEL curricula are developed for [43]. This points to the potential of technology-based support to help learners: (i) identify teachable moments within everyday interactions; (ii) scaffold reinforcement and learning in these situations, for example in similar ways to how teachers coach children in class; (iii) 'stop & learn' from such experiences by promoting reflective skills (e.g., making the interpersonal/emotional situations more tangible and available for post-hoc reflection); and (iv) further support the transfer of skills by providing novel spaces for practice that offer a combination of eliciting relevant and strong experiences, but in a safe space where failure is possible and scaffolding is designed into the activity itself.

These aspects are relevant for all contexts the child is interacting with: e.g., the school, peer interactions, and the home. As will be argued in the next section, embedding the learning within the at-home context was the main immediate challenge perceived by the SEL experts during the interviews (cf., the next section and [44]); and is also mirrored in the SEL literature as one of the crucial issues SEL domains faces [13, 23, 34].

Digitally supported parent-child interaction

Although an emerging body of work shows how digital technologies can scaffold parent-child *learning* activities (e.g., [29, 30]), these are so far associated with the classical school content such as math or literature, and are thus building mostly on declarative rather than procedural learning processes. In another related area, a number of projects provide basic social skills training for people with autism, mostly as part of the therapeutic treatment (see [26, 39] for reviews); including work looking at involving the patient's family in the process (e.g., [20]).

More generally, CSCW and HCI have an extended history with supporting parent-child communication, especially when the parent and the child are at remote locations. Existing work has explored how video systems can support parent-child relationships over long distances (e.g., [1, 53]); examined the opportunities of video-based technology to support remote play between children and parents [21] or peers (e.g., [54]); and provided a technology-based support for scaffolded reading of books over distance (e.g., [15, 38]). A number of other projects have explored the potential of technology in co-located contexts: using tabletops to drive engagement and parent-child interaction (see [52] for a review); dialogic reading experiences for children and their parents on tablet based ebooks [27]; sensor-based cooperative games [40]; and enhancing shared play or creative storytelling among children [7].

However, no work so far has explored if and how digital technology can support social-emotional skills reinforcement at home for neuro-typical children.

FORMATIVE STUDY: SEL EXPERTS INTERVIEWS

Building on the theoretical background, we conducted a series of interviews with SEL program experts and trainers from a wide range of nine established SEL curricula; altogether reaching more than 35% US schools. Each of the interviewed experts has been instrumental in developing their respective curricula and brought many years of experience with real-world deployment and evaluation of social-emotional learning curricula. Our aim was to build on this knowledge to identify the immediate key challenges and opportunities where technology could be of use within SEL field.

The issue of supporting parental engagement with SE skills learning and reinforcement at home—as a fundamental opportunity for out-of-classroom practice of children—emerged as one of the core themes from the preliminary analysis (cf. [44]). In what follows, we first describe the broader study design and then focus specifically on the part of the data corpus that unpacks the methods SEL curricula currently use to engage parents; to facilitate situations in which experiential learning can take place; and scaffold the progressive learning in increasingly 'hot' situations.

Participants and methods
We recruited 14 SEL experts: 9 curricula developers, and 5 key trainers, representing nine of the major SEL curricula providers to US schools. The experts had a median of 18 and an average of 20.8 years of SEL experience, and were reimbursed $100 for their time. The semi-structured interviews with each expert were conducted in person or over phone (53-75 min long). Each interview was audio recorded, annotated in the software package InqScribe, partially transcribed, and thematically analyzed as per the 6 step process outlined in [5]. The themes covered in the interview included: the participants' understanding of the challenges the learners, parents, teachers and curricula developers currently face; what they perceive as the key components of their program; what aspects are most difficult to learn or teach; and what are the actual methods they use to teach these. The following discussion focuses on the key challenges identified around bridging from the classroom to the home context and the key aspects of the SEL learning process that need to be supported in the home setting.

Current approaches and challenges

All of our participants' curricula include a family component, in the form of in-person workshops or materials sent home, which were designed for a wide range of target populations: from all neuro-typical children to at-risk families. The key challenge, as perceived by the SEL experts, was about *ways to effectively reach parents and then facilitate the needed experiential engagement* with either one of these two methods.

For those parents who choose to engage with the training, workshops were described as an effective way of helping parents support the children's learning, and a substantial majority of parents were seen as strongly motivated to support their child's social-emotional development. However, the workshop turn-out rates were reported as often very low. While these improve if child-care is provided and parents' travel is reimbursed, they are still sub-optimal even under such circumstances. The developers were also pessimistic about the effects of printed materials sent home without the workshop component. Even when the paper homework is actually sent home by the teachers, then *"these just do not get read (E1)"* by the parents; and also lose the social and interactive quality of the workshops, *"becoming more like schoolwork (E11)"*.

The SEL experts acknowledged the complex, multifaceted situation around why parents might or might not choose to engage with social-emotional skills learning, such as the possibly difficult relationship or the lack of trust between the school and parents, especially in lower socio-economic areas. However, they believed that a key difficulty for majority of the parents rests in the general 'busy-ness' of their lives: the ever-present lack of time; too many materials coming from school to keep track of; and, for the case of workshops, the pragmatic issues around a scheduled fixed time, need to travel, and other commitments.

Overall, the interviews suggested a need for another method that would combine the benefits both of the workshops (facilitate active, experiential learning) and materials sent home (low barriers to involvement).

Supporting experiential learning in workshops

This section outlines the aspects that the participants see as fundamental in making the workshop training effective; and

the lack of which limits the benefits of existing materials sent home. These are useful to identify the core aspects that would need to be supported by the technology.

According to the SEL experts, one of the key roles for parents in supporting their child's SE development is to either facilitate the appropriate experiential learning context for the child; or to skillfully take advantage of naturally occurring 'teachable moments', such as the child having to deal with the frustration of doing the dishes, not understanding homework, or having to go to bed. Such moments are plentiful in everyday settings and can provide the best reinforcement for children's skills. However, the SEL experts were concerned that many parents might lack the ability to provide the needed coaching and scaffolding effectively; and that these are also the families that might benefit from SEL most (cf., also [17,25,49,50]). As E6 pointed, *"the greatest challenge is that adults [often] do not understand social-emotional learning; they cannot break it down for their kids"*. In particular, although the parents *"think they are helping the child solve the [social-emotional] problem, they are actually giving them the answer (E3)"*, creating a dependency rather than coaching the child to develop a new skill. Moreover, many social-emotional skills bring up topics that some parents might not be used to discussing directly and might not know how to address.

In response to these concerns, the workshops strive to help parents to learn how to *scaffold* learning for their children. Parents are provided with example questions they can ask (as part of the paper-homework), practise such situations through role-plays, and are encouraged to use on-going reinforcement techniques such as a stable vocabulary for specific situations (e.g., calming down steps). The resulting scaffolding of parent-child interaction is then closely aligned with Emotion Coaching framework by Gottman and colleagues (e.g., [16, 17, 25]). Important aspects include inquiring about and validating emotional experiences of the child, helping him or her label what they are feeling, providing empathic support when needed (e.g., through the progression of questions), and promoting the child's agency.

DESIGNING TO SUPPORT PARENTAL ENGAGEMENT

The background literature and the expert interviews provide a theoretical basis to design technology in support of parental engagement and at-home reinforcement. Social-emotional learning fundamentally relies on experiential learning to develop procedural knowledge. Supporting such learning thus must elicit the 'right' social-emotional experiences for the learner, and offer the required scaffolding to learn from the experience. Moreover, the closer such learning is to real-world situations, emotions, and experiences (i.e., actual 'hot' moments), the higher the chance that the learning will successfully generalise to everyday settings. For example, learning how to help characters in a game to calm down is not going to be successful *unless* the child is additionally supported in experiencing or recalling an angry state (e.g., through role-play), and then helped in applying the techniques herself when she genuinely feels mad.

In the case of supporting parental involvement, this theory (and the best-practices shared by the SEL experts) translates to three key concerns and corresponding research questions for technology support in this space:

RQ1 How can technology provide a suitable *delivery channel* to effectively bridge classroom learning and at-home reinforcement by parents?

RQ2 Assuming it reaches the parents, how can technology *experientially engage* parents and children with the SEL concepts (as the workshops do) rather than just presenting them with 'dead', non-interactive information (as per the paper homeworks)?

RQ3 Finally, how can technology provide the *scaffolding for the scaffolding role* of the parent, who needs to carefully balance the nature and 'hotness' of the experience for the child, while offering direct support only when necessary?

Moreover, the underlying aim of the SEL technology should be similar to that of the workshops: to 'teach and disappear'. That is, technology should help scaffold the learning and reinforcement of skills during a limited period of time, so that the newly learned skills will persist also after the technology is taken away or just not used anymore (i.e., are not dependent on such technology support being continuously present).

TECHNOLOGY PROBE DESIGN

To start exploring design solutions to the research questions outlined above, we developed a 'technology probe' (cf., [22]). A technology probe is simple technology that is deployed in real-world settings with the aim to collect information about use and appropriation, and to inspire further design ideas. Such a methodology is well-suited to the research questions at hand, where the in-situ appropriation of the technology by parents, children, and teachers, forms a fundamental part of the challenge.

Our aim was thus to create a probe that could be also deployed in ecologically valid, real-world settings of a public K8 school[1], helping us identify promising mechanisms to promote parental involvement. We developed the probe in close collaboration with the SEL developers and researchers at Committee for Children—the developers of Second Step, the most widely used SEL curriculum in USA—who provided the team with key SEL expertise. This included access to all Second Step curricula materials and weekly design meetings.

The resulting probe comprises a 8.5 x 3.5 inch magnetic sheet (see Figure 1), that links the users to a series of online activities (more information below), accessed through a web-page interface. We chose a simple web-based solution to easily cater to all operating systems across desktop, mobile phones and tablets. The magnets were designed to be distributed to children by their class teachers, together with a simple story ('Harrdy needs your help to find the treasure') to pique the children's interest.

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[1]K8 school is a school that includes Kindergarten and Grades 1 to 8, i.e., approximately ages 5-13.

Figure 1. The probe – a magnet serving as a portal to digital content

Instantiating the design considerations

In what follows, we outline the design rationale in three sections: discussing our initial decisions on the scope of the probe, methods to support the two core principles for the intervention's content (RQ2 + RQ3), and the delivery channel considerations (RQ1).

Scoping decisions

We made several key decisions early on, drawing on the literature review, interviews, and the best-practices recommendations of the on-team SEL experts. First, we chose to focus on *early elementary school children* and their parents—i.e., Kindergarten through to 3rd Grade—as the target group. This choice was motivated by research consistently showing that SEL interventions are more effective in the early years (e.g., [47–49]). Second, we decided to focus the probe content on facilitating use of consistent vocabulary across school and home context. Such consistent *verbal labelling* is a crucial aspect of many SEL curricula (cf., [4, 43]), and can serve as a natural reminder in everyday situations, reinforcing the learning (e.g., [24]). However, the SEL literature suggests that parents are often unaware about the verbal labelling strategies that their children are learning at school [34]. Finally, we chose *self-regulation* (calming-down) as the specific topic to focus on. Self-regulation is a crucial-but-challenging issue within SEL (cf. [18, 44]). Moreover we expected that helping young children deal with frustration and anger could tap into the existing motivation that many parents might have around these issues.

Designing the content

The SEL theory highlights the need to scaffold 'appropriately hot' emotional experiences for the learners to provide material for experiential learning. To do so, we drew on the power of games and stories to engage young children with emotional content [48], and help them to re-live their own feelings from similar situations. In our case, we re-cut and re-purposed a Creative-Commons video to show a simple story of a grumpy Pirate Harrdy searching for his treasure, who has his map stolen by a monkey and gets very angry as a result. As many children have likely experienced the 'something was taken from me' scenario many times at home, on the playground, or at school, we expected the story could likely resurface sufficiently strong emotions for them to relate to.

To promote the parental involvement and support, the story also created a shared experience and set the scene for a more direct parent-child interaction. To scaffold this, we interjected

the story with questions to help the parent facilitate the learning for their child. Such a progression of questions was directly drawing on the coaching approaches used in SEL (and taught to parents in the workshops), in this case helping the child remember how they felt in similar situations first and then take the perspective of the other person. For example, when the map is snatched away by the monkey, the video is stopped with the question: "Have you ever had anything grabbed from you? How did that make you feel? Tell your adult!" This is then followed by "How do you think Harrdy feels now?" To further facilitate parental scaffolding, we chose to have the questions addressed to the child and to be read aloud by the adult. The aim was to create a sense of *interdependency* between the child and adult, as many children are not likely to read fluently at this age. As such, the written text nudges the parent to take the narrator role and to probe into the emotional states of the character; he or she is also scaffolded in helping their child do so through the carefully selected questions.

Moreover, as the story progresses, the prompts are increasingly taking the parent-child interaction from the story to real-world activities between parent and child: they are asked to first explain the Calming Steps that the child learned at school to Harrdy (and, implicitly, the parent), help Harrdy practice one or more calming down strategies (deep breathing, counting down, and positive self-talk), and eventually to role-play the situation themselves ("Harrdy needs to see another example ... how about your adult plays out what happened to Harrdy and you help them calm down?").

Finally, repeated practice—using the associated calming down steps vocabulary serving as triggers—is crucial for reinforcement of self-regulation. To explore if and how the probe could support such repeated engagement, we designed the story as a sequence of related sub-stories, with the initial activity ending on a cliff-hanger: the monkey runs away with pieces of the map and Harrdy sets out to find it. The child is then asked to return to the activity the next day to help him. Over three follow-up encounters, each practising one of the three calming down strategies, the child is helping Harrdy find the map pieces and, eventually, the treasure.

Designing the delivery channel

The delivery channel design accounts for the three key stakeholders in this context: the teacher (who distributes the activity); the parents; and the children. Appreciating the interview and literature findings about both parents' and teachers' busy life schedules, the distribution needs to (i) be simple and quick to distribute in class and engage with at home; (ii) stand out from the stream of other school-home messages the parents are already over-burdened by; and (iii) be pragmatically easy to build and deploy so that it can serve the data collection role on the scale of multiple classrooms (26-28 children each).

The design of the probe drew on a 'portal' metaphor: the probe was designed as a simple physical object—a magnetic card—that is sent home with the child together with other school-home documents. When engaged with, however, it then serves as a virtual portal to the online activities. Mag-

nets were selected as a 'known' object tapping into the common family practices around putting things on a fridge in the US; aiming to hopefully serve as an ongoing reminder and a stable link to the dynamically changing activities over time. Using a magnetic card, rather than a standard sheet of paper, also provided us with the option of sending home something possibly of 'perceived value' that might not be thrown away immediately after first use.

The probe was designed to utilise the child's motivation to play the activity as the key method of also engaging the parents. To this end, we framed the activity as a 'treasure hunt', hidden within the card, that they need to discover together with their parents. Our design rests on the assumption that the combination of the mystique of a magnet 'hiding a story' together with a likeable design would make the child an active participant in persuading the parent to engage with the activity; as opposed to a math homework, or the usual paper SEL homework exercise.

Finally, we needed to design for the conflicting needs of privacy considerations on the one side and the data collection functionality of the technology probe on the other. Each card has a unique 'secret code' that allows us to track interactions from each card. The secret codes also came in 'packs', one per each class, allowing us to track usage on the class level as well. However, as the system collected no personal information and the teachers were asked to randomly distribute cards to children in class, neither us nor the teacher were able to ascertain which secret code belongs to which family.

STUDIES WITH THE PROBE - OVERVIEW
The probe deployments aimed to answer multiple questions: First, test the delivery channel aspect, where the interest is in natural uptake of the probe and understanding if and how this (and similar) technology can fit into teachers' and parents' existing practices (RQ1). Second, analyse if and how the designed content *experientially engages* parents and children (RQ2), and whether it provides sufficient *scaffolding for the scaffolding role* of the parent (RQ3).

To explore these issues, we deployed the probe in two different contexts: First, we recruited four classrooms in a K8 school in a major US city, in which the magnets were sent home with kids in four classrooms. This allowed us to understand the in-situ uptake within the everyday settings of teachers, parents, and children (RQ1). The ecological validity of such in-the-wild deployment came at the expense of limited opportunities to observe the parent-child interactions directly (as that would affect the natural uptake). Second, we thus complemented the first study by recruiting 25 parent-child pairs on MTurk, who have consented to screen-recording their interactions with the activity. This provided us with detailed information about the parent-child interactions around the activity that were needed to analyse RQ2 and RQ3. We report on each of the deployments individually and combine what we have learned in the Discussion section.

STUDY 1: IN-THE-WILD DEPLOYMENT
The aim of the first probe deployment was to study the uptake within real-world classes and families. We aimed to understand if and how similar technology could serve as an engaging delivery channel, and how to design for a best fit with (or positive change of) teachers' and parents' existing practices.

Methodology
Participants
We recruited a school counsellor and 4 classroom teachers in a K8 school who had taught Second Step over multiple years already. To explore the effect of age, each of the recruited teachers taught at a different grade level: Kindergarten, Grade 1, Grade 2, and Grade 3. As part of our recruitment, we offered a $50 reimbursement each for the teachers and the counsellor to compensate the organisational overhead and the time spent with us on a (post-deployment) interview. Every child in each of the four classes received their own magnet card to take home to their family.

Methods and data collected
The packets of magnets (one pack per class) were sent to the school counsellor, who distributed them to teachers. The packets included a simple Parent Letter to be sent home with the magnet, and an information sheet for the teachers outlining the distribution of cards: they should hand out the cards to the class and tell a simple scripted story. Importantly, the magnet was not framed as homework, but as an optional extra-curricular activity.

Our server logged all interactions with the activity from any of the cards individually, using the 'secret code' on each card as the identifying information. This allowed us to collect de-personalised information about the usage, separated into the individual classrooms. In addition, we asked teachers and the counsellor for a 30 minute interview, several days after the cards were sent home (5 interviews, overall 131 minutes of recordings); and also had the opportunity to interview some of the children (post-deployment) about their experiences, for 40-45 minutes per class. Depending on the age range, we interviewed groups of 3-6 children, with one or two groups per class (27 children altogether).

The nature of the deployment made it impossible to directly recruit parents or offer rewards for participation before the deployment as this would alter the natural uptake. We however attempted to elicit feedback from parents in three alternative ways: At the end of the activity—i.e., the parents must have engaged with it already—the parents were asked to rate the activity via two sliders, namely 'perceived usefulness' and 'child enjoyment'. At this point, we also invited the parents to take part in a 10-15 min phone or Skype call, offering a $10 Amazon voucher in appreciation of their participation. Finally, the teachers invited the parents (through email) to participate in a 5 min online survey two to three weeks after deployment, connected to a $40 raffle prize.

Deployment results
Activity logs – at-home engagement
The lack of delivery channels to effectively engage parents with SEL content is one of key issue we identified in the literature and interviews (RQ1). A fundamental question of the first deployment was whether the activity will reach parents

	Used at least once		Finished first activity		Returned at least once		Returned all three times	
Class 1	16	62%	15	58%	6	23%	5	19%
Class 2	14	54%	11	42%	6	23%	5	19%
Class 3	15	58%	13	50%	9	35%	4	15%
Class 4	12	46%	11	42%	7	27%	3	12%

Table 1. Activity usage across classes

at all; or *"just not get read"* as seems to the case for paper materials. We focus on two key aspects in our analysis.

First, we explored the activity usage aiming to understand the extent of involvement for individual cards. The main indicators of interest were whether the family logged-on at least once, if they finished the first activity, and if they repeatedly returned to the card to continue the story. An overview of the results is in Table 1. Overall, our data shows that between 46% to 62% of distributed cards have been used in individual classes, and a large percentage of those who started have finished at least the first activity (78% to 93%). Putting this in context, the teacher's interviews (cf., next section) suggest that reaching initial engagement levels of ∼50% can be considered a success. A much smaller proportion of families returned to the activity for follow-up stories; the teachers' interviews indicate that one possible contributing factor is that the option to continue the story was not clear to some participants. Note that the logged data does not contain information about whether the cards were used with a parent, sibling, or alone. The interviews with children and the school counsellor however suggest that a large proportion of parents did know about and engaged with the card (see below).

Second, we looked at the ratings data submitted by families immediately after finishing the first activity. Out of the families that reached this point, 59.6% submitted a rating. Both 'perceived usefulness' (mean 86.9, SD 18.0) and 'child engagement' (mean 76.4, SD 22.4) were rated relatively high on the scale from 0 of 100. Only 4 people indicated a rating lower than the neutral point (50/100) on either of the scales. Overall, this suggests that, at least those who rated, have both enjoyed the activity as well as found it relatively useful.

Fitting into teacher's practices
Teachers play an important role in any delivery channel trying to bridge school and at-home learning. To better understand how the probe (and similar technologies) could fit into the school context, we inquired about the methods the teachers use to connect and engage with parents at the moment, their opinions on the activity as a learning tool, and what they would consider as success in terms of parental engagement with the probe[2].

All teachers valued thinking about ways of engaging the parents with SEL (as well as other subjects), especially as a preventive measure: *"Ideally we would involve parents more. It is so far with the parents of kids who have [behavioural]*

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[2] At the time of the interview, the teachers have just sent the cards home, but did not know if and how many parents might engage with the activity.

problems and then we have these conversations [...] but ideally, you would give these strategies pre-emptively (T2)." In particular, involving the parents with at-home learning was seen as a general problem: when sending anything home, *"we get around 50% for anything that requires an adult (T1)"*. Getting to higher engagement ratios then seemed to require substantial 'bugging work' on the part of the teachers, such as sending the information repeatedly through multiple channels (such as emails, newsletter and printouts) or requiring the child to collect a signature from the parents. The teachers were also particularly pessimistic about the ratio of parents who would already know about the Calming Down strategies (or other SEL content) as *"they probably read it in the newsletter [a few months back], and forgot about it. (T3)"*.

In terms of engagement rates for the probe activity, all teachers mentioned that 50% parents engaging with the probe would be something they consider a success, especially as it is framed as a voluntary activity. The biggest concern for most teachers was keeping a level field for all the students: a common worry was that through the use of technology we might be *"cutting away a bunch of kids who do not have access to internet (T1)"*. However, the teachers were willing to work on accessibility issues—for example, by giving such students the option to finish such activities in the library—due to their strong motivation to better connect to as many parents as possible.

When asked to tell us how they handed out the cards, it became apparent that all teachers went beyond the deployment instructions. Instead of just reading the scripted story as suggested, they all used their card to show children a part of the activity; aiming to get the children more engaged and excited. Three teachers showed at least a first few minutes of the video; while the kindergarten teacher went through the whole first activity, utilising it as a teaching resource to reinforce the calming down steps. In all classes, the teachers reported that children were mostly enthusiastic about the cards and were looking forward to taking them home.

We asked the teachers to go through the first activity as part of the interview with us, watching their reactions and comments. In spite of explicit request for critical comments, the activity elicited mostly positive responses, with the critique focussing on localised aspects (such as a specific wording, or a typo in the text) and pointing out that the mechanism for the follow-up stories has not been clear enough. The interactive nature of the parent-child interaction with the story, and the scaffolding of the experience for both child and the parent were points that teachers repeatedly mentioned as particularly important.

Children's experiences
Two of the authors facilitated the child interviews together. We structured the child groups around watching the activity on a tablet, using it as a reminder to elicit stories about their experiences at home. We were particularly interested in who they played it with, which parts they liked/disliked, and what they would suggest as improvements. We were not permitted to record the conversations so one of the researchers kept notes.

Most of the children, regardless of the age, talked about the enjoyment of receiving something physical that was linked to a digital game. The need for parental involvement was also often seen as positive: for example, one child explained how she *"[liked the activity] because you get alone time with your parents (C8)"*. When watching the activity with us, we often observed that the children huddled together around the tablet, enjoyed the 'goofy' animation, and repeated some of the characteristic sounds of individual characters (e.g., the Pirate's "Arrrgh"). They particularly enjoyed 'helping Harrdy' by doing the calming strategies (many recalled trying all three strategies when doing the activity at home).

When talking about their at-home experiences, most of the children said they did the activity with another person and that they enjoyed playing it. Surprisingly, the other person was not necessarily a parent: approximately a third of the children shared they played the activity with their sibling instead (either older or younger), often because their parents were away or too busy. Some of the older kids even took over the 'parental' role during such occasions: For example, C11 explained how she *"first played it with her mum [...] but then also pretended to be an adult for her younger sister"*. Others started alone but then included their siblings or parent when the social interaction was required. In contrast, two children from the younger end of the age range told us they went through the activity alone. They were often interested mainly in the Pirate story and did not partake in any of the off-screen activities; leading to disappointment with the game. For example, one of the kindergarten children told us that although his nanny was in the room, he has *"played through it myself just clicking through all the buttons as I didn't need to read that. A boring game (C2)"*. Some of the children also mentioned technical issues they experienced that prevented them, at least initially, from playing. These were often resolved with the help from their parents or siblings.

Parental qualitative feedback
While the system indicates that 56 cards were used at least once, only very few parents volunteered to take part in the interview or submit a survey: Only one mother signed up for the phone interview and we received only 13 responses to the survey.

Initially, we assumed that perhaps the reason for such low turn-out was that many parents might not know about the cards at all. To test this, the school counsellor offered to intercept parents in-person when they came to pick up their children after school, over a period of 3 days. She was however able to give out only 4 cards, with most of the other parents saying they have seen the card and often already played it with their child; suggesting the probe indeed reached many parents. However, these efforts did not lead to any increase in interview volunteers or survey responses. This suggests that while many parents did engage with the probe itself at home, we did not manage to incentivise them to provide additional feedback to the research team.

The one mother who volunteered was very positive about her experience of the probe; although this is likely affected by the self-selection bias. Her son, who has impulsivity and other behaviour issues, brought the card home and initiated the use. She was surprised he was patient with the story, and had liked the activity. She herself felt that the activity was a good reminder to her to reinforce the calming down skills; she also referred to the pirate story in the following days, saying things like *"What would the pirate do now to calm down?"*. She particularly liked having a concrete reference for her young son that was tied to a shared story. She did not realise that she could return to the activity over the following days.

The majority of the available survey responses came from parents of the kindergarten class (10 out of 13), with the remaining responses being two G1 parents and one G2 parent. Eleven of the thirteen parents said they played the activity with their child; one did not know about the activity at all; and one did not have time. Apart from a single family[3], all children were perceived by the parents as liking the activity and enthusiastic to try it out. Six of the parents told us the magnet is still visible in their home, mostly on their fridge; others either did not know or had thrown it away already.

STUDY 2: MTURK DEPLOYMENT
The second probe deployment aimed to address the remaining two research questions, unpacking if and how the probe would facilitate emotional experiences (RQ2) and help parents scaffold the appropriate experiential learning context for the children (RQ3).

We used MTurk to recruit 25 parent-child pairs who would be willing to have their interaction with the activity recorded (thus providing the detailed data needed for analysis), and also were more likely to report their experiences in a post-hoc survey. In doing so, we draw on the growing body of work showing the possible insights gained from MTurk collected data, both at CSCW [31, 32] as well as in other disciplines such as psychology (e.g., [33]). An additional advantage of MTurk recruitment was the possibility to also reach low-income parents and those living outside of principal cities, who are the key at-risk populations for many SEL curricula, but are often hard to reach through other methods.

Methods and data collected
To promote a wide uptake, we offered $5 for the 20 minute long Human Intelligence Task (HIT), placing the HIT among the higher paid end of MTurk jobs. We thus hoped to attract also parents who are not personally interested in the topic of calming down/SEL skills or parenting as such. To improve chances of high quality results, we required that turkers have at least 95% prior approval history, live in the US, and have at least 50 prior accepted HITs [36].

The HIT description asked the participants to 'play an education activity with your child and tell us what you thought about it.' We made it clear from the start that the study was to be completed with their child, aged 5-9. Turkers were also informed that they would need to download a third party application (UserZoom) onto their smart-phone to record their

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[3]The parent told us that *"although initially very excited to it, my child thought it was not very interesting"*.

phone screen, what they say, and the camera image. For technical reasons, we required that participants had access to an Android phone.

During the HIT, participants went through the first Harrdy activity together with their child (task 1), and then were asked to answer questions about their experience such as what they liked or disliked; what other SE skills they consider important, and how are they working on these with their child (task 2). After we reviewed the HIT, all accepted participants were invited to take part in a follow-up survey (8min), re-using the open-ended questions sent to in-school parents. The survey completion was compensated by a further $2 bonus.

Participants

The MTurk recruitment resulted in a diverse set of 25 participants, living across 14 different US states. They reported relatively low-income: nearly half (47%) reported yearly household income as 30k to 50k; and nearly an additional fifth (17%) reported yearly income under 30k. The participants lived mostly often in rural areas (42%), or in metropolitan areas but outside of principal cities (33%). We saw a quite consistent split of grades between Kindergarten and Grade 3, and a single Grade 4 participant. Approximately 80% of parents were mothers. Most of our participants were Caucasian parents; this strong under-representation of Afro-American and Spanish population in the US mirrors results of [33].

Data quality

Overall, we found the data quality very good, with no obvious cheating (e.g., only clicking through or faking the interaction). Due to technical issues with participants' phones or internet connection, only 17 videos of the pirate activity have been uploaded to the server. These recordings were 8:01 minutes long on average (min 5:06, max 9:56 minutes[4]). For additional 3 parent-child pairs, we had at least the uploaded video of the task 2; leaving 5 parent-child pairs with no video. In these cases, we initially rejected the work, but left the opportunity for the parent to contact us if they thought the rejection "was in error". All but one got back in touch and their HIT was subsequently accepted. These participants were then asked to at least fill out the follow-up survey. From the full sample of 25 accepted participants, 19 filled out the follow-up survey.

Data analysis

Our key focus was on the parent-child interactions elicited by the probe. We drew on Gottman et al. [16, 17] Emotion Coaching framework to theoretically ground the key indicators of parental scaffolding. These included, for example: if and how the parent scaffolds the child to become aware and verbalise their emotion during parent-child interactions around the prompts offered by the activity; whether they follow-up on such prompts to validate (and further probe into) child's feelings; and if and how the parent attempted to scaffold the learning experience for the child more broadly, e.g., subtly helping the child if the child seems lost or helping to rekindle interest if the child loses focus.

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[4]For technical reasons, the UserZoom application stops recording after 9:56 min. This happened in 3 parent-child pairs, whose interactions thus were, in reality, approximately 2-3 minutes longer.

We also looked at indicators of the engagement of the child (and parent) with the activity, such as whether they kept focus on the screen or reacted to the story in non-verbal ways (e.g., giggling or mimicking sounds or activities on screen). We annotated the collected videos within the UserZoom interface, both through marking important moments and sub-clips directly within the video. The resulting observation notes were then thematically analysed (methodology as per Study 1) together with the follow-up survey data.

Results

Most children and adults seemed focussed and engaged when watching the initial video and working with prompts. In particular, we saw children sitting still or pointing out things to parents such as 'look, there's Harrdy!' or 'O-oh!' when the monkey snatched the map. We also saw a lot of giggling at the animation (mirroring the child interviews in schools), and quick glimpses at the parent to see if they were also enjoying the story. Children's and parents' behaviour towards the prompts differed across families, but mostly with respect to age. Many of the older children took pride in trying to read the text out loud by themselves, with subtle support from the parent if they got stuck on a word or read something incorrectly. The younger children were more reliant on the parent reading and scaffolding the interaction with prompts.

We saw clear differences between parents around how they scaffolded the engagement with activity for their child through their reading style. For example, some parents immediately started using a 'story voice' to narrate the story to the child, facilitating the child's interest and involvement in the activity. In contrast, another group of parents started off reading the text in a flat way. These parents left pauses for children's responses, but only rarely followed-up with additional questions, leading to interactions that appeared much less engaged, and more like homework. Pragmatically, the reading style also seemed to depend on the adult comfort with reading-out-loud – if they struggled with the words themselves, it was harder for them to present the content in an engaging way immediately.

Most of the relevant scaffolding behaviours however appeared when parents and children shifted the attention from the screen to each other, transforming the activity into a joint discussion around the prompt. For example, we often saw the parents read the prompt out-loud (as if making sense of it for themselves), but then immediately turn to the child and repeat the question again in a more direct way. For example, the adult (M14) was reading out loud *"Did you ever have something taken away from you? How did that make you feel? Tell your adult. <turning to the child> So tell me, how did that make you feel when someone took something from you?"*. Many parents seemed to do this naturally from the start; others took longer to switch from storytelling mode of reading out prompts to directly scaffolding the discussion with their child; but a few never made the switch and read throughout the activity.

What seemed to particularly help parents turn from story-reading to scaffolding their child's thinking about emotions were the prompts asking for the child's own experiences

("how would you feel in this situation?"); especially if these were then connected back to the story ("so how do you think Harrdy feels now?"). Such questions also seemed to provoke the child's reflection and often also the deepest responses from children. For example, when a child was asked by his mum whether he had anything grabbed from him, he said *"<calm voice> "Not really ... but if I did, I would be really really mad. <thinking for 3s, then becoming excited> Oh yes, Lulu! [...] she took away my bike and it's mine and I really really really want to ride it! [Mum: how did that make you feel?] Really really mad! (M9)"*.

Another source of experiential engagement for the children was enacting the calming down strategies themselves to help Harrdy (or their adult) to calm down. Approximately half of the families went through more than one strategy, often all three. Part of the enjoyment seemed to arise from the funny pirate voice accompanying the strategies, but also from using their own body in response to the game. The adult calming prompt seemed as an enjoyable experience (when adults played along, as the majority of them did); and a number of parents skillfully supported their child in going through all the activities again: e.g., *""I breathe and breathe, but I'm still angry; what else can I do?" (M3)"*.

Some parents also repeatedly took advantage and creatively built on the prompts to further strengthen the connections between the story and life. For example, when M18 and her daughter finished the calming down strategy she said: *"<turning to face her daughter> So when he's really angry—or when you're really angry—you can breathe, right, to calm yourself down. Or you can count from ten..."*. Similarly, one of the questions in task 2 asked parents 'what other skills would they like their child to develop'. Interestingly, this question was also appropriated by a number of parents as a teaching moment: they often started answering the question as if talking to the camera ("I would like my child to become better at ..."), but then quickly turned towards their child addressed the request directly to him or her ("you see, I'd really like you to ..."). It seemed that, again, the indirectness and connection to the story seemed to create a context in which such requests could be made.

Finally, we saw in the MTurk videos that it was often the parents who were driving the participation of the child; understandably so, as the child had not heard about Harrdy or the activity before. Sometimes, they had obviously initially struggled to get to child to come and watch the activity; although, once the video started, children were often captivated.

Follow-up survey data
The follow-up survey included open-ended questions around the experience with the activity (e.g., "What particularly stood out for you about the activity, if anything?"), as well as explicit prompts to identify what they did not like or would like to change. There were two problem areas that some parents pointed to: first were technical issues such as the slow loading speed of videos or the recording software for parents on slow network connections (4 parents); second, some parents felt disappointed they haven't seen the full story as the three follow-up stories were not included in the MTurk deployment (5 parents).

Overall, the choice of the topic — calming down strategies — spoke positively to many parents. Importantly, many parents highlighted how the cartoon story kept the child engaged, but also how it presented an example situation they could well relate to. For example, M5 wrote *"What stood out for me was the way the activity engaged my child and got her to think about why the character was feeling certain emotions, and apply that to herself in certain situations."*

Surprisingly, three parents also mentioned in the time between finishing the activity and answering the survey (∼1 or 2 days) either they or their child had already used the strategies in other situations: one parent wrote how she *"suggested to breathe like the pirate"* when her daughter was upset about her bedtime, helping her calm down; another remarked how her son reminded her to stay calm and breathe when she was going through an unsettling experience; and finally the third shared a story of her younger son, B, instructing his brother to stay calm (*"[...] B walked over there and in a calm, therapist like voice said 'You know E, you can take big deep breaths and count to ten and that will help you to not be mad'."* The majority of our MTurk child participants did not know the strategies in advance; however, two children did, which came as a positive surprise for their parents — supporting the assumptions that many parents are not aware whether and which SE strategies their child is learning at school.

While such positive responses to the survey corroborate the observations from the videos, it should be kept in mind that both are likely affected by self-selection bias (as parents voluntarily chose to be part of the study); thus providing a relevant, but likely overly positive sample of how the activity would be perceived by broader population.

DISCUSSION

The results of the probe deployments provide the first steps towards addressing a key challenge for social-emotional learning (SEL) curricula: bridging the gap between classroom learning and at-home reinforcement of skills. True to the nature of technology probes, this work serves more to highlight the potential of technology in a novel design space (and avenues for future work) rather than to present a full solution. For example, the methodology of current deployments focussed on understanding the uptake of the probe and how the parent-child experiential interaction processes could be scaffolded; rather than evaluation of learning outcomes achieved by this specific prototype per se.

In what follows, we unpack what we learned about design approaches to address the three key constraints: providing an effective delivery channel (RQ1), facilitating experiential engagement with the activity (RQ2), and scaffolding of the parental supporting role (RQ3). We then take a step back and reflect on limitations of this study in the broader context of using technology in support of SEL.

Suitability of delivery channel (RQ1)
The literature review and expert interviews show that SEL curricula lack ways to actively engage parents (and children)

with experiential learning at home. The logged data from the in-the-wild probe deployment suggests that the probe was reasonably successful in getting into the homes; engaging 46% to 60% of learners. However, the low parent feedback rate within this deployment complicates our understanding of how exactly the card was used by parents (and the child) in the home setting. Still, the interviews with children and the school-counsellor would suggest that a large proportion of parents have seen and played the magnet ($\sim$ two thirds of children from our sample); and that only a few children played the activity alone (two children from our sample). Moreover, the MTurk data suggests that at least the MTurk parents engaged with, and scaffolded the learning for their children (see also below) while playing the activity.

Overall, this would suggest that the two main design concepts used by the probe point to promising avenues for future work. First, drawing on the *'portal' metaphor*, i.e., combining a physical object that is sent home and linked to digital content, seems to fit well existing practices around home-school communication; is easy to distribute for teachers; and was understandable to teachers, children, and (we assume) also parents. At the same time, such portals could plausibly deliver a wide range of interactive interventions that build on digital devices already available in homes of the families. Second, *relying on the child's motivation* to try the activity—while requiring parental support to do so—seems a plausible method of driving initial parental involvement (e.g., that the parents make a conscious decision whether to engage or not). In particular, giving children a game 'hidden' in a physical object that they can try only when they are back at home, seems to have elicited engagement and motivation across the age ranges we looked at (K-G3).

Interviews with children have shown that approximately a third of the learners in the in-the-wild study played the game with their sibling (as the parent was either away or busy). This points to an alternative option of engaging the learners at home: by involving siblings or other family members—rather than just the parents—into the activity as active participants. One opportunity for future work might be designing activities where children work with their (older) sibling to create something, e.g., a story, which is then shown and explained to the parent (still as part of the activity).

The probe was also designed to serve as an ambient reminder that stays visible in the family environment over time, as a magnetic card on the fridge or other places. The SEL theory suggests that providing such on-going reminders is crucial for reinforcement processes. However, we have only limited data on whether this has been successful in this trial. From the 13 completed survey responses, just under half of the cards were still posted on the fridge two to three weeks after the deployment. Though these numbers are somewhat promising, it is unclear what happened with the magnet in the families who did not respond to the survey. An important open question is then to understand how one might design for such long-term ambient reminders in the context of SEL and families (cf., also [37] or [9, p.287] for examples of related CSCW and HCI work in this space).

Experiential learning (RQ2)

The theory of social-emotional learning is clear that experiential learning situations are needed for meaningful practice and reinforcement to occur. The results of the probe deployments suggest the *combination of a video and embedded prompts* can create experiential situations similar to the role plays or puppet stories in class, in spite the lack of trained guidance normally provided by the teacher. In particular, we used a common SEL progression to present a story relevant to the reinforced SEL concept ('get angry when something is taken away from you'), utilise prompting questions to support the child's recall of a related personal experience ('how would you feel') and help them imagine the character's feelings, and then looping it back into to the story progress with the strategies taught as part of SEL training. This is a promising first step which suggests that a wider range of SEL learning activities could be delivered in a similar manner. However, the child's experience has been still limited to the tight coupling with the presented story itself, rather than a real-life 'hot' situation he or she is experiencing; the fundamental goal of SEL reinforcement.

The key next step for future systems is then to find way to extend the support for the parent and child beyond the video activity itself, helping them connect the strategies to their everyday 'hot' moments. The parent interview and MTurk surveys showed that four parents have already appropriated the existing activity in similar way, using a reference to the story to label the on-going situation and remind about available strategies. SEL theory suggests such behaviours are likely to help the child generalise learned skills into other everyday contexts. While this again shows promise in the potential of technology-based delivery to promote such on-going engagement, the open question is how to specifically facilitate such transfer through design. For example, what are the opportunities for 'smart' objects that could be delivered home together with the magnetic card, such as a 'calming down token' or an 'anti-anger wand', helping the child connect the learning with their everyday interactions? And, what might be the best developmentally appropriate metaphors to build on, similar to the 'treasure hunt' trope used in the current probe?

Scaffolding of parental scaffolding (RQ3)

The second crucial enabling component within the SE learning theory is the skillful scaffolding provided to the child by the adult, in this case the parent. The probe deployment suggests that designing for *interdependence* between the child and the adult as part of the activity seems like a promising direction to facilitate a part of such parental scaffolding: supporting the parent's active engagement with child's activity. In our case, such interdependence created a shared experience for the child and parent that could be then worked with, e.g., through the prompts suggested by the activity. While the current probe only scratched surface of designing for interdependence—through expecting the adult to narrate the story—it points to a wide range of opportunities for future systems (e.g., using multiple devices to drive a single story).

The aim of the carefully selected prompts has been to model Emotion Coaching-like interaction on part of the parent: ask-

ing for and validating emotional experiences of the child including labelling of emotion, providing support when needed (e.g., through the progression of questions), and promoting agency and emotional reflection on part of the child. The analysis of the MTurk videos suggests that this approach is promising. We saw that the most engaging and well-scaffolded interactions happened when parents and children turned away from the screen, building on the shared experience provided by the activity to have a dialog with each other. In such instances, the parents used the pre-prepared prompts as an opportunity to be elaborated on: either by asking the child for more detail about their experiences, or by bringing in their own agenda (such as strengthening the connections between what is learned within the story and real-life use). This opens questions around the methods to scaffold the parental role in a way that is not too tightly bound to the story/activity itself, but rather designed to help the parent to use the story and the embedded prompts as examples that can creatively appropriated to scaffold interactions 'outside of the phone'.

Limitations and novel design opportunities
The series of studies reported here form a first important step into this design space. We now point to several open questions that have not been addressed here and that invite follow-up work.

SEL expert vs. parent perspectives
The work has been so far focused mainly on understanding the SEL expert perspective: starting from identifying challenges address-able by technology; to designing a system that complements existing curricula and fits with what the SEL experts consider to be best-practices in the field. This provided us with the opportunity to directly work with key experts who have many years experience in developing SEL curricula used by millions of students and to directly draw on the existing SEL literature and theory, which is mostly curricula focussed.

However, such expert-centric approach needs to be complemented by in-depth participatory research with parents to validate if and how their perspective matches that of SEL experts. In particular, future work should aim to more deeply understand the key reasons behind some parents' existing lack of engagement with SEL. The SEL literature—and interviews with SEL experts and teachers here—would suggest that one of the key reasons is the lack of time (and overload with school materials). The full issue is however likely to be more complex and might depend on cultural background, socio-economic status, and multiple other aspects. More thus needs to be learned about the existing practices of how families communicate around SEL at home (and with school); the underlying parental beliefs and motivation; and the support that parents already provide their children around SE skills. Drawing on the longitudinal work by Gottman's et al. [17] can be a good starting point to understand what is known about parenting in these aspects, but should be complemented with established participatory methods within HCI.

Complex ethical space
Designing social-emotional learning interventions, whether at home or school, form a complex ethical space. By scoping the research as based on SEL experts perspective and curricula, this paper has side-stepped a number of important questions that will need to be critically examined as future work in this space emerges. In particular, we should be mindful of the possible tensions between expert knowledge and parents' approaches to parenting; the distribution of power in the educational space, especially as seen by lower socio-economic status families; as well as key discussions about what does 'supporting the well-being of children' mean, for whom, and who should make decisions. Existing work in CSCW and HCI in similarly complex settings such as healthcare [14] or persuasive computing more broadly [46] can serve as starting points for examination of these aspects.

Evaluating learning
This work has focused on exploring the potential of technology to enable important parent-child interactions that are needed for social-emotional learning to occur (cf., RQ1-3) but are seen as hard to establish at home with existing SEL methods. The deployments have, however, not aimed to test whether the scaffolded interactions lead to actual learning outcomes for the child or the parent.

Any such evaluation should distinguish between evaluating the success of the *delivery channel* (i.e., has the information reached the parents at all and has system scaffolded the relevant kind of parent-child interactions?); and whether the delivered content was *psychologically powerful* (i.e., have the interactions lead to lasting changes in parents' or child's behaviour?). While the former is more easily detectable during the deployment (e.g., through the methods used here such as logging or recording of interactions), evaluating the psychological effects of the interventions require specific experimental methodology that is applicable in-the-wild deployments: Quasi-experimental studies or Randomised Controlled Trials are the most common approaches (cf., [12, 42]). Coyle et al. [8] and Slovak and Fitzpatrick [43] recommend a two-stage approach to such evaluations, where the initial evaluation are ran by HCI researchers to establish that the systems are likely to lead to positive outcomes, but the needed large scale experimental evaluations are progressively led by SEL experts.

Existing SEL literature also provides well-tested indicators of SEL interventions outcomes e.g., see [10] or [11, chp.19]. These include methods such as specific behavioural tasks, questionnaires, real-world indicators such as academic outcome or lowered behavioural issues, or established coding systems for a detailed analysis of subsequent natural parent-child interactions.

CONCLUSIONS
This paper presents the first exploration into the role digital technology could play in bridging the home-school barrier in the context of SEL curricula. We draw on an interview study with SEL experts, representing major SEL curricula providers in US, to identify the key challenges in and learning principles that need to be supported for SEL reinforcement to take place – the reliance on active, experiential learning as well as the importance of scaffolding the parents' scaffolding role. Through the design and deployment of a technology probe in

two complementing contexts, we gathered a nuanced understanding of how technology-based interventions might reach out and engage parents, as well as help them to scaffold learning experiences that reinforce their children's SEL skills at home. Overall, our findings point to the potential of digital technology to support parent-child interactions that can reinforce social-emotional learning, providing an important first step for future research in this direction.

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CHAPTER 7

CSCW'15 – SEL in counselling

The upcoming chapter changes the focus onto the second case study – the masters counselling training. It encompasses the full 2 year, user-centred research process, looking at understanding how social-emotional competencies in counselling are taught (RQ1), what the challenges are (RQ2), and how these might be addressed by technology (RQ3).

Through four distinct phases, as outlined in the paper, we moved from initial observations and interviews aimed at understanding the problem space toward ideation and deployment of technology probe system. This has since developed into a full-fledged learning tool—called mPath—that is currently piloted with the whole masters cohort in Winter semester 2016; the resulting tool is described in Chapter 8.

Contributions Starting as a small-scale project in cooperation with David Murphy and Paul Tennent at Nottingham, the visit has developed into an informal collaboration among TU Wien and School of Education (Nottingham), Mixed Reality Lab (Nottingham), as well as Open Lab (Newcastle). I was leading the project throughout, benefiting from the advice of David Murphy (counselling angle) and Geraldine Fitzpatrick. Anja Thieme led some of the design prompt explorations and contributed to user study design. Patrick Olivier supported the work and funded the development of the resulting system.

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On Becoming a Counsellor: Challenges and Opportunities To Support Interpersonal Skills Training

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ABSTRACT

Well-developed interpersonal skills are crucial for all social interactions. However, understanding how interpersonal skills are taught or learned, and how technology can play a part in this, is yet an under-researched area in CSCW and HCI research. To start addressing this gap, our research explores the learning processes of counselling students, for whom developing interpersonal skills forms a fundamental part of their university education. We followed an iterative process to gain an in-depth understanding of a specific counselling program in the UK, combining interviews and low-fidelity technology prompts. Overall, 26 participants comprising tutors, students and expert counsellors took part. Our findings first provide insights into the highly collaborative and social learning process of the students. We highlight the complexity of interpersonal reflection as a crucial process for developing counselling skills, and identify the challenges to learning that students face. Second, we build on this understanding to draw out empirically grounded design considerations around opportunities for technology innovation in this setting.

AUTHOR KEYWORDS

Relational Skills; Empathy; Education; Healthcare; Counselling Training; Reflective Design.

ACM CLASSIFICATION KEYWORDS

H.5.m. [Information interfaces and presentation]: Miscellaneous.

INTRODUCTION

The importance of interpersonal skills in our everyday lives has been widely acknowledged [8, 36, 12, 16, 35]. Interpersonal skills are particularly important for mental health professionals such as counsellors and psychotherapists. Indeed, it is the counsellors' interpersonal skill and competence—gained through education, training, and experience—that is considered one of the critical elements for the positive effects

of counselling interventions [11, p.29]. However, thus far, no research has yet explored how digital technology could support counselling education, and the interpersonal skills training of students.

As a first step in this direction, this paper focuses on counselling students, for whom interpersonal skills development forms a crucial part of their university education and who have access to established training programs to support them in the learning of such skills. Our research aims to reach a deep understanding of the processes and challenges of how interpersonal skills are taught and learned in counselling; to outline opportunities for technology support for students' learning; and to offer specific examples of how some of these may translate into technology design. In this paper, we report on a study with students and tutors of an under- and postgraduate counselling program at a leading university in the UK over a period of 14 months. We use an iterative process based on a series of interviews and observations (see Table 1 for an overview), with the later phases including low-fidelity prototypes that were employed to deepen discussions with participants and to enhance both their and our understanding of opportunities for technology design in this setting.

We begin with a review of related work and describe how technology has been previously employed for supporting interpersonal skills learning in other settings. Following a description of our iterative research and design process, our findings are then presented in three parts. The first provides insights as to how counselling skills are learnt by the students, and how the learning is facilitated by professional counsellors as tutors. We particularly focus on the use of experiential and non-directive learning, and the importance of *interpersonal reflection* in the learning process, drawing out the *key challenges to learning* in this context. The second part then draws on this understanding to identify a set of four *design considerations* to support the development of counselling students' skills using technology. These include opportunities for (i) non-directively promoting students' reflection processes; (ii) helping in the co-construction of interpersonal interpretation; (iii) scaffolding constructive feedback; and (iv) facilitating iterative, multi-phase reflection over time. In part three, we build on these considerations to guide the development of a design prompt used to further explore and deepen our understanding of some of the identified challenges as well as possible design directions. In particular, the design prompt aims to support a core aspect of counselling students' training—

'practice counselling sessions' by role-play with peers—by providing them tools that support students' reflection on this activity. We conclude by highlighting the complementarity of the interpersonal reflection process with previous works on reflection within CSCW and HCI communities.

This paper makes two important contributions. First, we provide a nuanced understanding of how interpersonal skills are taught in this particular counselling setting and outline the related challenges learners face. Second, we provide empirically driven design considerations for systems aiming to address some of these challenges, and support the learning of interpersonal skills more generally. In doing so, this paper introduces a novel context for technology design targeted at supporting the learning of interpersonal skills, arguing that this is an important but so far under-researched area in CSCW, with wider implications for other contexts in which social and emotional skills learning is relevant.

BACKGROUND

Counselling skills and education

Counselling is part of the psychotherapy profession, with several competing schools of thought that differ in the approach to client and philosophical background (cf. [10]). Interpersonal skills such as the abilities to deeply understand the other, give attention, reflect, listen, or paraphrase, are however at the core of counsellors' training, regardless of the chosen school or training model. In addition, humanistically oriented training such as the counselling program that was the focus of our research, emphasizes the Rogers' three core conditions of a therapist [30], which include (1) *deep empathic understanding*, when the therapist is 'so much inside the private world of the other that he or she can clarify not only the meanings of which the client is aware but even those just below the level of awareness'; (2) *unconditional positive regard*, during which the therapist experiences a 'positive, acceptant attitude toward whatever the client is at that moment', i.e, accepts the client without judgment or conditions; and (3) *congruence*, which points to a 'close matching between what is being experienced at the gut level, what is present in counsellor's awareness, and what is expressed to the client', i.e., full authenticity of the counsellor in the interaction [ibid, p. 115].

Approaches to the training of interpersonal skills in counselling have a long history, with a number of manualized training programs that are widely used in practice – such as the Human Relation Training [7], Micro-Counselling [21], Interpersonal Process Recall [23], or the Skilled Helper Model [13]. A large body of literature in psychology has also shown the effectiveness of each of these to promote skill acquisition over the last 30 years – see for example [16] for a recent summary and narrative meta-review.

However, there is a clear gap in the counselling literature around how students actually experience the learning process and which aspects they find most challenging to learn [6, 17]. Similarly, very little is known about how technology solutions could be mobilized to support students' learning in this regard.

	Research Phase	Methods	Participants and activities	Length Demographics	Participants' IDs
UNDERSTANDING THE LEARNING PROCESSES	Phase 1	Semi-structured interview	**Participants:** 5 counselling students **Activities:** • Discussed the main issues students encounter as part of learning • Identified areas to explore in next stages -- practice counselling sessions, and facilitating feedback **Aims:** Design inspiration; understand the basics of the learning process and the key challenges	4 females 1 male Length 45 min	S1-S5
	Phase 2	Observation	**Participants:** 4 expert counsellors, 8 counselling students **Activities:** • Observed practice counselling sessions led by expert counsellor • Observed (and recorded) reflection practices of both student client and expert therapist after the session **Aims:** Design inspiration; understand the practice counselling sessions, and students' reflective abilities	10 females 2 males Length 60 min	E1-E4 S4, S6 - S12
	Phase 3	Semi-structured interview Design prompts	**Participants:** 3 members of staff, 3 counselling students **Activities:** • Discussed how learning is scaffolded in class, particularly around practice counselling sessions • Followed by design prompts to envision potential of novel sensing and feedback support technologies **Aims:** Refine design considerations.	5 females 1 male Length 60 min	T1-T3 S11, S13 - S14
	Development of the design prompt for Phase 4				
DESIGN EXPLORATION	Phase 4 part 1	Practice counselling session Semi-structured interview	**Participants:** 6 students (3 pairs), each participating in both parts **Activities:** • Practice counselling sessions -- each student took part once as the client and once as the counsellor.	5 females 1 male Length 90 + 90 min	S13, S15 - S19
	Phase 4 part 2	Wizard of Oz Semi-structured interview	• Observe and explore students' reflection practices on recorded counselling session. • Review and critique of the design concept presented through WoZ **Aims:** Confirm identified challenges and design confiderations		

Table 1. Outline of the iterative design approach – methods and activities for each phase

Technology and interpersonal training in other settings

A large body of work in CSCW and HCI has recently focused on technology support for social skills training for disadvantaged populations. Most of this work has supported people with autism spectrum disorders (see review by Kientz et. al. [25]), and in particular on children with autism with a view to promoting basic collaboration (e.g., [28]), core interpersonal acts such as eye-contact or turn taking (e.g., MOSOCO [14]), or self-reliance (e.g., [18]). Outside of the autism domain, researchers have looked at using Virtual Reality systems to support the training of people with anxieties such as Social Phobia (e.g., [26]), or video-based training of interpersonal skills for parents of children with behavior problems [36].

In contrast, design and research on the teaching and learning of interpersonal skills for non-challenged populations has so far received only limited attention. Existing work includes, for example, the early exploration of opportunities offered by virtual agents to augment the training of communication skills for medical students [22], inter-cultural communication training for US Army soldiers [9], and automated system to improve non-verbal behavior during work interviews [19].

However, none of these systems embrace the full complexity and mastery of interpersonal skills—such as picking up on subtle feelings and thoughts that might be hidden to the client[1] himself—that are needed and developed within counselling settings.

APPROACH (METHOD & PROCEDURE)

This paper presents findings from a series of interviews and observations that form part of an ongoing collaboration with a counselling degree program in the UK. We intended to better understand how interpersonal skills were taught and scaffolded in counselling training, and the challenges that this may entail generally and for technology design more specifically. To this end, we took an iterative, four phase research approach, with each of the stages being analyzed and informing the next (see Table 1 and below for more details). Overall, 3 teaching staff, 4 expert counsellors and 19 counselling students took part in the various research activities. Altogether 22 females and 4 males participated. This reflects the ratio of females to males in the course. Generally, each participant took part in a single Phase only; with the exception of three students participating in two Phases each (S4, S11, S13). We also drew on our multi-disciplinary research team, comprising a counsellor, interaction designer, psychologist and computer scientists.

Phases 1-3: Understanding the design context

In the first phase, we conducted 5 semi-structured, 45 min long interviews with 5 counselling students. We explored how students experience their skills training with a particular focus on what they find difficult. Based on these interviews, we identified that so called 'practice counselling sessions' formed an integral, but also the most challenging part in their learning process. The second phase aimed to gain insights into some of the practical issues that surround 'practice counselling sessions', and to increase our understanding as to how expert counsellors and students reflect on these sessions afterwards. We observed a set of eight practice counselling sessions that involved overall eight students and four expert counsellors (approx. 20 min for each session and 40 min for reflection). Our analysis of these initial two phases led to first ideas for a potential technology design. This centered on the development of an online tool to provide students with a wide range of opportunities to reflect, annotate, and receive peer feedback on practice counselling sessions.

The third phase aimed to elicit critique and comments on our initial ideas, and to gain a better understanding of how such a technology solution would fit into existing learning practices. We conducted semi-structured individual interviews (60 min) with three teaching staff and three master students. Each interview was divided into two parts: During the first, we asked participants to describe their experiences of how counselling skills are taught and practiced, focusing specifically on how students work with recordings of their practice counselling sessions, and their previous experiences of technology use as part of this process. During the second, we then presented our interviewees with a series of design prompts in

the form of post cards that visualized different ideas for potential sources of *feedback* (e.g. by tutor vs. other students; opportunities for video annotations; ideas for automatically generated feedback on the interaction dynamic between conversation partners); and offered examples of certain *modalities* for capturing such information (e.g. 1st or 3rd person camera perspective for video recordings; use of a smartphone app vs. physical buttons for providing feedback; use of sensor devices).

Phase 4: Translating identified challenges into design

Our findings from Phase 3 enabled the refinement of some of our considerations for the design, leading to the development of low-fidelity design prompts for Phase 4. This fourth phase consisted of interviews exploring the ways in which students reflected on their skills practice in greater depth, and also provided an initial, Wizard of Oz- style testing of our low fidelity prototype. Three pairs of students joined discussion with the researchers, each on two separate days. During the first meeting (90 min), we asked each pair to run two practice counselling sessions with their partner (so that each student took once the role of the client and once of the counsellor) and then interviewed them separately. As part of the interview, we invited the students to use the video recording of their session to talk us through their usual reflective processes. This led to a set of 6 interviews and 6 practice counselling sessions. For the second meeting (90 min), each student would individually be invited to discuss their experiences with our design prompts and to share their ideas for technology design aimed at supporting their learning process. This phase is described in more detail in the Design Led Exploration section on p. 7.

Analysis

All collected data from Phases 1 to 4 underwent a two-stage analysis process, whereby the data of each phase was at first analysed individually (to inform preparations for subsequent phases), and then revisited as a whole once the data collection was completed. Our final data set therefore encompasses all audio-recorded interviews, which were carefully transcribed and then included into a systematical thematic analysis following the approach by [5]. To this end, two of the researchers closely familiarized themselves with the data to identify and systematically search for (reoccurring) themes. Identified themes were then coded and higher-level categories developed. Our findings present the key themes that evolved through this analysis. To protect anonymity, participants are referred to by using an abbreviation of their role such as a T for teaching staff or S for student, followed by a participant number.

PART 1: UNDERSTANDING THE LEARNING PROCESSES

This section presents our findings and understanding of the current teaching processes that mediate learning of interpersonal skills for student counsellors, building mainly on the data gained from Phases 1-3. These findings complement the existing literature in two important ways. Firstly, they provide a nuanced understanding of the fundamental approaches

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[1]In mental health contexts, patients with mental health problems are referred to as clients.

shaping counsellors' learning in the setting of this course. Secondly, the interviews highlight how students' learning is based on a set of social reflection practices around the practice counselling sessions with peers.

Fundamental learning practices
Our interviews with staff and students emphasise several fundamental learning practices that were used throughout their learning and underplayed all interactions within the course.

Experiential, non-directive learning
In agreement with the literature [30, 16, 17], both students and tutors understand the learning process as (a) fundamentally based on tutors' on-going modelling of counselling skills (e.g. being empathic, congruent, respectful to other's experiences) in all their interactions with the students; and (b) strongly shaped by person-centered counselling values of *non-directiveness*, *experiential learning*, and a *focus on the 'here and now'*. In particular, both students and tutors referred to the non-directive approach, describing its evolution from a core belief that people learn best if they feel they are understood and that their perspectives are valued by others; rather than simply being told what to do. As such, the learning processes were described by teaching staff as designed to help students directly experience what they learn about, and to deeply engage with and reach new insights about themselves through reflection – helping them to *"push the edge of their awareness"* (T1).

Discomfort as a cue for learning
In addition, teaching staff regarded experiential learning to only happen when students are *"willing to come out of their comfort zone"* (T2). This is particularly important due to their belief that, if one is to learn, *"there needs to be a dynamic moment of feeling off-balance, like a waking up moment"* (T2), during which students learn. This highlights the need for enabling, at least to a certain extent, uncomfortable experiences to invite important processes of reflection and thereby the development of interpersonal skills. However, the teaching staff as well as the students frequently emphasized how such interactions had to be facilitated within a 'safe space', where confidence and trust could develop among the students. This need for a safe space and mutual respect was also manifested in a 'learning contract' that all students and tutors agreed to, and breach of which would be severely reprimanded.

Learning in stages
Similarly to the other counselling training programs (e.g., [13, 23]), the tutors frequently described in the interviews how they structure activities across the study program to stage the learning of counselling skills. Their goal entailed that students started their training by developing deep self-awareness and reflection abilities, scaffolded for example through sessions that aimed to support students to re-live strong feelings (e.g., shame, loneliness, loss). This was followed by rehearsing core interpersonal skills such as attentive listening, understanding or paraphrasing the other. These skills are deliberately practiced in 'isolation', without being connected to other aspects of the interaction. Only then the students
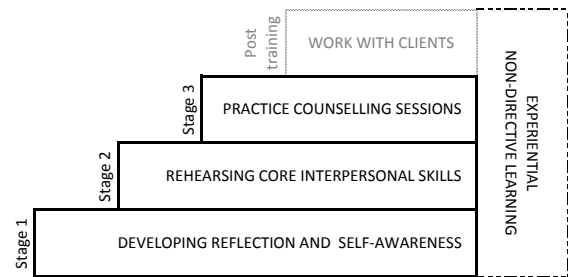

Figure 1. A diagram of the stages in student counsellors' training

would move onto the key part of the training—practice counselling sessions—where the interpersonal aspects of counselling skills were developed, tried out, and fine-tuned before the students were able to embark on interactions with real clients as part of post-training placement (see Figure 1).

Practice counselling sessions
Practice counselling sessions were described as the crucial stage where interpersonal counselling skills are taught in context. Such sessions took place in a 'triad', where three students took on the role of either a 'client', 'counsellor' or 'observer'. During the practice sessions, the student in the role of the 'client' was encouraged to talk about an existing issue they face, and the 'counsellor' would attempt to counsel him or her. The 'clients' were expected to choose something that felt important to them, but was not overly sensitive. Frequently however, students reported how 'clients' would bring quite intimate topics to these sessions, such as substance abuse in the family or serious marital and relationship issues. In the rest of the paper, we will continue to use the word 'client' as a shorthand for 'student in the role of client' unless explicitly stated otherwise; and will also use the analogous shorthand meaning for the words 'counsellor' and the 'observer'.

Participants explained how such practice sessions would be scheduled regularly (e.g., weekly) and that the sessions lasted between 5-20 minutes, with the duration increasing over time as students' experience with the activity develops. Each session is usually followed by a feedback phase (10 minutes in duration), where the observer, and at times also the client or counsellor, would share what they had observed during the interaction. Occasionally, the tutors would join the triad as additional observers and providers of feedback. Moreover, the students commonly rotated in the roles they were taking, enabling each to practice their counselling skills in turn. Some of these triad sessions were further reported to have been video recorded (e.g. 3-4 sessions a year) but there were no other reported uses of technology. The key part of the learning for the counselling student was however described to occur *after* the practice session had finished, when the student would 'process' and reflect on their experiences.

Learning through interpersonal reflection
Reflection on practice sessions is vital for student counsellors' learning. Our interviews point to the reflection process as a complex, inherently social activity. The students aim to deeply understand how their own actions have affected the

client's thoughts and feelings, although these are generally not directly observable and need to be collaboratively established. This leads to a complex interplay between several types of reflection that combine a deep, personal reflection on the student counsellor's own experiences with the need for 'interpersonal reflection', drawing on a shared sense-making with others.

In particular, we saw three ways of how such reflection was currently scaffolded around practice counselling sessions: (i) students received *external cues* provided directly after the triad session; (ii) such feedback was then employed to support *self-cued reflection*, when the student reflected on their session repeatedly over time, often at home and alone; and (iii) reflection on selected sessions could be guided through *Interpersonal Process Recall*, which is a structured process to facilitate deep self-awareness of the counsellor.

In the remainder of this section, we draw out the benefits and issues with each of the three reflection practices, preparing the ground for a set of design considerations to support students' interpersonal reflection through digital technology. Overall, our analysis suggests that the existing scaffolding of students' reflection is geared to mainly support internal self-reflection of the student-counsellors, only marginally facilitating the sharing of important interpersonal perspectives that could be offered for example by the client student and the observer student or tutor, or that would focus on the dynamics of the counselling session itself.

External cues for counsellors' reflection
Students in the counsellor role highly valued hearing about the client's and observers' experiences of the practice sessions, even if these conflicted with their own perspective. Such external feedback then served as a valuable cue for their reflection. However, students also described how the current processes could be improved by facilitating a more detailed interaction with the client and observers after the sessions; as well as the need to further improve the quality of feedback provided by their peers.

Both tutors and students described how the 'observers'—i.e., peers and/or tutors watching the practice session—provide most after-session feedback. Observers are expected to give a specific kind of comments that are tightly bound to what was directly *"observed and seen in the practice session"* (T1). Tutor 3 has eloquently described it as 'noticing', saying *"I don't want them to make a judgement about whether it's right, wrong, helpful, unhelpful, but just noticing."* Both tutors and students emphasised how providing *constructive feedback* from the observers' position is a difficult skill to learn; and that the students frequently struggle with providing such concrete, non-judgemental, yet constructive feedback. The tutors considered the ability to give good, constructive feedback as an important part of students learning, as well as a method of assessing their development.

In contrast, clients' feedback was rarely elicited, despite the fact that it is felt by students as even more relevant than feedback from observers. This is understandable as counselling is *"all about the relationship with the client"* (S17) and, especially when *"you're not experienced, you don't know what*

the client's experience [was]" (S3). However, even if client's did share their experiences, it was mostly only a very high-level overview summary of the session, not detailed enough to fully support more nuanced reflection on the counselling performance of the student in the role of the counsellor.

Finally, participants highlighted the qualitative difference between feedback from the tutors and peers. The students were often not satisfied with the feedback quality they receive from their peers; but also with the quality of feedback they are able to provide themselves when in the observer's role. The tutors were described as being more capable to help students pin-point areas for future development—an example of constructive feedback—as opposed to students comments being often described as much less specific. Some students particularly highlighted the lack of critical but constructive comments they would receive from peers. For example, students disliked the overly positive comments that are often shared among the group as *"even if it is genuine, I still hate it because I am not getting anything out of it"* (S13).

Self-cued reflection
Self-cued reflection is also an important part of the learning process, during which students repeatedly analyse their practice sessions by themselves. This mostly happened at home, especially if the practice session was video recorded. Both students and tutors saw the usefulness of such repeated, deep immersion into the session via video. This helps students unpick their session in detail and learn from both mistakes as well as accomplishments. While the students saw it as an opportunity to *"work deeply when you see the tape again and again by yourself"* (S6), they also described how there is a very limited support for further interaction with the client and observers during or after the self-cued reflection, although the inferences about the others' thoughts and feelings are crucial for students' reflective processes in this stage. This makes it very difficult for them to check whether their own assumptions about the client and observers' experiences are correct.

The following quotes provide an example of the level of detail in which students would reflect on their session and highlight the various aspects students generally paid most attention to.

(S15): "I noticed she said, 'That's a really amazing achievement', and there was just like a pause and the slight forcing of her saying she'd had an amazing achievement. [...] I found a pause and was able to say, 'I noticed that you did this. I just wanted to know if you noticed anything?' Then she thought about it and talked it though, and it turned out that she had some difficulty accepting that she'd had an achievement, because of various things that were to do with the support of her husband and stuff. [...] It gave her the option to change the flow of what she was talking about, to get a little bit deeper into acknowledging her own feelings, which is really important.

(S17): [Watching the session is] all about concentrating on not what was said, but what I was doing, my reactions, what were the client's reactions, facial expressions. I thought they are very, very interesting to

watch because a smile in the right place, or a frown, or a 'Mmm, mmm.' If the client goes, 'Mmm,' does that mean they are not quite understanding what I am asking, or saying?"

Both quotes illustrate how students generally paid attention to several interrelated aspects. First, we see a very detailed focus on their own and the client's non-verbal behaviour. While non-verbal behaviour is important also during the session, students often picked up on cues they have not noticed before revisiting the video.

Second, the focus on non-verbals was then combined with attempts to go beyond of what the client has said, and create a deeper understanding/interpretation of why they did what they did. For example, S15 has picked up on his client's subtle hesitations around accepting an achievement and used this to uncover a deeper issue they then spend the session talking about. Similarly, most of the students were using the video to continuously analyse and double-check if they had understood their clients well enough during the session; or if they had missed something crucial. Students always viewed their interpretations as tentative accounts of clients' experience that need to be verified. Such verification is however not a part of the current training processes.

Third, although noticing new aspects can be perceived as validation/clarification with advanced students when they watch the video (e.g., S15 or S17), it can also raise self-critical attitudes. This was particularly common for early students, as the video highlighted things they believed they had missed, or their own responses they thought they could improve. For example, speaking about the bachelor students, Tutor 3 said *"[T]hey always choose the worst bits and then beat themselves up. They never choose the bits that they do really well and show you that."* Balancing such self-critical attitudes seemed to be another important challenge for the students.

Fourth, counsellors often explored alternative ways of responding to a situation in their minds, especially after identifying a situation they were not happy with. Again, these required them to work with complex assumptions about the clients' possible responses and thoughts, but could not be sense-checked with the client later.

'Interpersonal Process Recall' (IPR) – guided reflection
Students are also taught a structured way of reflection, called Interpersonal Process Recall (IPR), as part of their normal learning process. IPR is a traditional technique developed by Kagan [24] in the 1970s, aiming to facilitate counsellors' deep reflection on, and awareness of, their own feelings and thoughts during counselling sessions – i.e., the focus is on their own self-awareness and experience of the sessions, not on the dynamic of the interaction as such. A brief description of the IPR process is below, see [23] for more detail. IPR draws on repeated viewing of a video recording of the session. The student in the role of a counsellor can stop the video at any time of their choice, often when they believe something important has happened. Another student or a tutor then asks the 'counsellor' a question from a list compiled by Kagan.

The 'counsellor' then uses this to reflect aloud on what was going on for them at that time. If done according to the guidelines, this is a very long process – e.g., 8 hours of IPR for 1 hour of the videotaped session.

As this protocol was originally designed for analysing real-world counselling sessions, the client's view is not supposed to be shared, nor can the clients stop the video at moments they would like to discuss, although they might be present at the IPR session. However, the students saw this as overly restrictive to their learning and told us that for most of the sessions they facilitated (i.e., without the tutor present), the comments would be eventually shared by all involved. The tutors were aware and accepted that such adaptations of the IPR protocol happen, and indicated that they would be open to modify IPR such that it would also involve the client to a larger extent.

Effects of video-recording on reflection practices
The inclusion of the video recording markedly changed the perception of the practice sessions for the students. Tutors and students described how having the video was useful as it provided more opportunities to explore and reflect on their own practice in detail, regardless whether it was to support external cues, the students' own reflection at home, or IPR. Video is understood as providing 'evidence' and specificity to reflection. In other words, by having the option to stop and point out particular moments, it was perceived as providing specific, non-judgemental grounds for deep reflection on the part of the student counsellor.

While the students saw the video as beneficial for their learning process, students also told us that they initially felt conscious, vulnerable, and very uncomfortable about the video recording, although they eventually got used to it. Tutors were aware of these challenges for students, but believed that this was an important part of the learning process, and that the benefits outweigh any uncomfortableness whilst engaging in this process. For example, after giving an example of her own experience with video-recorded skills practice (as a student), Tutor 2 told us: *"As soon as you start to get the feedback and you begin to see, 'Oh my God, this is powerful. I'm really learning a lot about myself here', the equipment becomes an aid not an enemy".*

PART 2: CHALLENGES TO LEARNING AND DESIGN
While the practices around the teaching and learning of counseling skills are effective, to the extent that students graduate as counselors, the previous section also outlined a number of challenges that suggest a potential for technology support.

Design considerations to support counselling training
Each of the three key reflective practices highlights particular facets that are crucial for interpersonal reflection, but each is, for pragmatic reasons, used independently in the current learning process. This points to opportunities for technology to combine and support all of these aspects of interpersonal reflection together, as well as to address some of the key challenges present.

In particular, the importance of external cues highlighted the need to include the client and observers in the interpersonal reflection process of the student-counsellor. Self-cued reflection highlights how counselling students process and learn from their practice sessions over longer periods of time, and thus do so mostly outside of formal learning settings (e.g., at home). The IPR then suggests the benefits of scaffolding reflection non-directively, for example by providing a structure for reflection while keeping the student-counsellor in charge to decide what to focus on and when; and also pointing to the importance of specificity and 'evidence' that a video recording can facilitate. We now outline four design considerations for systems aiming to support the learning of students' counselling skills.

(C1) Non-directive facilitation of the reflection process:
We already brought attention to the limited scaffolding for interpersonal reflection processes, especially for the counsellors' self-cued reflection outside of the lessons. Technology supporting such reflection should empower students to reflect and make personal choices, rather than directively restrict their experience. Furthermore, designs should aim to facilitate localised reflection, i.e., tying the reflection and feedback to particular moments of the session to provide specificity and 'evidence'.

(C2) Support co-constructing of interpretation with the client: We saw the need for processes or technologies that facilitate a better access to clients' experiences for the student in the role of the counsellor during their reflection process. In particular, technology should facilitate interactions with clients (and observers) to allow counsellors to verify and sense-check the intricate assumptions they may make about their client's feelings, thoughts or behaviours. Further facilitation would be useful to support students in making their reflection work or felt experience more tangible, and thus more accessible for discussion.

(C3) Scaffold constructive feedback from observers:
Providing constructive feedback from the role of an observer (or client) is understood as an important but difficult skill that students need to learn but tend to struggle with. In particular, students find it difficult to be concrete enough and link their comments to specific observations; or to provide constructive criticism instead of praise. Technology should aim to facilitate such localised, constructive (i.e., not only positive), yet non-shaming feedback from the observers, as well as support the observer's learning whilst giving feedback by presenting it for example as a valuable self-reflection exercise.

(C4) Support for iterative, multi-phase reflection:
Our data suggests that interpersonal reflection requires a long-term process, combining periods of deep individual sense-making and reflection (including creating assumptions about others' experiences and states), with periods of interactions where such thoughts are shared, checked and discussed. Technology should aim to scaffold such a series of in-depth engagements between the client, the counsellor and the observers, including enough time for deep reflection in between. It is also important to respect and design for the limited time available for the students (as opposed to a full IPR process).

PART 3: DESIGN-LED EXPLORATION
In response to these identified design challenges, we developed a series of low-fidelity design prompts for Phase 4 of our research. These were designed to be used by students in conjunction with the video recordings of their training session, which we recognized as a valuable source for reflection. Our aim was to explore and triangulate the design considerations in more depth, and to invite further thoughts and input on the potential design functionalities from the students.

Each of the design prompts explored specific ways of supporting one or more of the design considerations. For example, to probe the possibilities to promote constructive feedback (C3), we presented the students with draft interface designs that would allow the observers to indicate the moments they 'notice' in real-time when observing the session (e.g., through a simple mobile phone application time-synced with the video-recording), also scaffolding the type of feedback observers can then provide to the counsellor (e.g. by suggesting pre-formulated sentence starters such as "*I felt _____ when I saw _____ happening.*"). Other prompts explored how students could use the system to send and request feedback on specific parts of the video from each other (e.g. choosing and commenting on a particular video segment).

In the scope of this paper, we only focus on one of the design prompts—the AffectSlider—in detail. We chose to highlight the AffectSlider as it explores possible design directions to most of our design considerations (C1, C2, C4) in a single tool, and embodies many of the key design mechanisms that can support interpersonal reflection in this space.

Developing a design prompt: The AffectSlider
Drawing on the difficulties students indicated with the existing practices around reflection, such as the cognitive overload when reflecting and the time inefficiency of IPR process, we started exploring other mechanisms to indicate and track certain emotional responses that may support students' understanding of the interaction during the training. The design of the AffectSlider was inspired by our conversations with students and tutors in Phase 3, in which we explored different modalities as to how feedback on a training session could be provided or received, including examples of physical as well as digital push-buttons, dials and sliders. We were also inspired by literature in cognitive psychology using physical dials to indicate the positive and negative affect felt by experimental participants [31].

The final version of the AffectSlider, as presented to the students, was an interactive mock-up prototype that takes the form of a virtual 'slider' on a single line with two poles, where poles can represent any concept that students wish to explore, e.g., from non-empathic to empathic (see Fig. 2). The student can indicate their in-the-moment experience while they watch a video-recording of their session, by manipulating the slider position moving their PC mouse. The sequence of such slider position changes is recorded and time-stamped to tie the changes to the respective time in the video, and can be thus later presented as an overview graph (see Fig. 3).
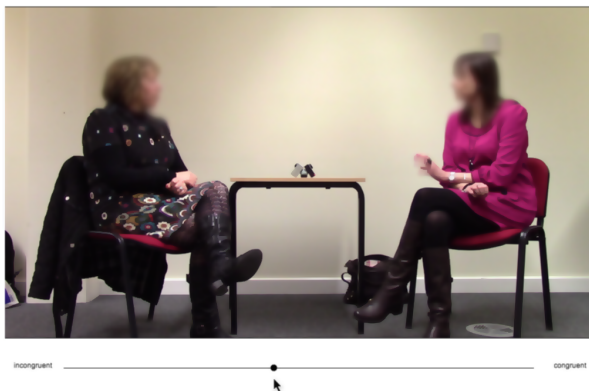
Figure 2. Indicating in-the-moment experience with the AffectSlider.

Figure 3. Visualisation of the AffectSlider traces, connected with the video, as presented during the Wizard of Oz (Phase 4).

Our design envisioned that such a form factor would support novel reflection practices for the students in several ways. First, asking students to choose a specific concept to analyse could help them prioritise and make conscious decisions about which aspects of their counselling skills they want to specifically focus on, reducing the cognitive overload. Moreover, we expected AffectSlider to promote sustained attention, as the slider position is to be continuously changed according to felt experience. Visualisation of the resulting trace once it has been indicated could further support localised reflection, as it is tied to the video-recording. Altogether, AffectSlider was therefore expected to non-directively promote focussed reflection (C1).

Second, we thought that use of the AffectSlider could directly promote students' perspective taking and help explore the differences in experiences between client and counsellor. For example, the student can decide to use AffectSlider to indicate not their own experience, but their assumptions about how another person feels – e.g., we asked the students in the role of the counsellor to indicate how they believe their client felt as part of Phase 4. Moreover, once such an AffectSlider trace is created, it can easily be presented to the client for comments, or compared with the client's own AffectSlider trace of the same concept, making it a tangible visualisation of the reflective process. Finally, the time required to provide feedback with AffectSlider equals only to the time needed to watch the part of the session to be rated. This is quite time efficient, especially when compared to IPR or similar procedures, and could allow for iterative engagements. As such, we hoped that interaction with the AffectSlider would promote co-construction of interpretation through sharing and discussion of felt experiences with the client (C2), and do so by facilitating an iterative, multi-phase engagement with the recorded data (C4).

Exploration of AffectSlider with students
For the exploration of the AffectSlider functionalitites we prepared a specific sequence of interactions for students to perform, designed to test our assumptions about the effects the use of the AffectSlider could have on students' reflection. In particular, we aimed to explore the combination of explicit
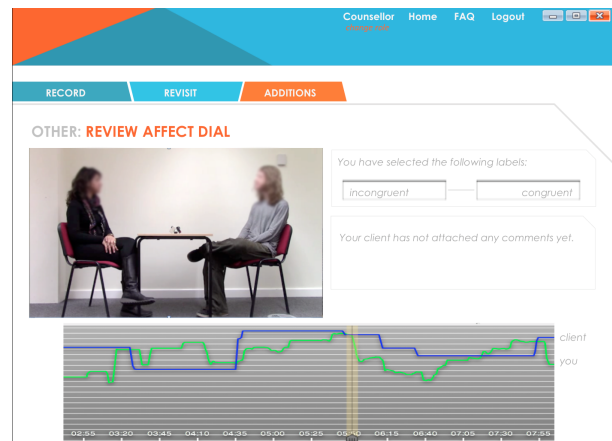
perspective taking (i.e., counsellor indicating their assumptions about client's experience) and facilitated sharing of experience between the student-client and counsellor via the AffectSlider trace.

Specifically we asked the counsellor at first to decide on a concept they would like to ask their client to feedback on using the AffectSlider (e.g., how anxious the client felt). The counsellor also chose a 5-10 minute long fragment from the session they've just finished, to specify which part of the session the client was asked to watch and give feedback on. We then passed this information to the client, who was in a different room, and who used the AffectSlider to indicate their experiences regarding the chosen concept on that video fragment. Independently, the counsellor rated the same fragment and concept, but *from the perspective of the client*, e.g., indicating how anxious he/she thinks the client was at moment. The two traces were thus recorded independently, but when brought together, this allowed the counsellor to compare the AffectSlider trace visualising their own assumptions of how, e.g., anxious the client was, with the trace indicating the felt anxiety directly by the client.

We then presented the counsellor with the overview of both AffectSlider traces and let the counsellor explore and compare these. The traces were connected to the video recording and counsellors could easily move to and review moments in the session they found interesting (see Fig 1). We recorded such interaction with the AffectSlider for each of the six practice counselling sessions in Phase 4. The following presents the findings from this process.

Students' responses to the AffectSlider
All six students found the slider interaction understandable, and were able to choose a concept they would like their client to feedback on. The concepts ranged from selecting one of the core Rogers' conditions such as felt empathy or congruence, to more specific concepts such as 'positively to negatively challenged' or 'helpful to unhelpful facilitation'.

Students shared with us that—by limiting their attention to a single facet of the experience and continuous manipulation with the slider—the interaction with the AffectSlider often facilitated a state of heightened awareness just for behaviours around the selected concept (without distraction by other aspects). This was described as a novel and pleasant experience for many students. For example, S15, who was indicating 'challenging responses', explained: *"I'm not really focussing on any of that [other aspects], I'm just focussing on the flow into whether I'm going to challenge or not and when there's a right pause, or whether I've missed it. That's quite interesting, just to go through that experience and be so focussed."* A downside to this extremely focussed attention was that the choice of the concept became crucial, and some students found it difficult to decide which of the many complex concepts they are potentially interested in should be chosen for detailed analysis. This suggests that the AffectSlider would require (but thus also promote) repeated passes through the video. Moreover, students reported that despite the sustained focus, other interesting aspects of the interaction could, momentarily, come to their attention. Students then wanted to have the option of leaving a marker in the video (e.g. by double clicking the mouse) to be able to easily come back to that point of the video once the AffectSlider exercise was completed.

Importantly, comparing their own and the client's trace helped students identify very specific moments they wanted to explore further. These were particularly moments where the two traces did not match (e.g., the client indicated a sharp position change of the slider while the counsellor did not) and thus the counsellor felt to may have misunderstood the client. Once the students returned to such moments (by re-watching the relevant part of the video), we saw them often re-frame their previous understanding of the situation. For example, S18 asked to revisit a particular fragment where her client indicated a drop in perceived helpfulness, but S18 did not. After revisiting the video, she shared: *"I think what happened there is [that] all I did then in my response was just copy, paraphrase of what she said, but that's it; I didn't do anything with it, I just reflected it. I think [she] needed a little bit more of something from me. [. . .] If I'd just watched that back, I wouldn't have picked that up."*

In other cases, for example when the traces did match remarkably, this served our students as a useful validation, i.e., that the assumptions they had were consistent with what the client experienced – which is something the students said they didn't have access to before. Similarly, the overview mode at times highlighted particular moments to look at for the counsellors even before seeing client's data, i.e., the overview showed some aspects they were not aware of when doing the reflection-in-the-moment.

However, relying entirely on the AffectSlider data could bring the risk of mis-interpretation of the mismatch or similarity of the traces. Acknowledging such a risk, students also often suggested that such pinpointed moments and the re-framing they made are something they would have liked to take further and discuss with their client face-to-face, as the next step of the learning process. On a similar note, students highlighted concerns related to potentially hurting the feelings of the counsellor after the feedback is exchanged, e.g., if the client was to indicate they perceived no empathy in a particular moment. While no such occasion arose during the six interactions we recorded, there is a clear need to ensure mechanisms are in place to safeguard practice; such as the opportunity to discuss the indicated traces in person soon after exchanging and/or opportunity to provide more detailed written explanations for parts that might perceived as hurtful.

DISCUSSION

Learning how to develop sophisticated interpersonal skills is a critical but challenging part of studying to be a counselor. Participants in our studies painted a nuanced picture of their learning processes, and the importance of interpersonal reflection practices to learn counselling skills. In this section, we discuss how these findings might inform the design of systems to support learning of interpersonal skills in counselling settings.

Specifics of 'interpersonal reflection' in counselling

Our findings show how learning of interpersonal skills in counselling is an inherently social endeavour, building on a complex interplay of interpersonal reflection processes around practice counselling sessions, and involving multiple actors. In other words, we saw that although the student in the role of a counsellor might do most of the reflection work, the reflection process cannot be fully completed by any one participant alone. The client and possibly observer(s) need to partake and share their perspectives to jointly co-construct the interpretation of the session, and this is needed for the learning to take place. As such, the focus on the 'interpersonal' comes in several variants – the activity itself, the skills that are learned and thus reflected on, and the interactions between the counsellor, the client, and observers in the processing stage after the practice session. As highlighted by the suggested design considerations, systems aiming to facilitate counselling learning will need to take into account, and provide support for, all these aspects of interpersonal reflection.

This presents an interesting reflection case that is complementary to existing reflection research in CSCW and HCI. The majority of such work aims to cue or facilitate reflection on individuals' reflection (e.g., [32, 34, 20]) supporting people to become more thoughtful about their everyday experiences. In contrast, the understanding of reflective processes as a collaborative or shared social activity is relatively rare [15, 29, 37], and is arguably an area ripe for more detailed study [2]. Further exploration of the interpersonal reflection processes, which we saw as crucial for counsellors' learning, could thus contribute to this increasing interest to explore technology support for social reflection, as a relevant part of learning and sense-making in other social situations.

Returning to the design consideration

Building on our experiences across the Phases 1-3 of this research project, we drew out four design considerations to support interpersonal reflection, which were then further triangulated in Phase 4 through a series of design prompts. We now return to these considerations to discuss the broader implications and opportunities for technology, using the experiences with AffectSlider to ground our analysis.

Non-directive facilitation of the reflection process

One promising option to non-directive facilitation is to support the learner in focusing their attention to specific aspects of the interaction. For example, the structure 'enforced' by AffectSlider—i.e., the need to choose and focus on a single concept while watching the video—led to very deep and focused reflection, while keeping control over the content in the hands of the counsellor. Similarly, the ability of technology to allow for easy re-structuring and novel viewpoints on data, such as the real-time indication combined with a post-hoc overview, can further support a focused reflection process. Moreover, prior HCI work (e.g., [27, 34]) suggest the possibility of using sensor or video-based data to provide people with novel cues for reflection and learning. Such cue-based support could again help to focus attention and empower students to explore novel interpretations of their and others' experiences. In particular, the recent advances in detecting relevant social signals such as non-verbal mimicry [3, 38] could be a promising avenue to explore in future work.

Support co-constructing of interpretation with the client

We saw that understanding of others' perspectives and feelings is a core aspect of counsellors' learning, but that the counsellor is unable to reach that understanding without including the others into the reflection process; this is an endeavour that often requires large commitments from all involved. As one possible approach, by helping make participants' reflection work or felt experience more tangible, technology could support counsellors in identifying, challenging, and testing their own assumptions about the other's experiences. For example, the perspective taking exercise with the AffectSlider not only provided a visible trace of a particular facet of the client's lived experience, but also allowed the counsellor to visualise and directly compare her own understanding of what the client could have been feeling with the clients own indication as to how they were feeling in, or experiencing, the interaction. While such a single slider trace cannot encompass the full complexity of the counselling interaction (a problem likely shared by any technology tool in this space), it showed potential for the counselling student to either 'validate' their understanding or pinpoint specific moments where misunderstandings were more likely to occur. Once such specific moments were found, we have observed during phase 4 how the students used these to improve their understanding of the interaction. Moreover, the students explained how such moments could provide good grounding for further discussion, and thus help the counsellor and their client to jointly re-frame their interpretation and understanding of the interaction.

Scaffold constructive feedback from observers

We suggest that technology can help scaffold the 'noticing' process for the observers, supporting them in providing more specific and non-judgemental feedback, but also facilitate the learning of their feedback-giving skills. For example, mobile or wearable technology could be used to help student observers ground their observations to specific moments within the session on-the-fly, such as allowing them to 'mark' or 'label' situations they would like to comment on while observing the session. Not only would this be a useful, grounded feedback for the counsellor, but also the act of indicating such situations could provide material for reflection and learning on the part of the observer.

Moreover, the distancing nature of technology, especially when used to provide feedback remotely, could be utilised to facilitate more 'honest', constructively critical interaction. For example, we would expect observer feedback given through AffectSlider to work this way, as it: (i) asks the observer or client to non-verbally indicate their own personal experience, and as such it is not felt directly as a judgement of the counsellor; and (ii) the act of requesting such information alone includes an implicit 'permission giving', as the counsellor is the one to select the concept in question as well as the part of the session to be looked at. Nevertheless, designs using such mechanisms need to put safeguards in place (e.g., allowing the counsellor to give 'feedback on feedback' back to the observer) to ensure that the interaction stays constructive, and that any misunderstanding or hard feelings are promptly talked about and resolved.

Support for iterative, multi-phase reflection

Asynchronous interaction, such as various forms of focussed 'requests for feedback' sent by the counsellor to the client, could prove particularly useful to support the long-term, multi-phase interpersonal reflection process. Such asynchronicity allows the individual students to engage with the sessions at the time of their choice, and provides an opportunity for the counsellor to carefully select the parts of the session they are particularly interested to focus on. We envision that such a series of asynchronous, iterative interactions would help identify a set of key discussion points, leading to a more in-depth and focussed face-to-face engagement to jointly interpret and discuss differences in viewpoints. This is again exemplified in the interaction we staged as a part of such a process with the AffectSlider, where the counsellor first reflected to select both the concept they were interested in as well as the part of the session to be looked at by the client. Once the request had been fulfilled (a relatively easy and quick activity for the client), the counsellor received useful data to further guide their own reflection, often leading to a focussed set of points they would like to discuss with the client in more detail at a face-to-face meeting.

Broader implications – social skills learning

The lessons from the counselling context can also inform and inspire a broader agenda looking at social and emotional skills learning in other settings, such as training for medical staff [1, 35], leadership [4], and increasingly also school education [12]. These are all areas where development of interpersonal skills is also crucial, and where similar sets of learning approaches are being used, including experiential learning and the need for interpersonal reflection [40]. As specific examples, curricula aiming to teaching skills such as empathy, awareness of own and other's emotions, or perspective taking are increasingly rolled out across primary and secondary schools within the US [12, 39]. Similarly, there is an established need in the medical community for an increase in

support for training communication skills and empathic interaction for medical staff across all roles [1, 33, 35] – including students, practicing doctors, and nurses. As all these programs use very limited technology so far, this opens questions if and how CSCW and HCI could support the social and emotional learning in these settings, and whether the findings around the opportunities to support counsellors' learning here could serve as a good starting point.

Potential Limitations

The study described in this paper presents exploratory research aimed at gaining a nuanced understanding of existing counselling practices and to then inform technology design in an area novel to CSCW. To this end, our research activities involved counselling students and tutors from one particular degree program in multiple phases of research that built on each other, rather than attempting to provide a overview of practices across many such programs. We believe that this continued and more in-depth involvement with our participants enabled us to gain rich insights into the particularities of this design context and the associated challenges, which can inspire and translate to similar design contexts (e.g., as per the previous section). We further acknowledge that the majority of our participants were women, which might suggest possible gender bias in the interview data. While this cannot be disregarded, this ratio also reflects the approximate gender distribution of students in the counselling program we worked with. Moreover, we did not observe any difference in the responses to the interviews or design probes that could be directly linked to gender alone.

CONCLUSIONS

This work presents a first exploration into the role digital technology could play in supporting the learning of interpersonal counselling skills. We present a nuanced understanding into how such skills are taught as part of a humanistically oriented counselling degree program, highlighting the challenges to learning students currently face. These revolve mainly around the need to better support interpersonal reflection processes, which are crucial for the student learners. Drawing on our interviews, observations and the design prompt, we offer four design considerations for systems aiming to mediate such challenges. Overall, our findings point to the potential for technology to enhance and support the learning of interpersonal skills in counselling training, and possibly also other settings, and provide an important first step for future research in this direction.

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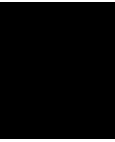
(in submission) – Technology in counselling training

This chapter positions the research described above in the counselling literature, with particular emphasis on the current state and the history of technology use in counselling training. It also provides a description of mPath software, including the expected benefits it will bring to students using it. As such it contributes predominantly to RQ3, outlining how technology might be positioned to address current challenges in psychotherapy education.

Contributions: David Murphy led the write-up of this paper, based on the joint research reported in the previous chapter. I led the sections on mPath and user-centred design, made substantial editing passes throughout the writing process as well as added literature and additional arguments within the review of technology support in helping skills sections.

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Introduction

A basic yet fundamental feature of training in all modalities of psychotherapy is a need to develop the interpersonal relationship skills of the students. Interpersonal relationship skills are a foundation of psychotherapy practice that students at both Masters and Doctoral levels training are required to acquire in both relational or technique oriented psychotherapy approaches. All trainees must master the skills of engaging their clients in psychotherapeutic work and be competent at building and maintaining psychotherapy relationships. .

Existing pedagogies for learning interpersonal relationship skills typically include a range of approaches such as modelling, watching films of expert psychotherapists, engaging in peer-to-peer practice skills sessions, or supervision of actual practice undertaken within an internship (see Hill & Lent, 2006 for a recent review). However, in comparison to the proliferation in technology mediated psychotherapy, the integration of technology to pedagogy in the field of psychotherapy is relatively under-researched and has progressed at a comparatively slow pace (Rousmaniere, 2014). Whilst research has investigated how the integration of new technology can be mobilized to enhance learning psychotherapy helping skills, much of this has focused on supporting the (often remote) supervision process (Wolf, 2011). This is in contrast to developing interpersonal relationship skills during the initial phases of psychotherapy education, when the tutor is often more involved in the process. There remains a significant gap in the literature on how use of technology can be integrated into this early stage of developing helping skills.

To address the technology gap in psychotherapy education, the aim in this paper is two-fold: We first provide an overview of the existing literature on approaches to learning interpersonal relationship skills. Next, drawing on this we highlight how the technological shift and increasingly ubiquitous access to new technologies can be utilized to enhance the

acquisition of effective interpersonal helping skills. We exemplify the potential of new technologies by outlining the development and design process of the *mPath* system; a new online system and software tool designed specifically to support students in iterative, multi levelled and deep reflection on their practice skills sessions. We end with considerations on how such technology-enhanced training could benefit not only students' learning, but also define a program of future research and development to better understand available, effective and efficient technologies to advance learning skills and ultimately lead to more effective psychotherapy practice.

Learning Interpersonal Skills in Psychotherapy Education

Rogers (1942) identified the core skills involved in psychotherapy and argued such skills were better considered as *basic attitudes* (Rogers, 1951). He argued the basic attitudes of the psychotherapist could be honed rather than taught. Three of the six necessary and sufficient conditions (Rogers, 1957) for constructive personality change refer directly to the psychotherapist attitudes that are now ubiquitous across psychotherapeutic approaches. The interpersonal relationship conditions are psychotherapist congruence, empathic understanding and unconditional acceptance for the client. These necessary attitudes of an effective psychotherapist and can be developed through training. The approaches to training incorporate a range of methods.

Historically the helping skills training models include Carkhuff's (1972) Human Relations Training (HRT), Ivey's (1971) Micro-Counseling (MC), and Kagan's (1984) Interpersonal Process Recall (IPR). Carkhuff's (1972) HRT involves skills practice with rotation through the roles of psychotherapist-client-observer. Ivey's (1971) MC involves role-

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play sessions that focus on specific skills, with tutors giving helpful guidance and constructive feedback. Kagan's (1984) IPR model is used to review recordings of either practice sessions with peers, or with real clients, to deepen students' understanding of what happened in specific moments of the interaction process. A rare recent development, an integrative approach to helping skills training, is the Helping Skills Model (Hill, 2004) that includes various aspects from HRT, MC and IPR.

The primary pedagogical theory underpinning learning interpersonal helping skills is experiential learning, as suggested by Kolb (1984). This is particularly apparent in Carkhuff's (1972) HRT and Kagan's (1984) IPR approaches. Each of these approaches will use the concrete experience of being in the role of psychotherapist followed by a phase of reflection on this action, and further facilitated discussion that enables abstract (re)conceptualization of what happened, followed by further experimentation of the developing skills.

Experiential learning relies on two major psychological processes being activated. The first of these relates to the differences between declarative and procedural memory systems (Squire, Knowlton & Musen, 1993). Declarative memories essentially relate to basic, factual information consciously known to the person. This might include the names of places and people or the route to work. In relation to learning psychotherapy helping skills this might translate to the facts about the background of the client, or important information from their past that was previously disclosed in assessment or during a psychotherapy session. In contrast, procedural memory is concerned with behaviors and their automization as specific skills become learned or known to the experiencer; such as knowing how to drive a car, or swimming, or in the psychotherapy process of being able to communicate empathic understanding and acceptance of the client in a fluid and calm manner. The second psychological process is related to cognitive adaption in situations involving intense

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emotional expression or of disclosure of significant events. Both might place the psychotherapist under intense pressure. Such cognitive adaption can reduce the availability of information stored in declarative memory and might disrupt effective communication to the client. Importantly, such cognitive adaptions might increase the use of procedural knowledge as people defer to well-rehearsed actions in the absence of other information. Because psychotherapy often involves experiences of intense emotions psychotherapists are often placed under pressure. Hence it is clear why the development of procedural knowledge is central to learning interpersonal helping skills. Embedded procedural knowledge enables the psychotherapist to have access to the necessary skills required even when under the intense pressure of an emotionally charged relational atmosphere.

Enhancing procedural knowledge in helping skills such as honing ability for empathic understanding and unconditional acceptance, and integrating these as attitudinal qualities of psychotherapists, requires extensive practice and exposure to the intense situations that mirror the psychotherapy setting. These experiences can be created by frequently engaging the helping skills methods set out above. However, beyond such concrete experiences, reflection on experience and opportunities for conceptualizing the abstract aspects of events are also important components in the experiential learning process. Theoretically, reflection can lead to developments in cognitive schema (Eyler, 2002). This is achieved by the student developing greater self-awareness through the reflective process and therefore being able to act on this awareness and make changes to behavior. These behavioral changes can enhance further the capacity for congruent empathic understanding and experiencing acceptance for clients, even under high pressure and intense emotional encounters. It is proposed from this that reflection on skills sessions is vital in creating the deep learning experiences that can lead to attitudinal changes and enhance practical skill development.

In addition to an experiential learning approach to develop helping skills other methods can be effectively integrated in support including direct instruction, modelling, and feedback. Instruction is a relatively didactic method where the instructor gives information about what to do in the practice session, how to do it, and identification of the likely or intended outcome. This may or may not include some minor modelling of technique behavior but the emphasis is on the learner following the instructor's directions. Instructions can be given using audio recordings, in written form or imparted directly from the class instructor. Second, modelling, involves the demonstration of specific helping skills that then become explicit learning outcomes. This can be done by playing a video or audio recording of an experienced psychotherapist working with a client to provide an 'expert' demonstration of the target skill. It might alternatively include a live demonstration, or perhaps make use of a psychotherapist-actor within a film or television series; although in one study the use of an actor from a television series was considered the least preferable by students (Jackson et al., 2014). Third, feedback to the student psychotherapist either involves giving in-the-moment feedback on their performance, such as the use of a light indicating a good response or less helpful response; or, similarly, the student psychotherapist may receive verbal feedback through an earpiece that is being worn during the practice session, receiving 'real-time' feedback on performances. These methods are not mutually exclusive: for instance some tutors might initially give some instruction, followed by a short demonstration, followed by immediate feedback after the student psychotherapist tries it out for themselves.

Each of these existing pedagogical methods, and particularly skills practice sessions, relies almost entirely on 'in-person' contact and is relatively low-tech. There are heavy cost implications to this and students being limited in access to tutorial support from only a small number of tutor staff. However, developing new technology that facilitates helping skills sessions, supports post-session deep reflection and can incorporate tutor input and feedback,

extending beyond the boundary of the practice session or classroom interactions, presents a major opportunity for psychotherapy training. New technology solutions applied in this field can enable students to understand how they can become more effective psychotherapists. By also introducing Internet technology staff providing tutorial feedback to the student can be located anywhere that has access to a connected web browser. Thus students in one part of the world can be tutored by staff in another. This radically shifts the boundary for learning from a classroom environment with a course tutor to other experts around the world.

Technology Support in Helping Skills Training in Psychotherapy Education

Despite the recent growth of research in technology-supported supervision (cf., Barnett, 2011; Rousmaniere, 2014 for reviews), supporting learning helping skills has been so far left untouched: working with video/film recordings is the only technology with a long history of use in psychotherapy education. As far back as the mid-1940s Carl Rogers was recording psychotherapy sessions (Kirschenbaum, 2007). As a pioneer in this field an Oscar award winning film was made about Rogers' encounter group method and, the famous 'Gloria' tapes reached almost iconic status within the field of psychotherapy. Not only has video been used for many decades as a pedagogical device it has also been deployed as a technique in its own right. Video playback was proposed as a potential technological breakthrough (Hogan, 1967) referring to a technique that involved playing back video recordings to clients in conjoint marital psychotherapy, with the aim to reduce resistance and defensiveness and enable change. Learning from films, dissecting the process, and gaining a deeper understanding of process in psychotherapy can be a rich learning experience. Hill, Stahl and Roffman (2007) state that: 'Trainees learn to use skills more successfully from observing videotapes and transcribing and coding helping sessions at various points in time and

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reflecting on their experiences than from just instruction, modelling, practice, and feedback' (p. 368).

It is the 'hands on' experiential approach to reflecting and reviewing psychotherapy sessions that video playback supports; and the high level of detail and hard evidence of what took place that allows for thoughtful and deep reflection on the meaning and place of specific interventions made by psychotherapists in training. Video playback of psychotherapy skills sessions, and specifically Kagan's (1984) IPR, has been used extensively to help train psychotherapists in specific techniques. IPR video playback shows cross cultural applicability. Berdondini, Grieve and Kaveh (2014) effectively provided humanistic psychotherapy training, using IPR for skills sessions, in a University in Afghanistan. Further, video playback for training is not confined solely to individual psychotherapy. Ohrt, Ener, Porter and Young (2014) have reported that group psychotherapy trainees also found the opportunity to film and playback their group leader experiences helpful for learning showing the versatility of video based reflection for learning. Much like with individual psychotherapy training, the opportunity to reflect on practice, to see oneself in action and consider alternative responses, or deepening understanding of the motives behind specific responses and interaction, was widely believed to be a helpful learning process when supported through the use of video playback.

Novel Opportunities for Addressing Limitations in Existing Helping Skills Training.

Whilst detailed scrutiny of psychotherapist practice is available through the use of video technology, much of the existing practice in helping skills training is shaped by technology limitations that were present when IPR and other techniques were developed: such as the difficulty of navigating within the video (linear viewing), the inability to 'annotate' or mark the video while reviewing sessions to support subsequent reflection, and the need to be

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physically present and co-located with others if the video was to be worked on in a group. A number of authors (Rousmaniere, 2014; Wolf, 2011) have pointed to the emerging possibilities of using the increasing power of computers and hand-held devices together with the connectivity made available by Internet to further extend existing skills training. These include the possibility for improved cost-effectiveness of an ever-increasingly expensive training, improved accessibility, but also the possibility to augment and change existing approaches for training in similarly marked ways as the video-recording equipment changed helping skills from the 1950s onwards. We argue that Rousmaniere's (2014, 232) comments about supervision can apply to helping skills training in general:

> the traditional methods of [training] are in wide use not because they were determined by research to be the most effective (e.g., Ellis & Ladany, 1997), but rather because they were the only methods available. The assumption that the "old methods are best" may cause the field a disservice, by blinding us to new opportunities and alienating a younger generation of supervisees who feel more comfortable with new technologies. Rather than questioning whether [technology-support] is "as good" as traditional [methods], supervisors and researchers are encouraged to instead ask, 'What is now possible, and how can it serve my supervisees and their clients?

Despite these opportunities, so far only a handful of systems have been developed.

Existing Examples of Technology Assisted Learning for Helping Skills.

Only a small number of technology systems have been deployed in learning helping skills. Abbass, Arthey, Elliott, Fedak, Nowoweiski et al. (2011) developed a protocol for conducting supervision including reviewing video recordings of sessions, freely available on

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the Internet. Their approach provides step by step instructions on how to set up the supervision review sessions so that both supervisor and supervisee can view the recording of a psychotherapy session simultaneously. They advocate for the use of text messaging whilst watching the video in order to add a form of micro-commentary by the supervisor on individual interventions by the trainee psychotherapist. The supervisee is then able to respond either in the session or has the option to save the messages for review at a later point in time. The primary benefit of this method is enabling the trainee psychotherapist and supervisor to engage in reflective discussions on the trainees' practice which is then deepened by the micro-commentary. However, a limitation to this system is that the micro-commentary gets stored in a separate location to the film itself. That is, the film still does not become annotated or 'marked-up' with the commentary. The student still needs to go back and synch the film with the micro-commentary to re-engage in the reflective process at a later stage. Moreover, as this has been used in supervision it suggests the system is designed for students already in practice beyond the introductory stage of initial helping skill development. Arguably this system might be considered more appropriate for more advanced students and practitioners and offers little for the novice trainee. Indeed Abbass et al. (2011) make no mention of the potential use of this a system for novice students and no research has been conducted to assess the application of the method within initial helping skills training setting.

McCullough, Bhatia, Ulvenes, Berggraf and Osborn (2011) developed a system for reviewing video footage of psychotherapy sessions. The software contains ratings by experts of selected 'master' psychotherapy sessions. The core feature rests on allowing students to watch and rate videos and make comparisons with those from experts saved within the system. Not only does the system enable students to observe expert practitioners model different approaches, it supports the development of skills by identifying examples of good practice, of client process, and of client changes taking place. Video used in this way might

also enhance the development of practice competence through deepening students' awareness of the psychotherapy process as it is known through the evaluation of good cases. However, while effective, the system still does not take full advantage of technology opportunities available – although the authors highlight the value of micro-analysis and picking up on, and working with individual moments within psychotherapy, the interaction with the system is limited to submitting the ratings (4-6 numerical values on scales 1-100 and a 'main affect') to pre-selected, 10-minutes long fragments of the sessions. A further downside is that students may try to copy the expert practitioners and fail in the development of their own personal style as a psychotherapist. Likewise, this approach does nothing to create the kind of intense emotional experiences that might lead to procedural knowledge becoming automated under such conditions.

Moving forward.

On the basis of this overview the following conclusions are drawn. Learning helping skills is an important part of the psychotherapy training process. Video playback technology is increasingly used in a range of formats: including skill development using pre-recorded expert psychotherapists or novices and experienced trainees in analogue sessions; for supervision purposes once working with 'real' clients, and for training in specific techniques and deepening understanding of psychotherapy process. Moreover, emerging literature in supervision strongly suggests that integrating video playback technology with Internet connectivity can extend possible uses. However, there is a lack of training-support software systems that can integrate existing knowledge of helping skills training that rely on experiential learning theories, technology solutions for Internet and web based video conferencing, with added features to enhance reflection and analysis of skills sessions. This is the task we addressed and the process-outcome of that task is detailed below.

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The Software Development Process

In the remaining sections we report on the process of software development for a new technology to support and enhance psychotherapy helping skills training. Whilst Slovak et al. (2015) have reported elsewhere on some empirical data related to the design process, our focus here is to highlight the existing pedagogical challenges identified in learning helping skills and point to the potential role for technology to help address these challenges.

Research Context and Technology Support

Developing the software, our aim was to address a gap in the use of technology assistance for helping skills training in a professional psychotherapy education context. A software system was built based on research conducted with students and tutors of psychotherapy program at a leading university in the United Kingdom over a period of 2 years. Through the process we drew on user-centered methodology (Rogers, Sharp, & Preece, 2011) as an established approach to developing an understanding of the underlying needs and challenges of the students, and designing an interactive system to address these. To this end, we conducted a series of interviews and observed practice skills sessions. That is, we looked at what the students current practice involved, how tutors supported helping skills development, and matched these to possible technology solutions. Figure 1 provides an overview of the research process that informed the development of the m-Path software that will be described below. This process included the creation of low-fidelity technology prototypes (e.g., mock-ups of envisioned systems from simple materials such as paper printouts) which were employed to illustrate technology possibilities, deepen discussions with participants and

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enhance both their and our understanding of opportunities for technology design in the psychotherapy training setting.

The research team was multi-disciplinary, comprising a psychologist/psychotherapy educator who is also a registered psychologist specializing in psychotherapy, interaction designer, and computer scientists. This diverse mix of research expertise provided a rich resource of theory, creative and practical skills and knowledge from which to draw on during the research process.

Initially we conducted interviews with 3 teaching staff, 4 expert psychotherapists and 19 psychotherapy students that took part in the various research activities. Altogether 22 females and 4 males participated. The sample reflects the ratio of females to males in the psychotherapy training programs. Generally, each participant took part in a single Phase only; with the exception of three students participating in two Phases each (S4, S11, S13[S = student participant]). Participants were mainly psychology graduate students studying a post-graduate degree in psychotherapy based on a theoretical orientation described as a person-centered experiential approach.

All student participants had at least one year of helping skills training and had previously been developing their skills through a range of methods including, tutor modelling, small group peer-to-peer skills session with tutor feedback, and video play back of peer-to-peer skills sessions using an adapted version of IPR. The adaptation meant the predefined script used by Kagan for facilitating processing had been replaced. Instead students identified a key process issue of interest to them emergent from their completed skills session and this was followed in the video playback by facilitators supporting deep reflection on the process issue. The facilitator modelled helping skills to empathically support the exploration of the process issues of interest to the student psychotherapist. Observers also provided feedback at the end

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Research Phase	Methods	Participants and activities	Length Demographics	Participants' IDs
Phase 1	Semi-structured interview	**Participants:** 5 counselling students **Activities:** • Discussed the main issues students encounter as part of learning • Identified areas to explore in next stages -- practice counselling sessions, and facilitating feedback **Aims:** Design inspiration; understand the basics of the learning process and the key challenges	4 females 1 male Length 45 min	S1-S5
Phase 2	Observation	**Participants:** 4 expert counsellors, 8 counselling students **Activities:** • Observed practice counselling sessions led by expert counsellor • Observed (and recorded) reflection practices of both student client and expert therapist after the session **Aims:** Design inspiration; understand the practice counselling sessions, and students' reflective abilities	10 females 2 males Length 60 min	E1-E4 S4, S6 - S12
Phase 3	Semi-structured interview Design prompts	**Participants:** 3 members of staff, 3 counselling students **Activities:** • Discussed how learning is scaffolded in class, particularly around practice counselling sessions • Followed by design prompts to envision potential of novel sensing and feedback support technologies **Aims:** Refine design considerations.	5 females 1 male Length 60 min	T1-T3 S11, S13 - S14
Development of the design prompt for Phase 4				
Phase 4 part 1 Phase 4 part 2	Practice counselling session Semi-structured interview Wizard of Oz Semi-structured interview	**Participants:** 6 students (3 pairs), each participating in both parts **Activities:** • Practice counselling sessions -- each student took part once as the client and once as the counsellor. • Observe and explore students' reflection practices on recorded counselling session. • Review and critique of the design concept presented through WoZ **Aims:** Confirm identified challenges and design confiderations	5 females 1 male Length 90 + 90 min	S13, S15 - S19

Figure 1. Outline of the iterative approach (methods and activities for each phase)

of their process reflection; clients also provided feedback on the session. Students typically worked in groups of five or six people and rotated through the various roles. Groups were supported by experienced tutors. Students had also watched videos of master therapists at

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work (e.g. Rogers, Perls and Ellis working with 'Gloria'; Cain, Greenberg and Pavio from the American Psychological Association Master therapy series).

The first two phases of the development process explored how students experience their skills training with a particular focus on what they found difficult. This explored how digital technology could be better used to support their learning process. Through the first phase, we identified that process work involving reflection on skills practice sessions was considered both integral and crucial to their learning; providing students with opportunities for 'deliberate practice', and the development of their self-awareness and reflective capacities. Clarifying the underlying difficulties faced by students led to first ideas for a potential technology design which centered on the development of an online tool to provide students with a wide range of opportunities to reflect, annotate, and receive peer feedback as part of the process work.

The subsequent two phases focused on iterative development of the system that would (a) build on but also conceptually extend the current pedagogical practices; (b) be designed with the 'student in mind' to support their work rather than hinder it. We took advantage of established methodologies in software development (Buxton, 2010) to progress from initial low-fidelity prototypes (exploring the design space), to digital prototypes used in the Wizard of Oz scenario (researchers doing some of the work behind the scenes to test computationally difficult aspects before these need to be fully implemented), and finally to a fully developed software package.

Identified Challenges to Learning

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Based on the findings from participant interviews (reported in Slovak et al., 2015) and our analysis of the existing literature, we proposed four challenges that can guide further work. The next section describes how it is intended to address these challenges in the design of the *mPath* system. The challenges identified the need to develop a system for:

- promoting students' self-directed reflection process activity/work;

- improving access to client's experiences as part of the process reflection work;

- supporting detailed, constructive feedback from peers in the process reflection activity;

- facilitating iterative, multi-phase process reflection over time.

Self-directed reflection process

Helping skills training can be conducted by tutors giving instruction for specific skill development as the focus of a practice session. This might refer to a specific competency in a particular model (e.g. developing empathic understanding, or emotion specificity in Person-Centered Psychotherapy; or the task of graded exposure in behavior psychotherapy). However, students can also benefit from developing capacities for self-directed reflection as a skill for future psychotherapy practice. Student psychotherapists need to be able to identify important inter- and intra-personal processes that shape and guide their in-the-moment responses to clients. Research suggested that psychotherapists are capable of identifying significant helpful or hindering aspects of psychotherapy (Llewelyn, 1988) and skills sessions provide an opportunity to learn from such significant aspects of practice sessions. However, the existing approaches to skills training offer only a limited platform for such learning; in fact when using the IPR prompt sheet students can be distracted away from what might be

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most personally important or significant for reflection as they are being directed by the 'inquirer'.

At the end of skills sessions students can often be left with unanswered questions that would benefit from an extended self-directed reflection process. Practicing reflection on self and one's cognitive processing can develop better metacognition (thinking about thoughts) (Breed, 2013). A risk to maximizing learning potential is that thoughts, comments and feedback are not accessed in standard IPR sessions. Being able to 'attach' reflections to specific moments of a video session could resolve this as could students being able to shape the timing of process reflection work. Larsen, Flesaker and Stege (2008) suggest that accessing the memories from deep emotional experiences can take time and are not as readily available as more cognitive aspects of memories. They refer to the earlier work of Greenberg, Rice and Elliott (1993) identifying that accessing emotional inner processing requires a cycle going back and forth between checking inner states and verbalizing these states. Larsen, Flesaker and Stege (2008) argue that slowing down the reflective process can optimize this cycle and lead to enhanced processing and verbalizing of complex internal experience. The data generated through process reflection and feedback is important for the development of felt experiences to be made tangible and accessible for future practice. Thus, how can a system be designed to help extend opportunities for students to identify important inter- and intra-personal reflection processes; and assist their reflective process by providing such functionality that allows for a synchronized documentation of comments and feedback to be attached to recordings of their behaviors as well as offering flexibility to revisit a session as and when the students are emotionally ready to engage with it?

Access to client's experiences

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We identified the need for the student in the role of the psychotherapist to have better access to their clients' experiences (thoughts, feelings, reactions etc.) of the helping skills sessions and those during the reflection process. In particular, it was noted there was often little direct interaction between the client and psychotherapist after the session. Research points to the significant benefits to clients when they receive feedback on their in-session progress (Lambert & Shimokawa, 2011). Gains in training psychotherapists could also be made by enabling feedback directly from peer-client to their peer psychotherapist. It would be valuable for learning to give student psychotherapists access to feedback for verifying and sense-checking the intricate assumptions they made about their client's feelings, thoughts or behaviors as part of their post-session process reflection work. Additionally, psychotherapists in real psychotherapy settings tend to be poor predictors of the quality of the helping relationship whereas clients offer a more reliable source of evaluation (Murphy, 2010). Enabling peer-clients to offer invited feedback and contribute to students' reflections on skills sessions provides a valuable source of feedback. In addition, getting a different perspective on one's own subjective experience can be informative and assist in making changes in self-understanding and self-development. In person-centered and psychodynamic approaches psychotherapist effectiveness is often thought to be related to self-awareness and self-acceptance. Client feedback could then help the student psychotherapist become more aware and ultimately self-accepting of issues directly affecting their interpersonal helping skills. Thus, how can new technology help enable the provision of client feedback?

Supporting peer feedback

Extending constructive feedback from clients through the role of an observer within the frame of a helping skills session is an important yet difficult skill to accomplish. In particular, students find it difficult to be concrete in giving feedback often failing to link

comments to specific observations or in-session events. The use of feedback for developing better outcomes in psychotherapy is an emerging area of interest and research development (Lambert & Shimokawa, 2011). The challenge is to generate a system for feedback to helpfully tie the reflective process to significant events in the skills session. The goal of doing so is to support the development of the procedural knowledge associated with helping skills whilst adding to the declarative knowledge associated with theory, all of this being facilitated via a technology assisted environment. A system that can enable feedback from one or multiple peers to be supplied following a skills session that flags areas for closer attention and reflection will serve to enhance the quality of feedback whilst ensuring this is tied to key moments in the skills sessions.

Facilitate iterative, multi-phase reflection

A commitment to process reflection work is a career-long responsibility for psychologists and psychotherapists. As clients continue to reflect on themselves between psychotherapy sessions student psychotherapists can also reflect on their skills development between sessions; these reflections might combine periods of deep individual sense-making and reflection (including creating assumptions about others' experiences and states), with periods of interactions where such thoughts and sensations are shared, checked, and discussed (e.g., in peer skills groups or supervision). A lack of technology in most current skills learning environments means such learning can be lost if only limited or sometimes no records are made of reflective processes and discussions. Students can struggle to maintain reflective journals based on practice sessions. Students could benefit from being able to continue to flag important events, rate aspects of practice, evaluate, and analyze their practice over time. After the session, few opportunities exist that enable the development of a deeper understanding of practice, the motivations for key in-session responses and the personal

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dimensions influencing decisions. Likewise, for uncovering relational and interpersonal dynamics between client and psychotherapist not immediately present in the reflection session. Revisiting skills sessions over a period of several days, being able to dialogue with peers, and gain support for further reflection is difficult using traditional approaches to helping skills practice.

Description of the *mPath* Software

Based on these identified challenges we will now describe a particular use-case to illustrate the technology opportunities for enhancing the reflection process and learning helping skills. An online software system was developed—called *mPath*—to be used by psychotherapy students as part of their training. *mPath* is organized around individual video recorded practice skills sessions that students can upload to the system. The system works by the student in the role of the psychotherapist uploading a video-recording of a peer skills session, which is possible only with the consent of their 'client'. *mPath* allows the student to work with the session from any place through using any computer with a modern Internet browser. All students are briefed on issues of confidentiality and of treating the session as a client record. Students that are clients for the sessions also give their informed consent for the sessions to be uploaded to the *mPath* system.

To help focus the process and to structure the reflection work over time *mPath* is designed to nudge students to explicitly select one of the following three perspectives: focusing on the *counsellor* (i.e., emphasis on own behaviors, thoughts, feelings, and process experiencing); focusing on *the client* (attempting to understand client's in-the-moment behaviors, thoughts, feelings, and process experiencing and also the client's reactions to the

student psychotherapist); and focusing on *the interaction* (looking at the inter-personal dynamics of the session).

Within each perspective, *mPath* offers multiple tools to assist in process reflection: the ability to mark and annotate any moment within the session with a text comment; focus on non-verbal interaction only by working within a silent mode of the video; create 'AffectSlider' traces to generate visual representations of ratings of perceived experiences within the session; as well as request any of these as feedback from the client. These experiences can be focused on exploring attempts at practicing key skills or techniques.

Students' reflection work with each tool is saved as a specific 'track' in the system, synchronized with the underlying session video, and can be reviewed individually. Alternatively, the student can simply click and select a number of tracks for the same skills session that have already been created and review them in combination. This supports the students to focus on specific aspects of the session in detail while creating multiple reflection tracks; but also offering the option to combine the resulting annotations together in an overarching picture that supports a more holistic understanding and reflection on the session. Additionally, the student can request feedback or rating on key variable, such as 'level of empathic engagement' or 'level of congruence', or for specific technique application such as 'facilitating emotion specificity'. This can be for during a given moment, defined period, or across a full session; the counsellor can request feedback from the client, observers or tutors on these parts of the session. In what follows, we describe each of these tools in more detail.

Annotation tools (see figure 2)

The annotation tool allows the student to place marks that are tied to the underlying video. The marks take two forms: simple 'flags' that mark a specific moment that is of
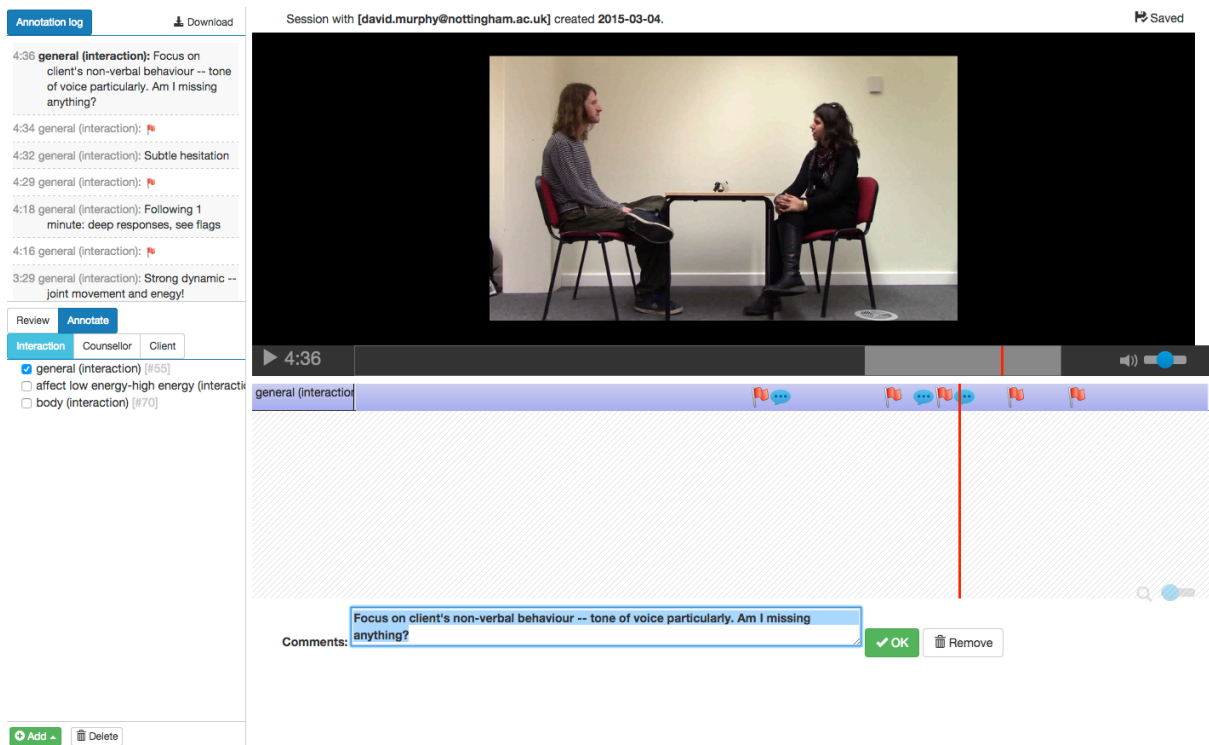
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Figure 2. Annotation interface

importance for the student, but carries no textual information; and 'comments' that allow the

student to add a more detailed description of their reflection. To add a flag to the video the

student can either press the mouse button when watching the video that automatically creates

a flag on the track they are currently annotating, or they can press the space button on the

keyboard, which pauses the video and allows the student to write down and save a comment

in the text box that appears underneath the video, linking their annotations to this particular

moment in the video. This mimics the practice of students entering notes into a text

document, or a physical notepad that are timestamped to be linked with the session video.

What technology adds is a substantial enhancement of these practices by allowing quick and

simple annotation that can be tied to the specific moments in the session. Moreover, the ease

of navigating the video to the moment (i.e. a seamless moving forward and backward in the

time line via drag-and-drop, or functionality to zoom-in and –out of the entire video track

aiding identification of those parts in the video that were annotated) has the potential to

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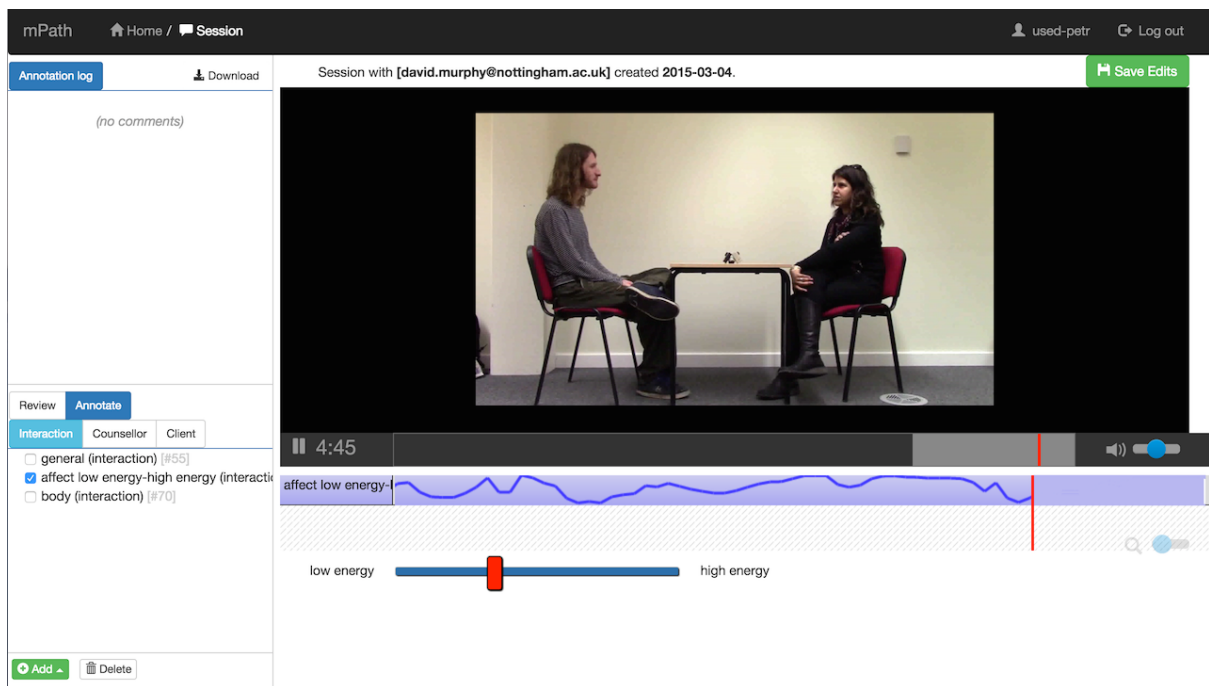
Figure 3. AffectSlider interface

support iterative, in-depth analysis by the student where they are able to track and reflect on different parts of the session more easily.

Non-verbal (body) focus

The 'Body focus' functionality allows the students to annotate the session with the audio of the recording deliberately being disenabled, whilst providing the full annotation tools functionality as described above. This is intended to support students to focus on the nonverbal aspects of the session as another important aspect of the skills session that can be analyzed in greater detail.

AffectSlider (see figure 3)

AffectSlider exemplifies one of the key novel features provided through technology, allowing the students to capture their subjective rating of experiences 'in-the-moment' (while watching the video), and then automatically transform it into an overview of the whole session. The current version of the AffectSlider takes the form of a virtual 'slider' on a single

line with two poles, where poles can represent any concept that students wish to explore, e.g., from low-empathic understanding to high-empathic understanding (see Fig. 3). The student can indicate their in-the-moment experience while they watch a video-recording of their session, adjusting the slider position by moving their PC mouse. The sequence of such slider position changes is automatically recorded and time-stamped to tie the changes to the respective time in the video, and can be thus later presented as an overview graph (see Fig. 4).

Discussion

Following from this work on developing *mPath,* we are now better placed to consider a wider range of ways that technology support can be utilized to enhance psychotherapy helping skills development. We identify two major areas where this might be possible. First is the development of a web based video technology system that facilitates a shift in the approach and style of reflection on skills practices. Second is enabling reflection processes to be developed from a range of perspectives on either the full length or segment of a skills practice session. This is achieved through the use of web based technologies and software developments to incorporate high levels of self, peer and tutor feedback to assist and support reflection and processing of sessions over time. We now consider these issues in turn.

Potential Changes to Reflective Practices

One of the major benefits that using technology support can offer to helping skills training is its potential to change the way that students reflect on their practice when learning helping skills. Reflection upon skills practice sessions will often be relatively brief, with (usually but not always) helpful feedback from observing peers, and include some tutor

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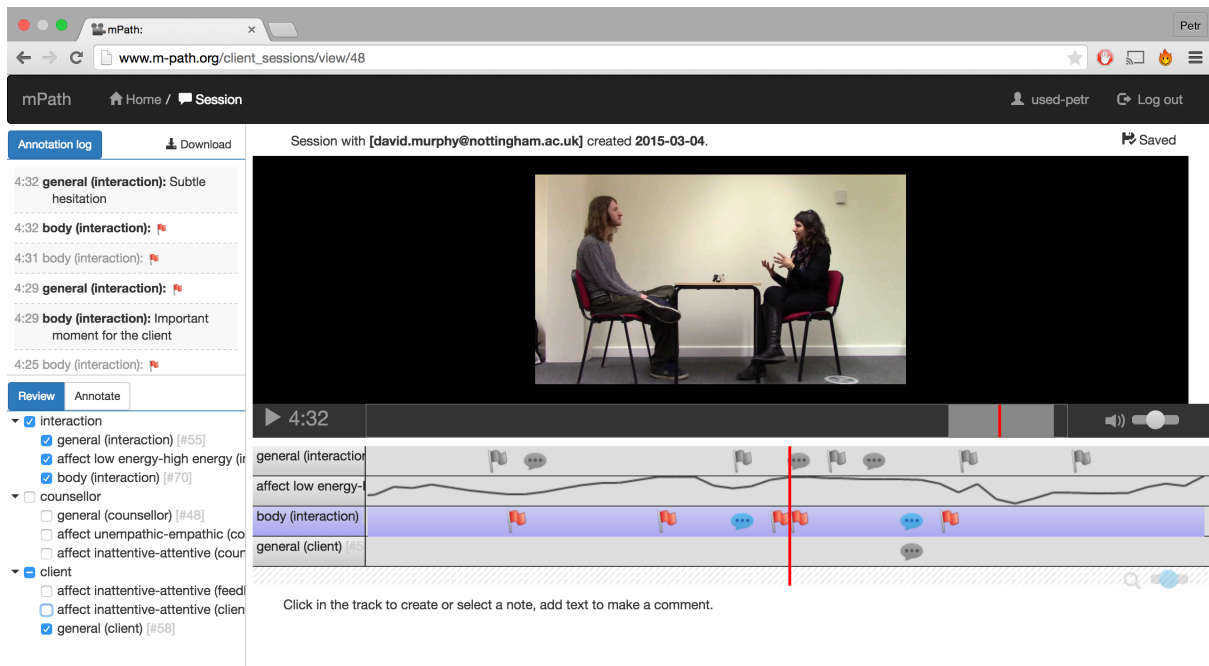
Figure 4. Summary view of selected annotation tracks

feedback. The use of technology can radically change this, possibly extending and deepening the time allowed for the reflection process and the accessibility to the film and further feedback. In particular, the ease with which technology can support annotation of specific moments within the video as well as easy restructuring of the comments can enable a 'layering' of reflection, where students re-visit and re-evaluate their annotations over time. Moreover, the spatial representation of the comments (cf., Fig. 4) and ability to quickly compare annotations made in multiple views, enables a novel form of representing and analyzing the session as 'out-in-the-world'; as opposed to simply as a video-recording accompanied by hand-written notes from a discussion amongst peers or one's own process work. In particular, such spatial representation can enable students to change from a linear temporal mode of reflection to a circular or spiral mode: repeatedly working with specific moments, adding layers of reflection, and pulling together multiple views to facilitate deeper understanding. All data is stored online using secure servers that offer protection through encryption. Access to videos is limited by issuing individual user accounts to students using the system.

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Technology can also offer completely new perspectives and tools for reflection. As an example, the technology behind the AffectSlider allows the student to freely move in between indicating the 'in-the-moment' feelings relevant to the selected concept; and the resulting 'overview trace' that is automatically generated (cf., Fig. 3); This would be pragmatically impossible on paper. In particular, visualization of the resulting trace once it has been indicated can help identify key moments of interest (e.g., a drop in perceived empathic understanding), as it is again tied to the video-recording, starting the next layer of reflection. Moreover, the in-the-moment use of AffectSlider promotes sustained attention, as the slider position is to be continuously changed according to perceived experience or behavior; and the students' choice of a specific variable of practice to analyze can reduce the cognitive overload and helps the student make conscious decisions about which aspects of their helping skills they want or need to specifically focus on.

Further to this it is possible for students to download and export their process notes, comments and AffectSlider data as a pdf or to print their annotation logs for further analysis. This facility is helpful and can support students in homework and assignment tasks that require the analysis of skills practice sessions.

Multiple Perspectives for Reflection

The second major potential contribution of technology solutions for helping skills training is the development of multiple perspectives for reflection on video skills sessions that involve the client-students or supervisors in the extended post-session reflection process in a pragmatically viable way. As the technology-based systems can run online, the student can select specific parts of a session—for example a specific sequence or time period—and send them to the client or supervisor with a request for feedback. Such time-limited feedback requests (i.e. a shorter 2-3 minute sequence of the video), which can be sent and answered

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asynchronously, provide a pragmatic opportunity for the student to receive important information from the client, which would be otherwise likely unavailable (e.g., due to the overhead of scheduling another in-person session with the student to discuss the matter). We suggest that facilitating such time-effective, asynchronous interaction between students can enhance post-session reflection by not only being much more viable to scale, but also likely to promote repeated and iterated reflection where the student can go 'deeper' with each round.

Technology-based systems can also directly promote students' perspective taking and help explore the differences in experiences of a given session between client, student and observers/tutors. Taking again the AffectSlider as an example, students can be invited to indicate not only their own experience, but their assumptions about how the client feels. If the client is then asked to do a similar AffectSlider, the student's perception can then be cross referenced with the client's own views by matching the resulting two traces. Moreover, once such tracks are created, it can easily be presented to a tutor for comments, or compared with the observers' views of the same segment. Significant mismatches or high levels of concordance between the client's, psychotherapist's or tutor's assessments might trigger further discussions and exploration of the moments in question. This makes for time efficiency, especially when compared to IPR or similar procedures, and could again allow for iterative engagements in a relatively low time requirement that is entirely self-directed learning.

Transferability of Concepts

mPath builds on a core practice that is mostly common across psychotherapy education, i.e., students analyzing their own sessions as a core method to developing helping skills. While *mPath* is currently designed and being developed to fit humanistic approaches, the

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underlying concepts guiding its design—all building on the need for support to visualize and make sense of experiences within the complexity of the psychotherapy session—are likely to be of value for many other approaches. In this sense, research around *mPath* is not only pointing to a specific tool that might be of use, but also highlighting how novel technology could help psychotherapists across all psychotherapeutic schools enhancing training practices and supporting effectiveness.

Future Work

mPath is already being deployed in real-world teaching scenarios and is being used with selected programs. We are also researching how mPath affects process reflection work following helping skills practice sessions for both the students and tutors and we anticipate this will lead to changes to pedagogical processes. In doing so, we want particularly to explore the following aspects: What will be the immediate outcomes concerning the perceived usefulness for students and staff members as well as the opportunities mPath offers to extending and enhancing the existing training process reflection work. We are also interested in how mPath supports and enhances the teaching of helping skills. We will focus on understanding how working with mPath can affect and enhance the students' experiences with process reflection work. One expectation is that we will see a 'deeper' level of process reflection work on part of students as well as gaining improved understanding of client's experiencing through the use of the mPath system to systematically reflect on practice sessions. A more distal but crucial aspect is trying to identify the outcomes of technology on students' skills development, including aspects such as differences in expert rated bona fide psychotherapy sessions pre-/post- mPath training, especially in comparison with a matched control group.

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Conclusion

Technology solutions for enhancing psychotherapy training are a much neglected area of research and development in the field. Psychotherapy has a long tradition of embracing new technologies and yet there seems to be little by way of technological advances in psychotherapy education. The *mPath* system presented here is just one example of what is possible by integrating and developing technology support for psychotherapy education. We call for further development of research in this area to enable our understanding of how psychotherapy works and how students can learn to make themselves as effective as possible in their role as psychotherapists.

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Part III

Discussion: Connecting the cases

CHAPTER 9

Understanding the learning processes: Reflective practicum in SEL

9.1   Introduction

The research described in previous chapters investigated the local mechanisms and practices of learning in each of the case study contexts separately. This and the next chapter moves on to compare the observations across the two case studies with the aim to identify a set of generalised 'causal principles' and the support factors underlying the learning in each of the contexts. In other words, the objective is to identify a set of concepts that can help understand both the similarities as well as the differences in learning mechanisms used within the two contexts. As discussed in Section 3.2, such an understanding can help us move beyond the individual case study settings and suggest broadly applicable mechanisms that can guide future work in other areas.

In what follows, we highlight the emphasis on *experiential learning* as the core general learning mechanism across the two case studies and how such experiential learning is scaffolded. In particular, we will argue that Schön's analysis of how 'expertise' is developed through a *reflective practicum* can serve as a useful lens to help articulate the underlying mechanisms of SE competencies development in more detail.

The argument proceeds in a number of steps: First, we start by reviewing the existing theories of experiential learning (Section 9.2). We then introduce Schön's notion of reflective practicum as an in-depth qualitative articulation of the mechanisms scaffolding experiential learning as seen by Schön's empirical work in predominantly architectural studio settings (Section 9.3). In essence, Schön emphasises the importance of the 'right sort of experience' for the learners, which is deliberately scaffolded through an interplay of curricular components. In doing so, it highlights the challenges and complexities of developing competencies that are impossible to fully articulate in words (as is also the case for SE competencies), and thus can be developed only through direct experiential involvement and experimentation on part of the learner.

Section 9.4 then illustrates how these core aspects of the reflective practicum can serve as a useful sensitising concept (Blumer, 1954) to help abstract the mechanisms underpinning the learning in the two SEL contexts. In particular, we outline characteristics of what makes an experience the 'right sort of' experience in the SEL contexts (as the key learning principle), as well as identify the curricular components (explicit, social and personal) we saw across the case studies. Section 9.5 returns to the details of the case studies to show how these general mechanisms were instantiated within the cases, specifically focussing on highlighting the differences and similarities in the support factors available and the resulting implications for the learning processes as well as technology support. Finally, Section 9.6 turns to unpacking the specific aspects that make the development of social-emotional skills different to the training processes in design, engineering, or music that Schön describes in his work.

The next chapter, Chapter 10, then draws on this analysis to extend the concept of reflective practicum into a conceptual framework to guide technology development in SEL. We do this by abstracting key strategies and curricular components across the case studies, particularly highlighting (i) a set of questions to help design for the 'right sort of' experience within SEL learning; and (ii) identifying the roles technology can play in

three identified curricular components (explicit, social, personal). We then illustrate how the developed framework might be used to inspire and guide future work in two ways: First, it outlining how it was used within two follow-up projects. Second, we point out how the approaches to scaffolding experiential learning similar to those described here, can be found in other previous HCI work in varied settings, such as those supporting reflection of diabetes patients (Mamykina et al., 2008), eating habits (Parker, 2014), or within romantic relationships (Thieme et al., 2011). Overall, this suggests the potential value of the extended reflective practicum framework as a lens to understand designing for experiential learning also outside the immediate domain of social-emotional learning.

9.2 Experiential learning: theories and methods

> *"When we go about the spontaneous, intuitive performance of the actions of everyday life, we show ourselves to be knowledgeable in a special way. Often we cannot say what it is that we know. When we try to describe it we find ourselves at a loss, or we produce descriptions that are obviously inappropriate. Our knowing is ordinarily tacit, implicit in our patterns of action, and in our feel for the stuff with which we are dealing." (Schön, 1983, p.49).*

Any social-emotional competency, as well as much of other expertise, is dependent on a form of knowledge that is not entirely accessible to conscious thought (cf. Dewey (1933); Bargh and Gardner (2003)). This brings the need for extensive experiential engagement and practice by the learners if the training is to be successful (see for example Ericsson et al. (1993)). To provide the theoretical grounding—as well as allow us to better distinguish the particularities of SE competencies from other competencies—we first situate the need for experiential practice in the underlying psychological processes (such as the difference between procedural and declarative memory) and the broad model of experiential learning put forth by Kolb (2014).

9.2.1 Psychological grounding for the need of experiential learning

Both conscious *and* non-conscious components are fundamental for any social-emotional behaviour (Lieberman, 2000; Ambady, 2010), as well as any competency more broadly (e.g., Schön (1983); Ericsson et al. (1993); Bargh and Gardner (2003)). One way in which

this duality is grounded in the underlying psychological mechanisms is in the difference between *declarative* and *procedural* memory systems (Squire et al., 1993). The declarative system stores what a person consciously knows, such as the names of capital cities, or a memorised sequence of steps to start a computer game. In contrast, procedural memory stores the behaviours as they become progressively automatised and thus not necessarily consciously known; such as 'knowing' how to ride a bike, or drive a car. There is an extensive body of work pointing at the importance of procedural knowledge and how it can be obtained through scaffolded repeated practice, requiring direct learning from experience (e.g., Sun et al. (2001); Ericsson et al. (1993).

A second factor for why procedural knowledge is of particular importance for SE competencies are the changes within cognitive processes in 'hot' moments, i.e., situations when the learner is overwhelmed with emotions. These cognitive changes diminish ability for conscious, analytical thought (Wyman et al., 2010; LeDoux, 1998) and thus reduce the availability of declarative knowledge and increase the reliance on procedural knowledge. As social-emotional skills are tightly interwoven with emotional activation, *procedural knowledge and the related experiential learning is fundamental* in SE competency development.

9.2.2   General experiential learning model – Kolb

Multiple models of how procedural knowledge can be developed through experiential learning exist within the literature. Kolb's Experiential Learning model (Kolb, 2014) is probably best known and used across education, business and other domains. According to the model, learning consists of four sequential stages: it begins with a concrete experience followed by collection of data and reflective observations about that experience. In the abstract conceptualization stage a learner makes generalizations, draws conclusions, and forms hypotheses about the experience. In the final stage, the learner tests these hypotheses and ideas through active experimentation in new circumstances. Generally, the model stresses the continuous nature of learning and the appropriate feedback which provides the basis for a continuous process of goal-directed action (Kiili, 2005).

Although Kolb argues that the theory is grounded in wealth of previous work of 'founding scholars' in philosophy, psychology and other disciplines (including references to James, Dewey, Lewin, Piaget, Ericsson, Rogers, Freire to list a sample) his model has been

strongly criticised for selectively drawing out only those founding scholars' thoughts that fit the model (Miettinen, 2000). Moreover, it does not go into detail of how each phase might be supported and in particular how the grasping and transformation of experience through reflection is to be guided (cf. Boud et al. (2013)); it assumes that all 4 stages must occur sequentially and independently from each other (in contrast to the complexity of learning processes described by Schön (1983)); and it insufficiently emphasises the social processes that support or hinder learning, such as the importance of coaching outlined in Vygotsky's or Ericsson's research (Vygotsky, 1987; Ericsson et al., 1993).

Within the context of this thesis, we see Kolb's model as a useful, if simplistic, set of arguments highlighting of the importance of experience in learning as well as the key role that active engagement of the learner with the experience plays for successful learning. In particular, we will see that the processes of a learner's intricate involvement with their experience to grasp and transform it into further action emerge—with more detail and complexity—as a key characteristic in Schön's Reflective practicum which is discussed in the rest of this chapter.

9.3 The 'Reflective practicum' as a model for SEL competency development

> *Practicum is a setting designed for the task of learning a practice. In a context that approximates a practice world, students learn by doing, although their doing usually falls short of real-world work. They learn by undertaking projects that simulate and simplify practice; or they take on real-world projects under close supervision.* (Schön, 1987, p36)

Schön's treatment of how practitioners—particularly in the design studio—manifest and develop expertise through reflection-in-action and 'talking with' the unique situations they face everyday has been highly influential in HCI work around reflection. In what follows, we thus do not attempt to provide a in-depth treatise of Schön, or the application of his thoughts across HCI so far (see, e.g., Fleck and Fitzpatrick (2010); Baumer et al. (2014); Baumer (2015) for recent reviews). The aim is instead to draw out the key concepts and ideas underpinning the Reflective Practicum framework that will then structure the discussion the two case studies in later sections of this chapter.

Reflection-in-action as the defining feature of expertise

In Schön's description, reflection has both a crucial importance for helping the expert to orient and make sense of the unique situation they are facing, but is also also seen the method through which the experts develop their competence. In particular, a practitioners' expertise relies on patterns that the practitioner can, consciously or unconsciously, draw on and appropriate within the novel situation; and these patterns are learnt through earlier reflection-in-action (e.g., Schön (1983, p140)).

Importantly, reflection-in-action is strongly grounded in specific experience. Schön describes it as necessarily including a 'discussion' as part of the experience, in which the expert probes and works 'with' the situation to transform their understanding of how a solution might look. As such, doing and thinking are complementary in reflection-in-action as *"[d]oing extends thinking in the tests, moves, and probes of experimental action, and reflection feeds on doing and its results. Each feeds the other, and each sets boundaries for the other"* (Schön, 1983, p280). In other words, though reflection-in-action the actor 'experiments' within the situation by acting on the experience with the expectation of a particular reaction (doing), and analyses the reaction—the 'backtalk'—of the situation to inform further action (thinking).

Reflection-in-action occurs while we are still engaged with the situation; as such, one of its core aspects is the opportunity to experiment with and affect the on-going activity. In contrast, we may reflect on action by *"thinking back on what we have done in order to discover how out knowing-in-action may have contributed to an unexpected outcome"* (Schön, 1987, p26). For Schön, the defining characteristic of reflection-on-action is that it has no direct connection to the present activity. It is thus closer to the reflection process as understood in the work of other reflection theorists, such as Kolb's experiential learning cycle (Kolb, 2014), as well as the post-hoc reflection processes in learning that Boud emphasises in his work (Boud et al., 2013). As we will see in the following sections, the distinction between reflection-in/on-action is complex for reflection within SEL curricula and a subtle combination of both is key.

9.3.1   Developing expertise – the 'reflective practicum'

Going beyond describing the reflection-in-action as the defining component of expertise, Schön also looks at processes by which such a competency can be taught. He draws

on the architectural design studio and the training process in (freudian) psychotherapy supervision as two key examples to identify a set of learning processes—the **reflective practicum**—that underpin the learning in these two domains; showing also how these are applicable in other areas such as musical performance and engineering. In the rest of this section, we outline the main characteristics of reflective practicum:

What is a practicum   Schön characterises the practicum as multiple layered settings whose sole purpose is the structuring of the learning process: *"In a context that approximates a practice world, students learn by doing, although their doing usually falls short of real-world work. They learn by undertaking projects that simulate and simplify practice; or they take on real-world projects under close supervision"* (Schön, 1987, p36). As such the practicum is seen as a *'virtual world'* that is free of the risks of the real one. This 'virtuality' of the practicum is crucial for the learning processes to happen: it provides the opportunity for safe exploration as well as structures the tasks so that the core aspects of the learnt competencies are highlighted. It seeks to enable students to *"experiment at low risks, vary the pace and focus of work, and go back to do things over when it seems useful to do so."* (Schön, 1987, p170). As such, it frames the activity as happening within a particular 'we-do-this-for-learning' mindset, which is crucial for the reflective engagement with the experience.

Paradox of learning by doing   The paradox of supporting students' reflection-in-action rests in the fact that the students do not, at first, *"have the necessary mental concepts so that they cannot understand what they need to learn; and can learn it only by beginning to do what they do not yet understand"* (Schön, 1987, p93). This requires an implicit agreement between the learner and the mentor: *"It is as if the mentor said: I can tell you that there is something you need to know, and with my help you may be able to learn it. But I cannot tell you what it is in a way you can now understand. I can only arrange for you to have the right sorts of experiences for yourself. You must be willing, therefore, to have these experiences"* (Schön, 1987, p93).

This points to what we argue is the key characteristic of reflective practicum: as reflection-in-action and the underlying expertise cannot be directly taught to students, the role of the practicum is to arrange *"the right sorts of experiences"* for the students. In other words, active engagement with the experience is necessary on part of the learner and

the practicum is there to carefully scaffold the learning experiences so that these can be successfully grasped by the learner.

The role of the mentor   In outlining the structures by which practicum accomplishes this scaffolding, Schön strongly emphasises the mentors' role. In his view, it consists of two equally important parts: (i) they need to scaffold the 'right sort' of experiences for the learner through well chosen tasks; but then also (ii) support the reflection-in-action process on these experiences so that the learner can learn. As such, the process is *"more like coaching than teaching"* (Schön, 1987, p157). in that the role of the mentor is in providing modelling and an opportunity for a dialogue around student's experience. It is this 'in-action' feedback and support that is used as means to scaffold students' attempts at reflection-in-action; and is thus seen are instrumental to successful learning on part of the student. As Schön says, *"whatever the coach may choose to say, it is important that he says it, for the most part, in the context of the students' doing. He must talk to the student while she is in the midst of a task (and perhaps stuck in it)"* (Schön, 1987, p102). The scaffolding of reflection-in-action itself thus comprises three essential features: (i) it takes place in the context of the students' attempts to do the activity, i.e., their immediate experience; (ii) it makes use of actions as well as words; and (iii) it depends on reciprocal reflection-in-action between the student and mentor.

9.3.2   Reflective practicum – summary

Based on the literature above, we now summarise Schön's concept of reflective practicum into a set of core points:

* ★ The key assumption is that the expertise (and thus transformative reflection) cannot be taught *to* the learners, but needs to be actively constructed *by* the students who rely on the practicum to facilitate and scaffold their experiences to lead to learning.

* ★ *Reflective practicum* is a setting designed specifically to generate a particular sort of experiences that allow the students to explore by doing, through an enmeshed interplay of action, imitation, and reflection leading to further action.

* ★ This includes (i) appropriate teachable moments that provide the experience to work with; and (ii) the (scaffolded) processes of reflection that facilitate the act of 'grasping' of the experience and transforming it into learning.

⋆ In particular, the reflective curriculum provides a *'virtual space'*, where the core of the task-to-be-learnt can be explored/practiced repeatedly (thus is 'experience-able'), but without the adverse effects of failure. The main difficulty is then in facilitating activities that include the core characteristics of needed expertise but without the full associated pressures of the real-world.

⋆ Such 'right sort of experiences' often do not arise automatically; they are generated through an interplay of the varied *curricular components* that comprise the practicum.

⋆ In Schön's apprenticeship contexts, the curricular structures have predominantly relied on the role of the mentor: mentors played an instrumental role in facilitating meaningful teachable moments through well-selected tasks while at the same time providing modelling and in-the-moment scaffolding to help students make sense of the resulting experience through reflection.

⋆ Finally, the complex socio-technical system of a reflective practicum is not clearly bound to a particular space or time: any particular task, such as a design crit session, is embedded in a larger trajectory of learning experiences enabled by the practicum and the social norms it constructs.

In the remainder of the chapter, we focus on understanding the details of: Can we characterise the learning processes seen in the case studies as reflective practicum? If so, how does the 'reflective practicum' look within the two SEL contexts? What are the challenges of these existing learning structures, and what, if anything, makes these challenges particular to SEL learning? How and where might technology provide meaningful support to learners to develop their own competencies in this space?

Before moving onto the case studies, we however briefly mention two aspects that are missing in Schön's account but would be beneficial for HCI applications: First, as a learning theorist, Schön's interest was predominantly in understanding how the existing curricula work. As such, his framework does not directly address how technology might be drawn in to augment, support or change reflective processes. Second, the reflective practicum as described by Schön relies strongly on mentors' in-the-moment support as the main curricular structure. This is mainly as both architecture and Freudian psychotherapy training come with a strong apprenticeship focus. As such, other possible curricular components are not described in detail. We will touch on both of these aspects in the rest of this thesis.

9.4 Two SEL case studies as instances of a reflective practicum

The reflective practica outlined by Schön are concerned mainly with the structures of practitioners' learning in traditional subjects (such as the architecture, engineering, or freudian psychotherapy). The rest of this section however argues that the underlying processes and learning structures highlighted in the reflective practicum model will also help us understand the learning processes during social-emotional competencies development. In particular, we will use these empirical observations to exemplify how reflective practicum: *sensitises us to particular aspects of the reflection process that have not been unpacked by previous work* (Slovák et al., 2015a,b; Slovák and Fitzpatrick, 2015; Slovák et al., 2016); as well as *provides a conceptual framework that allows us to identify the strategies through which reflection is scaffolded across these two very diverse contexts*. We note that such fit of Schön's concepts within the SEL context was not immediately apparent as neither counselling nor prevention science directly build on or even reference Schön.

In what follows, we briefly revisit the case studies to resurface the key observations made in previous chapters[1]. We then apply Schön's reflective practicum as a sensitising concept (Blumer, 1954) to unpack the experiential processes underpinning learning across the two SEL contexts, by emphasising two key aspects: first, the focus on understanding what constitutes 'right sort of' experience for the learners; and second, the interplay between different scaffolding structures within the practicum that then generate such experiences.

Through this discussion, we suggest that the reflective practicum serves as a useful sensitising lens to help us dissect the reliance of SEL curricula on carefully facilitated sets of experiences for learners as well as identify the strategies through which reflection—necessary to learning from experience—is scaffolded across the two settings. The resulting framework then prepares ground for the next chapter proposing how such analysis can inspire and guide future HCI work in this area.

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[1]We note that Section 9.5 will then return the case studies in much more detail, showing how the general mechanisms identified in this section are instantiated in the case studies.

9.4.1 Revisiting the two case studies

SEL in Counselling

The counselling curriculum has a strong experiential focus, emphasising the importance of an in-depth understanding of the client (empathy) and well-tuned self-awareness ability. The program had very explicit processes and tools to promote reflection by students, always closely tied to a particular experience (such as a 'practice counselling session' with a peer student). For example, the 'Interpersonal Process Recall' (IPR) was used throughout the course. IPR is a traditional technique developed by Kagan et al. (1969) in the 1970s, aiming to facilitate counsellors' deep reflection on, and awareness of, their own feelings and thoughts during counselling sessions[2]. However, these were complemented by carefully designed learning sessions (such as lessons facilitating of particular emotions or structured ways of providing feedback during practice counselling sessions), as well as an intricate set of social norms encompassing all interactions (such as a 'learning contract' where all students commit to helping each other learn, and create a safe space where trust and confidentiality are a norm). The aim of such curricular scaffolding was two-fold: first, to create 'real' experiences for the students, whether that was working with actual emotions of a peer client, or getting to grips with their own emotional states facilitated by a particular lesson; and second, to then allow for experimentation and reflection on their own behaviour in the safe learning space established by the curriculum. To allow students to do so, the full first year of the course was dedicated to developing their reflective abilities, so that they were able to process and analyse their experiences in detail, even without an in-the-moment support from the mentor.

In terms of existing challenges and possibilities for technology support, the study identified a key issue around the difficulty to 'close reflection loops' within the interpersonal settings of client-counsellor sessions. In particular, a fundamental difficulty in the counselling practicum lies in directly supporting reflection-in-action within the practice counselling session experience. The counsellor cannot step out of the role to ask the client if "they wouldn't mind going two questions back and taking it from there to try another way of framing it", as that would break the emotional realness of the situation. To limit impact

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[2]IPR draws on repeated viewing of a video recording of the session. The student in the role of a counsellor can stop the video at any time of their choice, often when they believe something important has happened. They are then asked a question from a list compiled by Kagan, using this as reflect aloud on what was going on for them at that time. If done according to the guidelines, this is a very long process – e.g., 8 hours of IPR for 1 hour of the videotaped session.

of this mismatch between what is possible and what would be preferable, the curriculum in our case study (and the designed technology) focused on extending the experience beyond the practice session. Such processes so far relied on scaffolding students' reflection through 're-living' the counselling situations including various ways of engaging with the video replay, albeit mostly relying on pen-and-paper methods.

The designed technology took up this challenge to extend and deepen the reflection process through a custom made annotation tool. The aim was to allow for 'localised reflection' (tying comments to particular places in video), as well as bringing in client's reflection as a way to sense check and close the reflection loops. These then built on the reflective support structures such as the IPR to help counsellors to return as closely as possible into their experience within the session; reflecting on their assumptions at that time as well as identifying the reasons for the decisions, misunderstandings, or blunders in the session.

SEL in Primary education

The SEL curricula in education depend on mostly in-class, scripted lessons delivered over longer periods of time (e.g., 20 minute lesson twice a week over the whole year). The learning strategies strongly rely on role-plays, in-the-moment coaching from an adult such as the teacher, and 'mental tools' (Vygotsky, 1987). Mental tools are simple cognitive or behavioural strategies designed to serve as an internal scaffolding that allows the learners to recognise and work with the naturally occurring situations as teachable moments: if working well, they provide a space to take a step back, reflect, and re-engage with the situation only after it has been processed. An example of such mental tool is the 'Turtle technique' (Robin et al., 1976). The children are taught to 'withdraw into their shell' (by pulling their arms and legs close their body and closing their eyes) at specified occasions such as when they feel increasingly angry. This is followed by a relaxation phase, where specific muscle groups are tensed and released. Once this technique is mastered, children discuss appropriate alternative strategies for dealing with stressful situations, now that they are able to consciously reflect and react to them.

The aim is that—through the use of these tools—the children will re-interpret the ongoing real-world situations as learning experiences and opportunities for applying the developing competencies. In addition, the mental tools serve as external triggers that can be tapped into by teachers/adults to support the child in developing the competency, if

the child has not appropriated these fully. This points to the strong reliance on the social support structures provided by teachers/adults more broadly, which we turn to below.

As role-plays and other scaffolded interactions are not seen as 'real enough', the curricula rely on complementing the in-class role-plays with appropriating everyday moments from the naturally occurring situations (such as instances of conflict or strong emotion in class/on the playground). This however brings issues because such natural situations lack explicit scaffolding (cf., the carefully designed safeguards in counselling practice sessions). As such, there is a strong risk of the situations becoming 'too real', overwhelm the student, and lead to a loss of the learning focus (such as getting into a fight rather than calming down). Out-of-lesson learning is thus still strongly dependent on coaching by an adult such as a teacher, school staff or a parent, who provides the on-going cues, prompts and reminders needed by learners.

The key challenge then is in the lack of scalable techniques to get beyond classroom-based learning and support the in-the-moment reinforcement and scaffolding in everyday settings, as these are needed for the skills (and reflection support) to be transfered from in-class intervention to practice. To explore one possible solution, the technology probe we reported on in Slovák et al. (2016) aimed to provide a shared experience for parents and children together through an interactive story. A key part of the design was focused on facilitating the in-the-moment scaffolding role of the adult to help children reflect on the experience that the interaction generated.

9.4.2 Characteristics of the 'right' SE learning experience

We now return to the first of the two key aspects in Schön's work: understanding what are the characteristics of the 'right sort of' experiences that can be expected to lead to learning in SEL. For example, the 'right experiences' within the architectural studio were seen as an act of *"reflective designing"* (Schön, 1983, p79): a combination of (1) the students' active involvement with a particular design case they struggle with, such as sketching a solution to a design problem; (2) with their reflection scaffolded by the in-the-moment support from the mentor; and (3) doing so in a 'safe space' where experimentation was encouraged and effect of failure low. In other words, it was the experience of grappling with a design problem that felt hard to do, coupled with access to scaffolding such as the mentor's in-the-moment feedback that allowed for reflection as

part of the experience, while knowing it is embedded in the low-risk 'virtual world' of the curriculum.

Applying this analytical concept to SEL learning across case studies, we argue there are similarities between such 'real-enough but not-too-real' experiences that Schön draws out and the SEL contexts: In particular, we propose that the 'right sort of' experience in SEL can be then characterised as including an element of tension between (i) eliciting emotions and/or experience of interpersonal interaction that feel real, but at the same time (ii) not being too overwhelming so that it can still be approached with a learning mindset and reflected upon.

We see this 'real-but-not-too-real' quality as fundamental to what Schön describes as the *virtuality of the curriculum*: the practicum strives to generates real-enough experiences for the learning goal at hand, but does so as part of a 'virtual training world' where failures are not a 'problem' but rather a welcome input for reflection and learning. In the architectural studio that might mean that a 'failed' design leads to an enlightening design crit session with the mentor rather than a loss of money and customers. Analogously for SEL, such virtuality might for example suggest that if one learns about dealing with conflicts—and thus must experience, to some extent, a real conflict with another— both parties preferably understand this is a learning situation, done for the purpose of competency development, and will not generate hard feelings regardless of the outcome.

Balancing real-enough and not-too-real   We can interpret the curricula in the two case studies as aiming to resolve this tension between real-but-not-too-real experiences by *careful balancing of the emotional strength of the experience* for the learners. As shown within the case studies, this then means generating or appropriating situations where the learners themselves experience actual (rather than pretend) emotions or interactions, while preventing the emotional strength of these experiences from spinning out of control (and thus losing the learning qualities of the experience).

One example of such careful balancing embedded within the structure of SEL curricula can be seen within the counselling practice sessions (cf., Slovák et al. (2015a)). On one side, the emphasis is placed on discussing personal issues the peer-client experiences in order to create a 'real' counselling scenario. That is, the mentors make clear that very little can be learnt unless the peer-client is willing to talk about matters that emotionally affect them, giving the peer-counsellor the chance experience and work with situations

that are emotionally real for the client. However, extensive care goes into how these sessions are scaffolded and perceived by the participants to ensure the learning goals of the generated experience are kept. This includes multiple mechanisms that re-inforce the learning focus at various points, such as the learning contract of 'being here to help each other', the immediate post-session debrief, the use of reflection processes such as IPR or the client-counsellor discussions inherent in mPath, as well as the availability of mentors should the 'issues get out of hand'.

Importance of 'perceived realness' In highlighting the 'real-but-not-too-real' experiences, we need to clarify what makes an experience 'real' in the reflective practicum context. In line with the strong focus on learners' experiences, we suggest it is the notion of *perceived realness* that is key here: what matters is if the emotion or social interaction 'feels real' to the learners rather than whether the experience has been staged or naturally occurring. For example, if one wants to learn to self-regulate, then the essential feature of the learning experience is a strong enough emotion so that controlling it becomes an issue. While appropriating moments of stress in the real-world, such as everyday conflicts within the classroom, is one possible option, a well made horror-game can provide a similarly real feeling of stress and pressure for the learner, albeit in actuality completely staged. In the architecture training, the students need not work on designing houses that will be built; instead what matters is that the assignment creates meaningful design choices to be solved. Similarly, a carefully scaffolded situation in the counselling course managed to elicit a deep experience of shame although no participant was shamed in the real-world.

In other words, it is not the real-world implications of the situation (i.e., whether or not the experience will lead to real-world impacts), but rather the learners' perception of the emotion that matters for learning. This is what makes the virtuality of curriculum possible even within SE contexts – the ability to work with strong emotions that are still somehow bounded within a safe space.

Progression within curriculum One of the implications of importance of perceived realness is that what is a 'real enough' experience is highly dependent on the students' current abilities and progression within the curriculum[3]. For example, the SEL in

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[3]This is analogous to, for example, how one might be changing the reading difficulty of assigned books depending on the comprehension level of the individual pupils.

Characteristics of the 'right sort of' SEL experience	
Real enough	**But not too much**
The experience must be **meaningful for learning**:	The experience must be **available to be reflected with/on**:
In SEL this means eliciting actual emotions and/or interpersonal interaction for the learners.	This requires the opportunities for reflection-in/on-action, which includes the ability for safe exploration of alternative actions and thus 'closing of the reflective loop'.

Figure 9.1: Aspects of the 'right sort of experience' within the SEL practicum.

education explicitly works with a progression from 'cold' (video vignettes) through warm (role plays) to 'hot' (coaching during real interactions) moments. Similarly, counselling progresses from personal introspection in guided lessons, to individual components of counsellors' craft (e.g., active listening, reframing, or showing understanding), to practice sessions, and finally supervision building on sessions with real clients.

Summary   Overall, across both domains the aim was to always work with the 'most real' situation that can still be grasped as a 'teachable moment', rather than being swept away by it. See Figure 9.1 for an illustration of this tension. The next section discusses how such 'right sort' of experience is then generated through the learning structures of the practicum.

9.4.3   Three scaffolding components of reflective practicum

Schön's analysis highlights how the reflective practicum comprises a range of structures that all contribute to facilitating learning experiences for students. For example, Schön argues how the architectural studios have *"evolved their own 'rituals', such as master*

demonstrations, design reviews, desk crits, and design juries" (Schön, 1987, p43) within which the crucial coaching role of the mentor is embedded. In other words, the reflective practicum can be seen as an interplay of different types of components, all working together to generate the 'right experiences' for the students and scaffolding their reflection on these.

So how does this view map onto the empirical observations of the two SEL curricula? Similar to the settings described by Schön, the 'right sort' of experiences did not appear automatically in either the SEL in education or counselling curricula; instead, a number of specifically designed curricular components scaffolded experiences and the associated reflection process. We suggest, based on our analysis of the two case studies, that it is possible to unpack the characteristics of such components into the *explicit components* in the practicum (i.e., the 'rituals' such as projects, design crits or demonstrations), the *social components* (i.e., in Schön's setting mostly the role of the mentor), and the *personal components* (i.e., the competencies of the learners that are utilised by the practicum). Each of these components plays a distinct role and it is only through the interplay all of these that the 'real-but-not-too-real' experiences are made available for the students. Moreover, this distinction will further help us think about the possible role of technology as part of reflective practicum in the next chapter. Figure 9.2 provides a summary diagram of these three components and their relation to the characteristics of the SE learning experience.

Explicit components

We propose that the role of the explicit components can be interpreted as directly restructuring/shaping the experiences of the learners through tasks or specific 'tools' to scaffold reflection. For example, tasks such as the role-play vignettes in education, the counselling practice sessions, or a design crit in architecture provide boundaries on what kind of experiences can arise for students. Similarly, reflection tools such as the IPR process in counselling or mental tools in education structure particular ways of working with the experience and mediate how learners relate with the world. As such, explicit structures include both shaping the situations through which experiences are generated, but also provide explicit scaffolding processes to facilitate grasping of these through reflection.

Three components of SEL reflective practicum		
Explicit	**Social**	**Personal**
Approach: Explicit components directly re-structure or shape the experiences of the learners.	**Approach:** Social components provide supportive learning environment and a set of learning resources the learners draw on.	**Approach:** Personal components draw on learners' existing compentencies including ability to reflect and motivation to engage.
Methods: Provide specific tasks or tools to shape situations learners go through as well as directly scaffold the reflection process.	**Methods:** Providing access to peer support, expert in-the-moment feedback, as well as faciliating creation of social norms that promote learning.	**Methods:** Other aspects of the curriculum rely on expected personal competencies; or need to compensate lack of these with explicit and social components.
Examples: Role-plays, mental tools, specifically designed social situations (such as practice counselling sessions)	**Examples:** Learning contract in counselling, coaching by teachers or parent, mechanisms to promote peer support.	**Examples:** Reliance on students' strong reflective abilities in counselling, the lack of these and associated need for coaching in education.

Figure 9.2: Overview highlighting the key aspects of reflective practica

Social components

In contrast, the role of the social components can be seen as providing a supportive learning environment and a set of social resources the learners can draw on as they proceed with the training. This might include establishing specific norms (such as the learning contract in counselling) and access to expert in-the-moment feedback and peer support. Specifically, strong social structures play an important role in creating a safe practicum space in which the other training components are embedded. This includes the expectation that the interaction will be seen through the learning lens, i.e., understood and supported by others as 'learning material'.

Personal components

Finally, the personal components correspond to the learners' internal qualities that are crucial for the learners' grasping of the experience. This includes the students' motivation to actively engage with and learn from their experience, as well as their existing abilities to reflect-in/on-action. For example, the practice sessions within counselling curriculum strongly rely on the presumed abilities to reflect that the students are expected to develop earlier (over the first year of the course).

9.4.4 Summary – the SEL Reflective practicum model

Using Schön's reflective practicum model as a sensitising concept brings two key aspects: i.e., the idea of the 'right sort of experience' that is necessary for learning; and the reflective practicum itself comprising an interplay of specifically design curricular components that help generate such experiences for the learners.

In particular, we discussed how the SE learning experiences are characterised by the fundamental tension between making the experience both a **real-enough** experience (i.e., including emotions/interaction that are perceived as 'real') but **not-too-much** experience (as the experience must be available for reflection). The aim of the SEL reflective practicum is then to generate many of such learning experiences for learners, carefully balancing the support that is available to allow for the appropriate real-but-not-too-much sort of experience. Such balancing results from the intricate interplay of the explicit learning structures (such as tasks or formally defined settings such as the practice counselling session), social practices and expectations around the learning (e.g., the on-the-fly coaching from teachers in SEL or learning contract in counselling), and the learners' personal capabilities and motivation to engage in learning; as illustrated below.

If we imagined the 'realness' of an experience as a continuum, such appropriate balance can be achieved at multiple points through adding (or removing) the external support: for example, SEL learners can independently work with and learn from their experiences during a role play; but might need external support during a real conflict. As such, the interplay between individual aspects of the SEL practicum is not fixed, but preferably fluidly changes with the experience at hand, as well as the needs and existing competences of the learners. In particular, as learners progress through the program, the balancing role of the curriculum should progressively diminish, as the learners' abilities increase and

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they can take on the more elaborate roles. In other words, the practicum is a temporary, supportive scaffolding, with the ultimate goal of becoming unnecessary.

9.5   Differences and similarities in curricular components across the two case studies

We now turn to discussing how the curricular components were instantiated in each of the case studies. In particular, we will use these as examples to illustrate how the interplay of curricular components can lead to generating the 'right' experiences as well as highlight how the availability or lack of particular learning structures can explain the differences in particular challenges for learning we saw within the case studies. We will structure each of the two case studies by first going through the curricular components, discussing how these were instantiated. We then draw out how the interplay of different components leads to the (lack of) learning support and the challenges observed in the case studies. We start with Counselling setting this time as its more intricate curricular components provide a good reference point for the discussion of SEL in education.

9.5.1   Counselling

Explicit components   As the counselling curriculum is centred around experiential development of socio-emotional skills, we saw a number of explicit learning components used throughout the counselling course. These include specific tasks and associated roles, such as the experiences in 'process groups' (facilitating students' reflection abilities), specific lesson plans aimed at generating specific emotional experiences (e.g., shame, loneliness, loss), and the set of activities around practice counselling sessions. Similarly, multiple explicit learning structures were available to students to promote their reflection process, starting from the emphasis on working with the video-recorded practice sessions, the Interpersonal Process Recall (IPR) methods, as well as other rubrics that guided reflective thinking such as Person Centred and Experiential Psychotherapy Scale[4]. Overall, these tasks were specifically designed to allow the students experience real-enough situations, while providing ample opportunities for turning such experiences into successful teachable moments by including deliberately designed reflection as part of the activities.

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[4]https://sites.google.com/site/pcepsresources/home/pceps-versions

Social components We saw in the case study how the learning process was (a) fundamentally based on trained tutors' on-going modelling of counselling skills (e.g. being empathic, congruent, respectful to other's experiences) in all their interactions with the students; and (b) strongly shaped by person-centered counselling values of *non-directiveness*, *experiential learning*, and a *focus on the 'here and now'*. This was further emphasised by the 'learning contract' that the students followed, which specifically specifies the commitment to helping others (and self) grow as well as reinforces the feeling of a safe space by explicitly noting bounds on confidentiality, and the learning focus in all of the interactions. Together, these components seemed to provide a basis for a strong learning culture that permeated any and all interactions of the students as part of the class.

Personal components Finally, the students' reflective abilities were being deliberately developed and seen as a crucial aspect of the counselling practice. Recall for example, how the process groups were designed to directly train the 'reflection-in-action' process by modelling and 'forcing' the students to experiment with the here-and-now processing of their feelings, thoughts and learning experiences. Moreover, as part of a selective course, the students seemed to have been committed to learning, and further developing their reflective abilities. For example, this has been evidenced by the students' extended reflection work on practice counselling session, as seen in the case study. As such, the students seemed both motivated and able to actively engage with the experiences available to them as part of the practicum.

Interplay among the curricular structures – resulting challenges Working together, the existing structures in the counselling curriculum seems to cover nearly all the important aspects outlined by Schön: a set of strong implicit social practices is deliberately put into place and supported by the tutors, with the aim to provide the feeling of a safe space for learning with failures explicitly embraced as learning experiences. There is specific focus on 'pushing the edge of students' awareness' that then leads to growth, instantiated by both the task design (individual lessons or practice sessions), as well as the implicit modelling of tutors. The tasks are then successful in creating emotional and social experiences that encompass the core aspects of the skills to be learnt. The students are also capable of actively reflecting on and engaging with their

experiences; and the practicum is designed to build these abilities even further. Figure 9.3 summarises these considerations.

As outlined by the CSCW paper (Slovák et al., 2015a), the remaining fundamental difficulty in the counselling practicum lies in directly supporting reflection-in-action in the interpersonal settings of practice counselling: i.e., the difficulty with closing the students' reflection loops quickly enough. In particular, exploring multiple approaches is not possible within the session itself, as it would break the 'real-ness' of the situation for both client and counsellor role; and client is no longer present when the reflective process can take place.

To limit impact of this mismatch the curriculum in our case study focused on extending the experience beyond the practice session. In particular, it strongly relied on promoting students' reflection through 're-living' the counselling situations including various ways of engaging with the video replay as well as 'localised' revising it with the client. In doing so, it built on the reflective support structures such as the IPR to help counsellors to return as closely as possible into their experience within the session; reflecting on their assumptions at that time as well as identifying the reasons for the decisions, misunderstandings, or blunders in the session[5].

9.5.2 SEL in education

Explicit structures In comparison to the counselling context, the programs in SEL for education lack such a set of effective explicit structures that would create 'strong enough' experiences while at the same time supporting active reflection. As such, we can identify two approaches to getting to teachable moments: First, explicitly scaffolded lessons (such as vignettes, role-plays) were used to *generate* SE experiences during the early training, where the intended learning experiences are still supposed to be on the low end of the 'perceived realness' spectrum. However, as shown from the interviews and literature,

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[5]We see a very similar pattern in Schön's examples from the psychotherapy supervision practice: the actual therapy situation is revisited through the recollections of the apprentice therapist. The mentor then models what would be his reflection-in-action on the situation, using the apprentice's descriptions—and added detail as he goes on—as the situations backtalk. Note that the theoretical background of psychoanalysis is particularly suitable for these efforts, given the trust in the therapists' interpretation of the situation (often done after the session while perusing of patients notes) that is seen as a key part of the process. This is in contrast to the rogerian therapeutic approach, where the therapist is to serve as a 'Socratesian gatfly', helping the client make their own interpretations rather then trying to persuade the client of the therapists' "expert opinion".

EXPLICIT COMPONENTS

- roles, tasks, assessment to facilitate the 'right' experience

- support structures to facilitate grasping of the experience through reflection

Many well designed tasks and roles that support learning such as IPR, process groups practice sessions.

In-the-moment support for reflection is challenging, especially in terms being able to close the reflection loops quickly enough.

SOCIAL COMPONENTS

- external support and scaffolding, such as from tutors

- the (lack of) learning culture and/or peer support

Learning culture and support is very strong: such as the learning contract, felt obligation to support others' growth, tutors' support ...

PERSONAL COMPONENTS

- including students' motivation to actively engage with and learn from experience

- existing ability for Reflection-in/on-action

Highly selective program, students motivated to become counsellors.

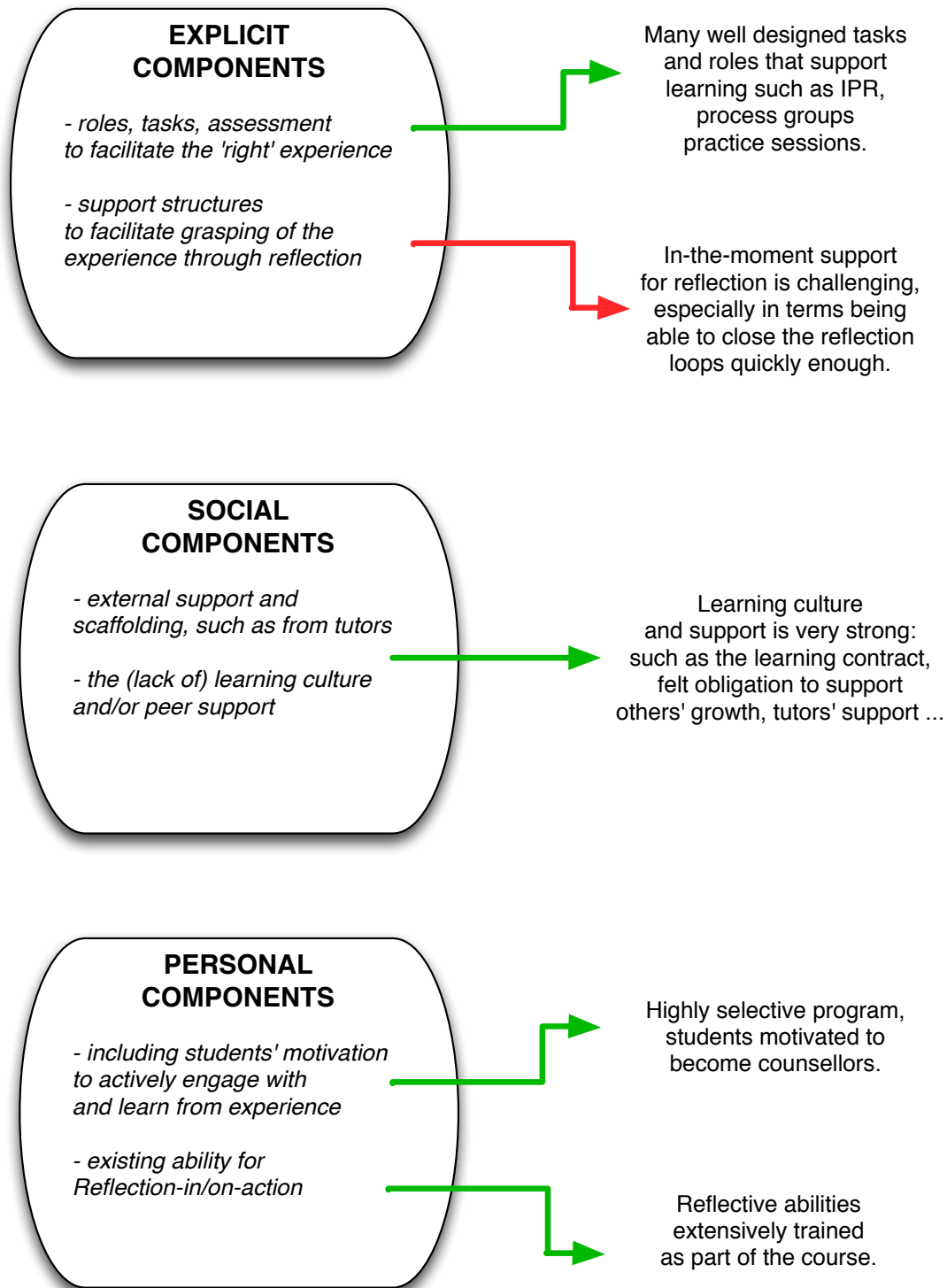Reflective abilities extensively trained as part of the course.

Figure 9.3: The available and missing aspects in the counselling reflective practicum

there is a shared understanding in the school SEL community that such methods are not working to generate real-enough experiences to mimic real-world situations. They need to be complemented other methods, if the competencies are to be transferable into interactions beyond in-class learning. The second approach is then the reliance on *appropriating everyday moments from the naturally occurring situations*, such as instances of conflict or strong emotion in class/on the playground. This however brings issues with such natural situations lacking any inherent balancing of the emotional hotness of the learning situations (cf., the carefully designed safeguards in counselling practice sessions). As such, there is a strong risk of the situations becoming 'too real', overwhelming the student, and leading to the loss of the learning focus.

The key explicit structure curricula used to support such appropriation is the focus on helping children develop set of *'mental tools'*, such as the turtle, the semaphore, or labelling emotions and thoughts. These mental tools are designed to serve as an internal scaffolding that allows the learners to recognise and work with the naturally occurring situations as teachable moments: if working well, they provide a space to take a step back, reflect, and re-engage with the situation only after it has been processed. The aim is that—through the use of these tools—the children will re-interpret the on-going real-world situations as learning experiences and opportunities for applying the developing competencies. In addition, the mental tools serve as external triggers that can be tapped into by teachers/adults more broadly, if the child has not appropriated these fully.

Implicit structures Implicit support for learners is especially key in appropriating everyday moments, where the learners generally find it very difficult to use/practice skills without guidance (cf., Slovák et al. (2015a); Bar-On et al. (2007); Jones and Bouffard (2012); Patrikakou et al. (2005)). As such, out-of-lesson learning is still strongly dependent on coaching by an adult (teacher, school staff or parent), who provides the on-going cues, prompts and reminders needed by learners. This is further exacerbated by the school climate often not resembling a 'safe space' with regards to SE aspects, so does not help reframe the emotionally charged and challenging situations into learning situations rather than, e.g., full blown conflicts. As such, the students cannot rely on strong peer-support in balancing with the naturally occurring moments, bringing further emphasis on the scaffolding role of the adults.

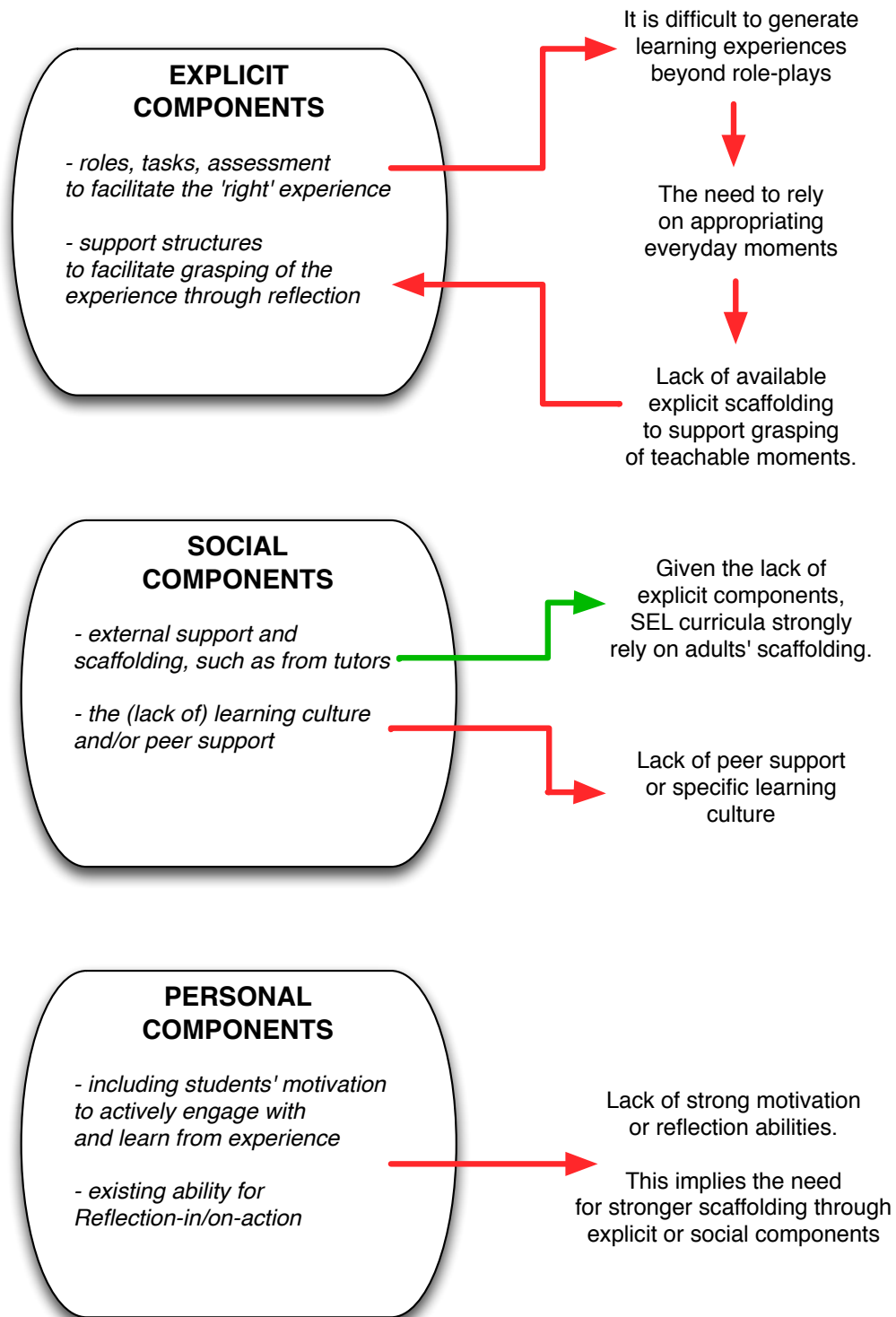This reliance on implicit, in-the-moment support from adults was then seen as the funda-

EXPLICIT COMPONENTS

- roles, tasks, assessment to facilitate the 'right' experience

- support structures to facilitate grasping of the experience through reflection

It is difficult to generate learning experiences beyond role-plays

The need to rely on appropriating everyday moments

Lack of available explicit scaffolding to support grasping of teachable moments.

SOCIAL COMPONENTS

- external support and scaffolding, such as from tutors

- the (lack of) learning culture and/or peer support

Given the lack of explicit components, SEL curricula strongly rely on adults' scaffolding.

Lack of peer support or specific learning culture

PERSONAL COMPONENTS

- including students' motivation to actively engage with and learn from experience

- existing ability for Reflection-in/on-action

Lack of strong motivation or reflection abilities.

This implies the need for stronger scaffolding through explicit or social components

Figure 9.4: The available and missing aspects in the SEL in education

mental challenge for SEL. It brings issues with scale due to the one-on-one interactions needed for scaffolding individuals 'hot moments' reflection that occur at unexpected and possibly infrequent moments. In addition, in contrast to the counselling setting, many of the teachers and parents are not well versed in SEL approaches. Explicit training for teachers/parents is thus often necessary before they are able to facilitate learning consistently with the curricula.

Students' active engagement   The SEL curricula in education are general prevention programs and as such presented to all students (as would other schools subjects such as Math or Literature) rather than only for those are particularly motivated to join. Coupled together with the developmental implications of the still maturing brains of the learners, this brings limitations in the existing reflective abilities as well as possibly lack of inherent motivation to actively engage with and work on personal growth on these competencies. As such, supporting students' self-awareness is a crucial initial aspect of all curricula (cf., Slovák and Fitzpatrick (2015)). In addition, the mental tools exemplify the mechanisms used to further support development of reflective abilities, serving as internal scaffolds enable specific forms of reflection-in-action in everyday teachable moments. In particular, they point the learner to their emotions/situation at hand, and give them multiple ways to get to a well-defined goal (e.g., "not to hit someone when I'm getting angry").

Interplay among the curricular structures – resulting challenges   Overall, SEL in education lacks much of the structural and social support that is available in counselling. The key implications are the inability of existing at-school curricula to generate 'real-enough' experiences through explicit support structures (such as tasks) coupled together with lower inherent abilities of the learners. This leads to the SEL curricula relying predominantly on appropriating naturally occurring teachable moments. To do so, they draw on an interplay of explicit support structures (mental tools) that help support students' active engagement and implicit social structures (adult scaffolding) to balance the perceived hotness of the in-the-moment situation and promote reflection to grasp the learning.

The balancing role of SEL curricula in education strongly depends on social competencies; as opposed to working more strongly with explicit activities as per counselling. One

explanation is that SEL in education can only rely on short lessons with lower intensity, as well as the ubiquity of situations requiring competencies taught by the SEL curricula. In contrast, the competencies developed by the MA counselling program are expert skills that are (predominantly) practiced in well-defined situations and carefully designed situations; and which are thus perhaps easier to incorporate into training situations. In other words, counselling sessions don't 'end up' happening to you (e.g., that you'd find yourself all of a sudden with a client while riding home on a bus from the university), while you experience strong emotions and the need for collaborations at all times.

Such reliance on appropriating naturally occurring teachable moments beyond the in-class activities scaffolded by the adults brings a number of challenges. These include the need for well-trained teachers/parents as well as pragmatic issues of the adults being 'in the right moment at the right place', and the implied dependency of young learners on such social support. These observations were the reason why our technology probe design (cf., Slovák et al. (2016)) focused on the 'scaffolding the scaffolding' role of the parent, aiming to provide the first step for extending of the curricular outreach into homes. Figure 9.4 summarises these considerations.

In summary, the fundamental difficulty in SEL in education is in helping young learners 'grasp' the naturally occurring moments, transforming the budding skills taught in-class into full-fledged competences applicable in their everyday encounters. As such, the difficulties with closing reflective loops quickly enough or getting access to others' perspectives (identified in Counselling case) are still challenging here, but are over-shadowed by the difficulty of even getting to the 'right sort of' learning situations in the first place.

9.6   Specifics of SE reflective practica – challenges and general design implications

So far we have been using the Schön's practicum model as a lens to understand the similarities and differences in SE learning process across the two case studies, leading to developing a particular instantiation of the reflective practicum model. We now turn to thinking about how this model, and the underlying learning process and competencies it encompasses, differ to those described by Schön. To do so, we again draw together the observations from across the two case studies, but this time aiming to highlight

the particularities of SE development that make it different to the learning processes in the areas for which reflective practicum was initially established (such as design or engineering education).

In particular, we argue for three interrelated challenges:

1. ***Creating the 'right sort of experiences'*** *as part of the virtual space within the curriculum is difficult as these require real emotions and/or interaction with other people.*

2. *Inherent* ***emotional entanglement within the situation*** *is both needed for the experience to be 'real-enough', but also hinders other cognitive processes such as the active reflection on own action.*

3. *As SE competencies are* ***ephemeral and intangible****, it is challenging to make examples of expert 'doing' visible for students.*

The next three subsections will analyse each challenge in detail.

9.6.1   The challenge of creating the 'right sort of experiences'

The previous section argued that the experience of real emotions and/or social interactions (e.g., conflict) are required for a situation to be a potential teachable moment. The extent of effort that was dedicated to creating such real (but not 'too real') experiences in both case studies points to the difficulty of creating such 'right experiences' in a controlled manner within the SE reflective practicum. In contrast, we can compare this to, say, the design practicum with architecture students, where a relatively real scenario can be presented through a project vignette, such as a map of the site and the description of the future inhabitants' requirements; similarly in music education, a well selected piece of music, possibly with mentors' feedback, presents a reliable source of learning experiences for the student.

Moreover, supporting the 'right sort' of social-emotional situations is troublesome for another reason: even if emotion or social interaction is successfully evoked, the *transient* nature of such situations brings further difficulties for how it can be made available for reflection and the associated in-action exploration needed for learning. As strongly argued by Schön, such exploration is necessary for the reflective cycles underlying learning, and

involves experimentation with possible actions within a responsive the situation; allowing the learner to attend to the 'backtalk' of the situation. However, such an opportunity for exploration is difficult in SEL for two reasons:

- First, most of the social-emotional situations rely on an uninterrupted flow of action. As such, they are hard to divide into parts that could be independently reflected on and experimented with. While one can clearly reflect-in-action (as evidenced by the student counselors) the flow of action often makes it impossible to experiment with multiple possible reactions in that particular situation in a way that would be similar to an architecture student sketching out and comparing multiple possible room-layouts. Experimentation with multiple approaches is thus difficult within a single learning experience.

- Second, engaging with multiple instances of a situation is also difficult: it is hard to re-create an experience as the emotions will not be the same. This is analogous to how watching the same film for a second time brings a very different experience and emotional involvement. Again, this is in stark contrast to many of the learning activities in design or music as discussed by Schön. For example, music as well as many of physical activities such as learning to cycle, snowboard, or play tennis, allow themselves to be divided into steps or at least very similar learning situations re-experienced over and over again (e.g., going down the same slope every time).

Implications for learning Due to these issues, the learning in SEL is either more emergent and opportunistic in trying to transform everyday real-world experiences into teachable moments; or requires a much more substantial effort and energy in creating the right emotional experiences within a virtual space (such as the practice sessions or role plays). What is challenging within such exploration, however, is the need to simulate the other person's thoughts, emotions and goals as well as keep the internal experience emotionally charged.

The next section present further discussion on why this process can be successful: as one of the main difficulties in SE competency development is in 'hotness' of the experience and its effects on reflection-in-action, recreating an emotional experience 'strongly' enough presents a good training approximation for the reflection-in-action processes that would be needed.

9.6.2   The challenge of emotional entanglement within the learning situation

Both social and emotional competencies are intrinsically linked with strong emotional states that are necessary for the learning experience to be 'real-enough'. However, as outlined in Section 9.2.1, such emotional activation entangles us within the ongoing situation and hinders the cognitive processes necessary for the active reflection on one's own action. Indeed, it is exactly the ability that would allow the student to learn from such emotional experiences—i.e., the competence to regulate emotions and reflect-in-action—which the student is trying to learn in the first place.

These issues are much less marked in the competencies that Schön talks about such as design, music, or engineering[6]. Indeed, while Schön talks about reflection-in/on-action as an ability that students need to bring into the curriculum (see Schön (1987, p118)), the designer's competency itself is then grounded in the design way of thinking and related craft (such as drawing skills). Thus, while the ability to reflect affects the ability to grasp design, it is not the focus of what is learned; it is a necessary catalyst brought in from the outside of the learning process. In other words, while the ability to reflect-in/on-action in Schön's reflective practica is applied to the competencies at hand, in SEL it is, however, applied on itself.

How did the two case-study curricula deal with this entanglement challenge? We saw that the curricular structures were specifically designed to balance the 'hotness' of a situation through deliberate scaffolding both through the explicit learning tasks as well as implicit social practices. The underlying aim was to prevent the learners from switching to automatic reaction (and thus the loss of the learning focus) if the situation becomes too 'hot'; and if this happened, then employing methods such as coaching or post-hoc reflection to still transform the experience into a teachable moment. In fact, this dilemma of balancing the appropriate emotional/interpersonal 'hotness' of the experience has been at the core of 'real-enough' but 'not-too-much' issue within the curricula. Such delicate balance was achieved through multiple ways:

- First, carefully created situations (such as the practice sessions in counselling) that included safeguards in case things get too intensive (e.g., the debriefing process, the

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[6]Including also his description of the psychoanalytic supervision process, which is portrayed as being about conscious post-hoc interpretation of the situation and remembered emotions, rather than the acting on the emotions in the moment.

'learning focus' and social structures allowing the client not to go too deep; or asking to delete the video afterwards);

• Second, extensive external scaffolding within the situation that helped the learner grasp and reflect-in-action on even on emotional experiences that would otherwise be too 'hot' (such as the scaffolding role of the teacher in SEL in education). A key aspect was often in providing support to get the learner back on track if the emotions were starting to spiral out of control, but still were not completely uncontrollable.

• Third, the post-hoc 're-living' of the situation allows for re-enacting some of the emotional engagement but with more control given the distancing characteristic of hindsight; albeit with the caveat of only having access to thought experiments, thus needing to 'simulate' the reactions of others (or self) within the situation.

Implications for learning   The entanglement with the emotional side of SE competencies brings stronger need for careful balance of real-enough situations with external scaffolding, so that the learners do not reach the 'tipping point'. Scaffolding that would include external guidance in-the-moment to provide an appropriate emotional hotness of the situation is key to appropriation of potentially overly hot situations as teachable moments. However, the current curricula face the difficulty of providing scaffolding support in ways that do not irreparably alter the learning situation. They are thus mostly relying on: post-hoc reflection on collected traces or recalled experiences; on-going scaffolding by a teacher that provides the external support (while possibly altering the situation, such as a conflict with another student is a different social situation if a teacher is intervening); or re-shaping the underlying social situations in ways that the scaffolding is designed into/embedded into the social practices there.

9.6.3   The challenge of teaching ephemeral and intangible processes

The intangible nature of social-emotional competencies makes it challenging to provide examples of the 'process of doing' available for students. While some surface characteristics might be visible for all of these (e.g., an apparently reduced level of anger when calming down), the underlying processes are quite untraceable. Such inherent ephemeral characteristics are in contrast to the domains that Schön describes, where it is possible to observe the master architect explore a design through a series of multiple drawing, a music teacher explore a piece by play-throughs, or a psychoanalyst following a particular

suggested interpretation of the clients' issues. This is not to argue that all knowledge in these domains is visible and easily observable; in fact, the complexity of reflective practicums in these domains shows this is not true and a substantial part of the knowledge must be induced by the student from subtle indications. However, we argue that such intangibility and ephemerality of the knowledge-in-action is especially pronounced in social-emotional learning, given the nature of the competencies at play.

Implications for learning   As the manifestations of SE competencies are less visible and persistent, the processes underlying these competencies are thus also less readily shared between the mentor and student, or available for inspection. This makes the immediate 'joint exploration' or 'reframing' together with the mentor more difficult to achieve than in other areas such as design. One of the approaches by which SEL curricula deal with this issue is to provide structures to record examples of the otherwise ephemeral competencies, thus making the traces of activity (and reflections on it) available for more in-depth analysis. In addition, the tutors are not only asked to consciously model the behaviours that correspond to the learnt competencies, but to also try to verbalise or otherwise highlight the underlying processes. Finally, the curricula deliberately provide the learners with overly simplified templates to use in particular situations (such as the basic responses and actions practiced out of context in counselling, or the 'stop, label, do x' progressions in SEL). This is not because these would be representative of the final competency, but because such simplified 'steps' create an initial more tangible structure that can be elaborated on.

9.7   Chapter summary

This chapter set out to suggest a set of concepts that would help us understand possible 'causal principles' underpinning the learning across the case studies. We argued that these can be seen as emerging on two main levels: First is the emphasis on *experiential learning* which revolves around the situatedness of SE competencies in actual experiences of emotion or interpersonal interactions: they cannot just be told, shown, or written about, the students need to live through—and try things out within—the 'right sort' of experiences for the learning to take place. Second, we *drew on and extended Schön's notion of reflective practicum* to unpack both the *characteristics of such experiences* (real-enough but not-too-real); as well as the *learning components* used across the two case

studies to scaffold and facilitate such experiences (explicit, social, personal components). In addition, we discussed the specific challenges with SEL that make development of SE competencies different to the expertise taught by the curricula discussed by Schön: their intangibility, embeddedness in social interaction, and the inherent role of (strong) emotion that disrupt reflection.

Throughout this chapter, our aim has thus been 'descriptive', i.e, to understand and systematise observations across the case studies with regards to the underlying learning mechanisms. The next chapter now turns to a more 'constructive' mode: trying to understand how might such knowledge be useful to guide design.

CHAPTER 10

Designing for the SEL practicum

This chapter draws on the analysis in previous chapters to suggest a conceptual framework to guide design of technology-based system for developing social-emotional competencies. The aim is to support both HCI researchers in thinking about developing systems for SEL as well as the SEL practitioners in considering how technology could fit and enhance their curriculum. As such, we hope it can serve as a boundary object (Star and Griesemer, 1989), connecting the two communities and inspiring further research in this novel space.

Building on the understanding of how reflection is scaffolded in existing curricula, we suggest a two step process to designing a technology-enabled SEL system: The first step offers a set of questions aimed to help understand characteristics of the 'right sort of' experiences that are likely to be conducive for developing the targeted social-emotional competence: the 'reflection experience space'. The answers to these can inform the initial design brief to be taken to the next step. Second, we propose that the types of support brought in by the three curricular components within the existing curricula (explicit, social, personal) highlight possible roles that technology might take on in scaffolding the selected experiences. In particular, these aim to translate the strategies used in the (non-technological) curricular components into plausible directions for technology scaffolding: the 'technology design space'. The Figure 10.1 provides an overview of the steps.

We then show how these might be applied within two contexts: first illustrating how the articulation of the framework was used in follow-up research projects arising from this

Questions	
What constitutes a real-enough experience?	**How available are the experiences for reflection-in/on-action?**
Q1: What characteristics make the experience 'real-enough'?	Q4: Is emotional entanglement likely?
Q2: How 'real' should the experience feel?	Q5: How directly visible/tangible is the process of doing?
Q3: How much balancing support should be available?	Q6: How easy is it to close the reflection loops?
How are the experiences achieved -- generated or appropriated?	

Roles for technology	
Explicit components	R1: Generate emotional/interpersonal experiences
	R2: Appropriate the naturally occurring experiences
	R3: Directly scaffold the reflection process
Social components	R4: Scaffolding mentors' scaffolding role
	R5: Support establishing learning culture and peer support
Personal components	R6: Supporting motivation to engage

Figure 10.1: An overview of the framework that will be developed throughout this chapter.

thesis; and second showing how it could contribute to current discussions within HCI around the ways to design for 'transformative reflection' (cf., Baumer (2015); Baumer et al. (2014); Fleck and Fitzpatrick (2010)).

10.1   Reflection experience space

The crucial role of the reflective practicum is to generate the 'right sort of' experiences for the learners. However, it often might not be clear what constitutes such experience or what are the challenges to reflection inherent within the situation/competency at hand.

The aim of the 'reflection experience space' is to distill what we saw as the key underlying mechanisms identified in the previous chapter into a set of questions. We suggest these

can orient designers to the key decisions and considerations that the designers will need to make when identifying the trajectory of learning experiences (cf., Benford et al. (2009)) they hope to facilitate for the learners. So similar to how the key aspects of reflective practicum served as sensitising concepts in our analysis of SEL learning across the two case studies, our aim is that these questions can provide similar sensitising role for researchers starting to work on an SEL related project.

10.1.1 What constitutes a 'real-enough' experience?

The three questions below emphasise what we see as core aspects of the tension between experiencing a strong-enough emotion/interpersonal situation while keeping the reflective focus needed for learning. Each is illustrated by an example taken from the case studies.

Q1: What characteristics make the experience 'real-enough'? This question aims to help the designer explicate what are the *"essential features of a practice to be learned"* (Schön, 1987, p170) that will make the experience seem 'real' for the learner. Given that SE competencies are normally embedded in complex social settings, this question aims to help designers unpack the minimal set of features that are essential for a meaningful learning experience (at the learner's competency level). For example, as mentioned earlier, in learning to self-regulate it is the strength of actual emotion perceived by the learner that is important – this is regardless of whether this is triggered by a scary movie, a recollection of a memory, or a real-world event such as a conflict with a significant other. Understanding these characteristics for the selected competency then points to particular experiences that the learners could or should have as part of the learning trajectory.

> *Example vignette: In the counselling training, the exercises helping students understand and reflect on the experience with a difficult feeling such as shame do so by getting students to craft an object instantiating their strongest recollection of shame, and then letting them show and explain this object to a peer. In doing so, the curriculum recognises the importance of interpersonal interaction as core to shame, but is able to elicit these feelings without having any student 'shamed' by the others.*

Q2: How 'real' should the experience feel? We noted above how the curricula endeavoured to create the 'most real' situation possible that still allows for a learning focus rather than being swept away by emotions. Thinking of experiences as being positioned along a 'perceived realness continuum' is useful in understanding the type of experience and the associated learning trajectory the system/intervention aims to facilitate. Again we note that it is the 'felt realness' that matters, rather than whether or not the experiences are directly embedded in the real-world settings.

> *Example vignette: The pirate story we used in Chapter 6 was designed to trigger links from over-expressed experience of characters—Harrdy getting extremely mad—to the everyday experiences of the children. Exactly because the emotions of anger the children went through in that moment were not particularly strong, the aim was to create a shared experience that both the child and parent could refer back to in other situations and that was linked to specific 'calming down strategies' that can be used. In doing so, the interactive experience was designed around a 'non-hot' moment, to serve as a stepping stone that can be used for more emotionally hot situations.*

Q3: How much balancing support should be available? We saw how the existing curricula carefully balance the perceived 'realness' of the experience through multiple mechanisms, such as adding (or removing) scaffolding to structure the experiences or facilitate the reflection process that the learners should go through around these. This emphasises the focus on the mechanisms of transferring the learnt competencies from in-class or otherwise externally supported context to real-world unsupported situations by reducing the balancing support available to learners. This highlights decisions such as whether the aim is to transfer a competency mastered in one context to another (i.e., helping the learners to develop abilities to react to situations that are otherwise still 'too-real' for them), or the focus on creating a safe space with plenty of support where the initial seeds of competencies can be created.

> *Example vignette: The practice counselling sessions are seen as the final step before sessions with real clients. As such, they deliberately do not include any in-the-moment scaffolding for the counsellor that would help apply the learnt skills (as this would be seen as breaking the realness of the context and*

invalidating the learning experience). However, there are specific safeguards to prevent the situation to spiral out of control: both the client and the therapist are required to end the session if they feel it is beyond their capabilities or shared too much; and a fully trained counsellor is available in case a debrief was needed. Moreover, the ability to discuss and reflect on the recording together with the client is another mechanisms through which the learning experience is mediated.

10.1.2 How available are the experiences for Reflection-in/on-action?

We saw from both case studies how several inherent characteristics of SE experiences can make reflection-in/on-action difficult for learners. In particular, we emphasise the danger of *emotional entanglement*, the implications of *intangibility* of some SE competencies; and more broadly the inherent challenge *in closing reflection loops* as exploration of various responses to the transient and ephemeral nature of the experiences is often not possible.

The extent to which each of the three challenges is relevant for a particular SE competency can markedly differ: for example, learning to self-regulate runs a high-risk of entanglement but allows for a relatively quick closing of reflection loops ("I've tried breathing but I'm still mad, so it probably hasn't worked, what else can I try"); in contrast, active listening with someone is less likely to tip learners over the edge emotionally, but has longer reflection loops (it is difficult to ask the person to 'tell you the story again as you want to try something else now'). Understanding the mix of these challenges for the particular competency can help the designer decide on an appropriate degree of scaffolding to support the learning experiences.

Q4: Is emotional entanglement likely? We discussed the danger of particular experiences becoming emotionally 'too real'; so real that the learners become entangled in the emotional states and lose the learning frame necessary for reflection-in/on-action. Should the designer assume that emotional entanglement is going to be an important challenge within the learning trajectory they envision, the existing curricula can provide an inspiration in how this can be mitigated with balancing the perceived realness of the experience by the support components. This might include providing the learners with in-the-moment scaffolding from a mentor or mental tools to be triggered in these situations, as well as recording traces of the key aspects of the experiences in order to facilitate

reflection on the 're-lived' experience. Overall, the extent of expected entanglement is key to understanding the extent and type of support structures that will be needed to facilitate the learners' reflection.

> *Example vignette: As also stated previously, an example of such mental tool is the 'Turtle technique' (Robin et al., 1976). The children are taught to 'withdraw into their shell' (by pulling their arms and legs close their body and closing their eyes) at specified occasions such as when they feel increasingly angry; often on a cue from the teacher, oneself, or even peers. This is followed by a relaxation phase, where specific muscle groups are tensed and released. Once this technique is mastered, children discuss appropriate alternative strategies for dealing with stressful situations, now that they are able to consciously reflect and react to them.*

Q5: How directly visible/tangible is the process of 'doing'? We saw how many of the social-emotional competencies are ephemeral and intangible. This makes them hard for the mentors to model effectively and similarly difficult to grasp for the learners. For example, the experience of being 'self-aware' has some visible implications (such as being congruent in what one does and what one says), but the process of 'becoming self-aware' as well as the work that goes into it remains hidden. If this is the case, additional scaffolding might be needed to help learners both 'see' what the mentor does as well as make their own reflective processes more tangible.

> *Example vignette: The reliance on working with video-recordings of sessions in counselling is a prime example of an approach to make the fleeting experiences and choices more visible and available for analysis. Moreover, there is a tradition in the counselling training to deeply analyse and examine the 'masters' tapes'. The students watch recordings of counselling sessions led by acclaimed psychotherapists such as Rogers, reflecting on individual statements and their perceived impact on the client. Capturing the complex social interactions of a therapy session on tapes allows these to be better dissected and learnt from.*

Q6: How easy is it to close the reflection loops? Social-emotional situations can be a highly continuous flow of action, and thus do not allow for exploration of multiple

possible responses within a single situation. In addition, for some SE competencies it is also often not immediately clear if/how that particular experience was successful or unsuccessful (for example, how do I know whether my client perceived me as being understanding and supportive). As such, it may be difficult for students to 'close the reflection loops' quickly enough to understand how their current behaviour works/doesn't work, and what might be the alternative approaches. Under such circumstances, this suggests the need for the practicum to either generate multiple highly analogous situations if that is possible; or provide scaffolding to extend the reflection phase beyond the situation itself (such as the reflection processes around video-playback in counselling).

> *Example vignette: As an example of technology-enabled closing of reflection loops, Bouchard et al. (2012) shows how a bio-sensor component (measuring increases in stress) embedded in a first-person shooter game strongly supported self regulation training. The immediate, situated feedback provided by bio-sensors directly within the game (i.e., substantially limiting field of view when under stress) provided the opportunity for a fast reflection cycle, a motivation to 'do well', as well as many teachable moments to train in.*

10.1.3 How are the experiences achieved: appropriated or generated?

The case studies point to two main approaches through which SEL curricula facilitate the 'right sort of' experiences for the learners: The first corresponds to setting up of a particular situation that is likely to **generate** such 'right' experiences. Examples are the role-plays in education or the practice counselling session in counselling. The second relies on providing support so that the learners can **appropriate** real-world situations into the context of the curriculum, such as the coaching expected from teachers or parents within the SEL in education, or the supervision model in counselling. In effect, this re-interprets otherwise unsolicited experiences into teachable moments.

These two approaches can be interpreted as bringing complementary benefits and challenges: Generating the experiences allows for good control and on-task support for the learners, but might struggle with eliciting real-enough experiences once the learners pass beyond a certain competency level; for example, recall the need of education curricula to move beyond role-plays. In contrast, aiming to appropriate real-world moments requires the curriculum to be much more opportunistic and presents difficulties in providing the

necessary scaffolding for reflection and balancing emotional realness within the real-world settings.

As such, the likely 'limit' on the perceived realness of the generated experience implies that generated experiences are more likely to be useful in the early stages of competency development, where strong scaffolding support is required and even moderately real experiences are enough for learning. Consequently, the support for appropriated experiences is likely to become increasingly needed as the learners' competencies mature and transfer into real-world settings becomes necessary.

10.2   Technology design space

Seeing the questions from the previous section as leading to the design brief, this section illustrates how the reflective practicum can help unpack the design space for scaffolding the selected experiences. We structure such discussion independently for explicit, social, and personal practicum components, as each of these suggests particular mechanisms to scaffold the 'right sort' of experience for the learners, and thus also the prospective roles for technology systems.

10.2.1   Explicit components

The explicit components directly re-structure and shape the experiences of the learners through tasks or specific 'tools' to scaffold reflection. Looking across the case studies, we propose that these components can be further interpreted as addressing three possible roles: (i) structure tasks or social interactions to generate particular experiences; (ii) provide mechanisms to appropriate real-world experiences as teachable moments; (iii) directly scaffold the reflection process. Each of these then suggests a particular role for technologies in support of transformative reflection in SEL, as well as underlying strategies and mechanisms that could be incorporated into technology-based systems. We discuss each below, exemplifying the suggested Roles (R) by links to existing HCI work in other areas.

R1: Generate emotional/interpersonal experiences   Both SEL in education and counselling relied on highly structured tasks that helped generate experiences for learners. These might have taken the shape of simple vignettes and role plays, as well as the

intricate structure of practice counselling sessions. This points to the potential technology might play in facilitating emotional/interpersonal experiences such as through interactive media (Benford et al., 2012) or games (both on screen (Bouchard et al., 2012) and virtual/mixed reality systems (Rosenberg et al., 2013; Isbister and Mueller, 2015)). For a specific SEL example, the system developed by Slovák et al. (2016) used an interactive animated story to scaffold a particular emotional situation for the parent and child to work with.

R2: Appropriate the naturally occurring experiences Components helping to appropriate naturally occurring instances as teachable moments were present in both counselling and educational settings. Such components supported learners in identifying the teachable moments (e.g., that one is becoming angry), balancing the emotional realness of the situation (e.g., through in-the-moment scaffolding such as triggering particular mental tools), or making it available for reflection later (e.g., video recording in counselling or working with recollections in education). Each of these aspects could be addressed by the emerging wearables and other UbiComp technologies: sensor-based systems could help identify key situations and trigger self-regulation strategies (e.g., Pina et al. (2014)), as well as collect traces that create 'time-windows' into the experience for future reflection.

R3: Directly scaffold the reflection process While the previous two strands focussed on facilitating access to the underlying experience, this strand of explicit components aims to scaffold the process of reflection on that experience. Both education and counselling curricula relied on tools that emphasise or problematise particular aspects of experience (such as the IPR questions), as well as providing structured ways of working with traces to revisit and 're-live' the underlying experiences. The implications for possible roles of technology are for example by thinking about systems that can deepen the link between reflection and experience in one of two ways: by embedding the reflection scaffolding into the experience itself (e.g., through a bio-feedback object that is incorporated into self-regulation strategies learners use to facilitate closing reflection loops quickly); or through extending the possibilities to work with a trace of an experience post-hoc (e.g., Slovák et al. (2015a) facilitates reflection through making the reflection work visible and closely tied to the underlying video).

10.2.2   Social components

The role of social components is to provide a supportive learning environment through enabling a set of social resources the learners can draw on as they proceed with the training. In contrast to the explicit components, the focus of social components therefore shifts from directly affecting the learners' experiences to providing support to others who support the learning. In particular, the common strategies across SEL curricula can be interpreted as either supporting 'in-the-moment' coaching, as exemplified within the education settings; or the more diffuse set of social norms that promote (or at least do not impede) reflection and learning processes from situations that happen in the space (such as the learning contract in counselling). This suggests two example roles for technology in this space.

R4: Scaffolding mentors' scaffolding role   The scaffolding role of the mentor is a key component across both SEL contexts. The emphasis is then on the mentor's own competency through which they model and facilitate reflection-in-action. This suggests potential for technology to *scaffold this role for available-but-untrained mentors* (such as parents); as well as providing support so that *mentors become more effective* such as through streamlining the scaffolding process. For an example of the former, the system developed by Slovak et al. (Slovák et al., 2016) was deliberately designed to support parents with prompts and questions to structure their interaction with children. For the latter, the mPath system developed in (Slovák et al., 2015a) provides mentors with tangible record of students' reflection with the aim of making it easier and quicker to provide in-depth feedback during a one-on-one session with the student.

R5: Support establishing learning culture and peer support   The analysis of both SEL contexts has highlighted the importance of the social support grounded in a learning culture (whereby instances of interpersonal/emotional behaviour are seen as material for learning) and direct peer support in doing so (e.g., to deliver feedback or participate in generating of teachable moments). We argue that while such social norms and support are beneficial for any learning, they are of particular importance for SEL, where most teachable moments require the presence of, and interaction with, others. Prior work in HCI suggests that technology could facilitate such social support both within existing peer groups (such as the research around designing for social-support in

behaviour change technologies, e.g., Consolvo et al. (2009); Parker (2014)), as well as connect networks of strangers together around a single cause (such as the Koko application (Morris et al., 2015) using crowdsourcing to help reflection process based on strategies from Cognitive-Behavioural Therapy).

10.2.3 Personal components

The personal components correspond to the learners' internal qualities that are crucial for the learners' grasping of the experience. This includes the students' motivation to actively engage with and learn from their experience, as well as their existing abilities to reflect-in/on-action. As such, we see these as much harder to directly affect by technology than the other two sets of components. In fact, limitations of personal components in the target user group might suggest the need to compensate for these through explicit/social components, such as the reliance on coaching (social) and mental tools (explicit) in SEL in education.

R6: Supporting motivation to engage   That said, we see opportunities in technology-based systems to facilitate motivation to engage for the users: for example, gamification elements have been shown to be successful in increasing motivation in other contexts (Simões et al., 2013; Deterding, 2015); and there might be potential for technology-based short-term interventions that reduce internal barriers to action, such as those building on mindset interventions (O'Rourke et al., 2014; Walton, 2014).

10.3 Application of the framework

We now move on to exemplify how the framework can be pro-actively used to understand and design systems in new SEL contexts; as well as to retrospectively applied to analyse/critique/reframe existing work. We do so in two ways: First by illustrating how articulation of the framework shaped the ideas within two of my own follow-up projects, emerging from the work presented in this thesis; second by showing how the concept technology-enabled reflective practicum could contribute to our understanding of scaffolding reflection through technology more broadly, beyond the immediate domain of SEL interventions. The following sections discuss each of these in turn.

10.3.1   Impact on follow-up projects

The two different projects each show a particular angle of potential application of the framework: The first is an on-going project looking at embedding evidence-based conflict-resolution approaches into a moderated Minecraft server, drawing on collaboration among Committee for Children[1] (SEL partner), Connected Camps[2], and myself. The second is a post-doctoral research fellowship that I have been awarded to work on at University College London, Anna Freud Centre in London, and TU Wien. The focus is on exploring how novel digital technologies (e.g., mobile devices or sensors) can be embedded in the everyday lives of young children and their families to provide in-situ support for the development of self-regulation competencies.

Within the first, the teachable moments are emergent from the 'virtual' world of a computer game, bringing interesting novel possibilities for capturing, scaffolding, and working with 'real-but-not-too-real' situations; in this case, conflicts within the game space. The second deliberately aims to work within difficult real-world settings of underprivileged families, specifically children aged 8-10. It aims to develop physical objects that can serve as extensions of the programs also into everyday situations. This comes with the dual focus of (i) providing scaffolding for parents who can then support their children without extensive training; but also (ii) empowering the child to practise even when no adults are around or available.

Project 1: Conflict resolution in Minecraft

Project status   The project started in April 2016 and is just starting a pilot deployment phase of the developed intervention in January 2017. A formal evaluation of the intervention effects is expected by May 2017. We use a mixed method approach relying on quasi-experimental design (time-series with multiple baselines and follow-ups) to understand how the interventions impacted interactions on the server.

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[1]Committee for Children (CfC) are the developer of the largest evidence-based SEL curricula in the US, with over 35 years of experience with developing and deploying SEL programs in real-world settings (e.g., more than 8 million students using the program in 26,000+ schools world-wide).

[2]Connected Camps are an organisation led by Prof Mimi Ito, Katie Salen and Tara Brown serving thousands of kids through online Minecraft programs as part of their mission of mobilising new technology in the service of equity, access and opportunity for all young people.

Context   The use of online games and virtual worlds is becoming increasingly prominent, particularly among children and young adults. However, parents and educators have concerns about risks their children might encounter in these online spaces, leading to calls for 'moderated' online spaces (Ringland et al., 2015). This project investigates how conflicts (including griefing, drama, bad language etc) arise, escalate, and are currently resolved within the setting of a moderated Minecraft server for children aged 8-13. The aim is then to explore how evidence-based conflict resolution curricula could be embedded into the gameplay on the server, and how technology might scaffold the intervention.

To understand the problem space, we first started with a thematic analysis of 350+ hours of logs of 'camps' of different types sampled from 18 months' history of the server, as well as interviews/extended participatory engagement with experienced moderators and lead counsellors on the server over a 6 months period. The results points to an observed tension between providing immediate fixes to the outcomes of conflict (such as direct moderator resolution of the problem, e.g., re-creating destroyed building) versus building social norms that would address the underlying reasons children had for these behaviours and the emotions that arose from these (as argued for by the evidenced based curricula).

In particular, we saw: (i) moderators monopolising the conflict resolution process, acting as an arbiter that provides the children with solutions, rather than involving them in the problem solving process; and (ii) the strong reliance on technological solutions that 'physically' prevent children in engaging in problematic behaviours rather than establishing appropriate social norms and conflict resolution strategies. We decided to focus the technology intervention on developing conflict mediation competencies of moderators, building on specific SEL programs (ICPS, Peacemakers, RCCP) for evidence-based components.

Phase 1 – Reflection experience space   The first phase aims to understand what kind of experiences are likely to lead to learning, within the particular contexts we are working with. The Figure 10.2 outlines the responses to the questions suggested by the framework. Overall, the table highlights: (i) the need we see for working with real conflicts (as it would be difficult to generate real-enough experiences otherwise); (ii) the possibilities for strong scaffolding components in-the-moment due to the chat-based nature of the system; (iii) and the availability of 'recordings' of the conversations from server logs that can serve as ground for post-hoc reflection and community involvement. As such, the

resulting design brief has particularly emphasised the combination of: (i) in-the-moment scaffolding for moderators while they are mediating actual conflicts on the server which will serve as the key 'teachable moments resource', (ii) a set of post-hoc reflective practices around the 'transcripts' of mediations that can be automatically collected, and (iii) a set of tools promoting feedback from other moderators to help uncover patterns and 'best practices'.

Phase 2 – Technology design space   Overall, the design is grounded mainly in an interplay between providing explicit and social components, and is divided into 3 main threads. See Figure 10.3 for an overview.

The first thread comprises an initial on-boarding training workshop. The primary aim is to deliver a change of moderators' mindset, from one of seeing the moderators' roles as telling the kids what to do, to one where their role is to facilitate the children's own problem solving. The workshop comprises tasks designed to generate personal experiences as a combination of role-plays and following discussion[3] (explicit components). It also includes messaging around the importance of these approaches as part of the culture on the server (social component).

The second thread provides a number of explicit components to facilitate in-the-moment scaffolding of the conflict mediation. Specifically, we designed an in-game tool that provides the moderator with sample language progression to use during conflict, as well as manipulates the chat view to support full focus on the conflict at hand. Moreover, it automatically uploads the transcript of the conflict to Slack[4] (used as the main communication platform for the moderator team), as well as an option to call-in immediate help from more experienced moderators (also from Slack). A quick reflection check-in questionnaire is automatically triggered once the system assumes the conflict is finished.

The third thread is designed around a mix of social and explicit components, with the aim to facilitate reflection and learning on the conflict transcripts automatically uploaded from in-game. The server leadership is engaged in developing a culture that will encourage requests for feedback and discussions around both 'successful' and 'failed' examples of conflict mediation. We are currently designing in-Slack workflows that

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[3]These specifically highlight the moderators' own reactions to someone telling them what to do as opposed to letting them work it out.

[4]Slack [TM] is a team-based communication platform that combines asynchronous and synchronous chat as well as voice interactions: http://www.slack.com

What constitutes a real-enough experience?	How available are the experiences for Reflection-in/on-action
Q1: What characteristics make the experience 'real-enough'? * The key competencies of mediator are to listen carefully, rephrase well, and scaffold the discussion flow so that it is those people in conflict who come up with mutually agreeable solutions * Training mediation thus requires the other 'minds and emotions' who you are trying to help; the experience of being involved in mediating existing conflict between kids. * An important part of the experience is then the responsiveness (or lack thereof) from the kids who are in conflict, including possible hidden incorrect assumption (many conflicts stem from misunderstandings).	**Q4: Is emotional entanglement likely?** * While the kids might be strongly emotionally vested in the situations, moderators are unlikely to feel strong emotions (at least at the beginning of the mediation process) * The system can assume relatively good cognitive control on part of the moderator throughout the process, so supporting components can focus more on scaffolding the steps to take, rather than managing strong emotions.
Q2: How 'real' should the experience feel? * The aim is to develop support for moderators dealing with real situations on the server. The ultimate outcome should be 'full realness' in terms of responding to actual conflict; although perhaps with in-the-moment support of a mentor/system * However, it will be likely needed that moderators are 'on-boarded' with training situations that are not 'fully real'; e.g., working with recorded logs of prior conflict resolution situations.	**Q5: How directly visible/tangible is the process of doing?** * Chat based interaction and server logs afford automatic 'recording' of conversations, also making them available for analysis. * The effect of particular statement could be also drawn out from the reading the logs. However it might be less clear why that particular statement was selected by a mentor, and what else could have been done.
Q3: How much balancing support should be available? * The training period should likely be very short (as the aim is to be able to scale the suite of support tools widely). This suggests a need for strong support/balancing components that will guide moderators through the mediation process in early stages. * The chat-based interaction within an in-game settings can provide opportunities for in-the-moment scaffolding that is undetected by the kids	**Q6: How easy is it to close the reflection loops?** * While the outcome of particular situations is often clear in whether the selected approach works---such as a child showing a new understanding of the situation or logging off in frustration---as with other SEL contexts it is difficult to try out multiple responses within the same situation. * The relatively high occurence of conflict (at least a couple every shift) can however facilitate closing the reflective loops across situations. * Finally, the server is managed by many moderators, bringing the opportunities to receive feedback and learn from experiences of other mods (especially as the transcripts are 'logged' automatically by the server).
How are the experiences to be achieved?	
* Due to answers to Q1, Q2 and Q3, it is likely that the majority of teachable moment will need to be appropriated as they require interaction with real conflicts between kids, which is difficult to simulate.	* However, the experiences necessary for initial on-boarding of moderators should be generated.

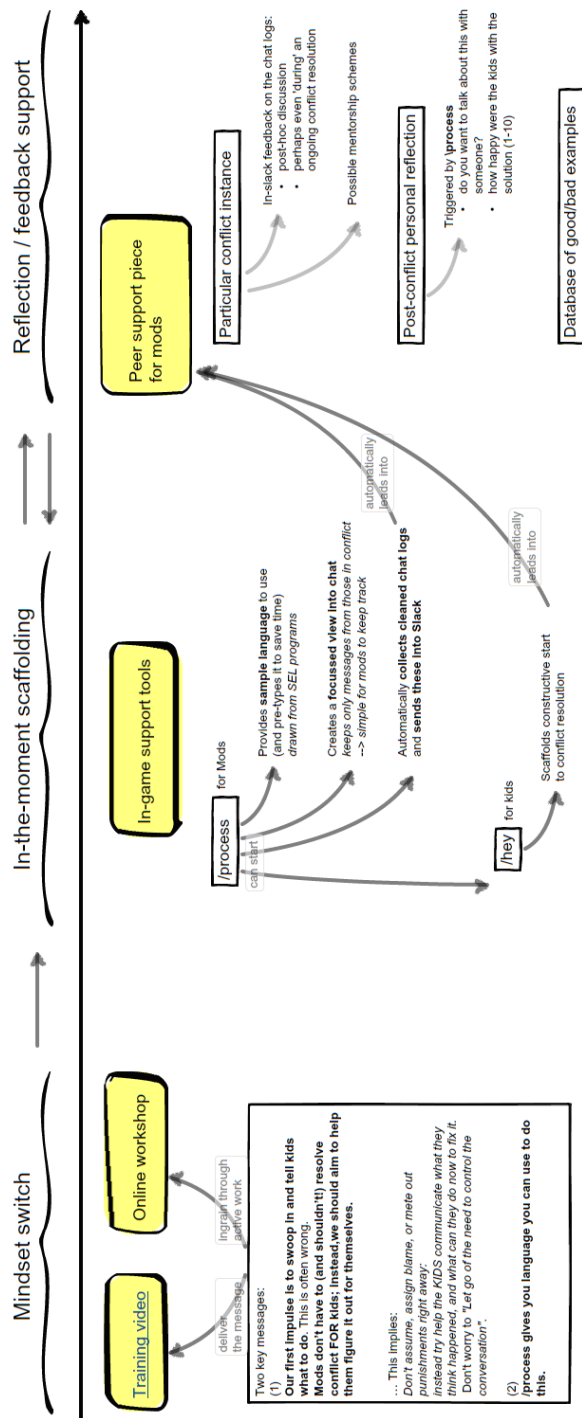**Figure 10.2:** Overview of framework questions responses within the Minecraft project

Figure 10.3: Sketch of the designed system: supporting moderators' mediation of conflicts

would facilitate such peer and/or mentorship interactions (social components). Personal reflection processes will be also embedded in weekly tasks that moderators are asked to do. A possible extension might include a bot-based interaction, scaffolding moderators' reflection on selected transcripts on Slack (explicit components).

Summary Overall, the emphasis the framework puts on SE learning coming from active engagement with particular experiences has been instrumental in every step of the design process, and resonated with both SEL and Minecraft partners. Positioning these arguments as part of the broader learning framework help articulate the need for a such experiences-based learning trajectory to both the moderators as well as other stakeholders, leading to a strong co-design process around the design brief. In terms of the resulting design, various parts of the system touch upon many of the roles identified above: the workshop generating particular emotional experiences to facilitate a mindset switch (R1,R6), in-the-moment in-game support to help appropriate and work with naturally occurring situations (R2), as well as connecting these specific 'teachable moments' with post-hoc reflection opportunities through Slack (R3). The focus on designing for peer support practices within the Slack environment then maps to R5.

Project 2: Technology for Everyday Self-regulation Scaffolding (TESS)

Project status This project discusses plans for an accepted research fellowship starting in March 2017 that will be conducted at University College London for 2 years, with a 1 year return phase back at Prof. Fitzpatrick's lab in Vienna. In what follows, we illustrate how the framework can be used to provide a structured way of articulation of the research aims; as well as highlights key issues we will need to tackle as part of the project.

Context As mentioned in the introduction a principal challenge for existing SEL programs in primary education is how to provide reinforcement of the learnt competencies in everyday contexts and beyond the in-school lessons (Bar-On et al., 2007; Jones and Bouffard, 2012; Patrikakou et al., 2005). In particular, learners must have access on-going, in-the-moment scaffolding during naturally occurring 'teachable moments' (such as peer conflicts) in order to transfer the new competencies into everyday life. This critical role is currently left to in-person coaching by adults (teachers or parents), substantially limiting

the scale and impact the prevention programs could have (Durlak et al., 2011; Jones and Bouffard, 2012). This research aims to investigate if and how digital technologies can address this crucial gap in the context of developing self-regulation skills of 8-10 year olds, coming from underprivileged communities.

The research will be supported by a consortium of partners, providing access to the necessary interdisciplinary expertise and recruitment channels: beyond the host and receiving institutions, we will closely collaborate with the *Anna Freud Centre* (secondment UK, experts in children prevention programs with access to UK recruitment channels) and the *Clinic for Transcultural Psychiatry and Migration* (secondment Austria, promoting wellbeing of migrant children); as well as partner with *Committee for Children* (the developers of the largest evidence-based social-emotional learning program in the US and Austria), *Rochester Resilience Project* (evidence-based self-regulation curriculum with a strong focus on at-home components), and the *Austrian Ministry of Education* (recruitment support through schools in Austria).

Phase 1 – Reflection experience space   The proposed research aims to scaffold self-regulation skills development during naturally occurring 'teachable moments', such as children's everyday frustrations around bedtime, household chores, or peer conflicts. The intertwined dual focus of the work, i.e., the child-facing component empowering the child to practice even when no adults are available; but also scaffolding-the-scaffolding role for parents, will require a more complicated intervention model. Our preliminary responses to the framework questions are in Figure 10.4. Overall, the table highlights: (i) the strong threat of emotional entanglement as working with real-world situations; (ii) the associated need for both in-the-moment balancing if possible; as well as (iii) support for post-hoc reflection on 'unsuccessful' experiences. We now outline the vision, as described in the proposal, together with indications of the roles the particular aspects of the system would play.

Phase 2 – Vision   We aim to develop a set of smart UbiComp objects that can be embedded in the everyday lives of young children and their families, providing in-situ support to practice and develop self-regulation; illustrating the potential of novel technology to extend the reach of prevention programs into the home. While the final selection of the design/technology will be an important part of the research process

What constitutes a real-enough experience?	How available are the experiences for Reflection-in/on-action
Q1: What characteristics make the experience 'real-enough'?	**Q4: Is emotional entanglement likely?**
* Self-regulation requires strong negative emotions (such as stress, anxiety, anger), where the level of emotion perceived as `strong-enough' is bound to the existing competence level of the student.	* **For the student:** Yes. This will likely be the single biggest challenge for the student in applying the self-regulation strategies into daily life.
* **For the student:** The aim of the project is to support transfer of competencies from class into everyday settings of students. As such, the experiences should be naturally occuring moments the student encounters in their life.	* **For the parent:** Emotional entanglement is less likely when discussing child's experiences where parent was not present (e.g., at the playground). It is highly likely if the experience involves parent directly (e.g., bedtime routines), or if the parent attempts to employ the strategies themselves.
* **For the parent:** The system will need to: (i) provide access to some `trace' of the kids' experiences during the day to support discussion; as well as (ii) create shared experiences between parent and child where the parent can see/learn the self-regulation strategies.	
Q2: How 'real' should the experience feel?	**Q5: How directly visible/tangible is the process of doing?**
* **For the student:** As we will be supporting student's self-regulation within actual real-world situations, the system should ultimately work with fully `real' experiences, appropriating these into teachable moments. However, it is likely that at least at the beginning, not all encounters will be `successful' in-the-moment and returning to recollections/traces of such situations will be key for learning.	* **For the student:** Many self-regulation strategies have externally visible indicators (such as deep breathing); however their impact on internal states is less immediately visible without good self-awareness competencies.
* **For the parent:** The parental role will predominantly rely on helping the child work with (and learn from) their unsuccessful experiences. As such, it will be important that the parent is able to understand as closely as possible what has happened for the child.	* **For the parent:** Same as above if parent physically present during the situation. If this is not the case, then parent needs to rely on recollection from the student, or available traces from the system.
Q3: How much balancing support should be available?	**Q6: How easy is it to close the reflection loops?**
* **For the student:** Although balancing the strength of the naturally occuring experiences will be preferable, the system is unlikely to be able to affect the generating situation itself (but should provide in-the-moment scaffolding once it is happening).	* Emotional entanglement can make closing reflection loops highly difficult as the student might be caught in the strong emotion and not recollect what happened (and why) correctly.
* **For the parent:** The system should scaffold-the-scaffolding role as part of the parental-facing aspect. This will be relevant both for the post-hoc discussions of child's experiences during the day, as well as for situations arising between parent and child at home.	* That said, the success/failure of particular situations is often clear in whether the selected approach works (such as a child not throwing a fit). However, as with other SEL contexts it is difficult to try out multiple responses within the same situation.
How are the experiences to be achieved?	
* Due to the focus of the project, experiences should be appropriated from naturally occurring teachable moments.	* However, additional training situations could be generated by the system when scaffolding post-hoc reflection or discussions between the student and the parent.

Figure 10.4: Overview of framework questions responses within the TESS project.

(especially in terms of ethnographically informed 'fit' into lived practices), the following vignette illustrates the types of technologies we expect to be successful based on the knowledge so far:

Martin is 8 and has just started Form 4. This year, his class is taking part in a social-emotional curriculum. In one of the first lessons, he and his friends learnt strategies to calm down. Their teacher gave every student a 'magical amulet' that they can keep for the next month. Martin was really curious as to what the amulet can do – all he knew was that there'll be a Pirate, a treasure to be found... and that he will need to play a short game with his parents to activate it.

The amulet Martin received is a 3D printed object with simple bio-feedback functionality and the ability to communicate with nearby mobile devices. It is designed so that Martin can keep it with him at all times (R2). When used (e.g., held cupped in hands), the amulet scaffolds the use of the learnt calming down techniques such as controlled breathing by providing immediate bio-feedback to gauge progress (R2,R3). It also facilitates triggers for post-hoc reflection on how things went. In doing so, each usage feeds back into the online component, helping unlock the next parts of the story that can be played with his parents at home: for example, every use slowly 'charges' a magical compass that Pirate needs to find the treasure (R4,R5,R6). This promotes engagement over time as well as tying the virtual adventure to the real-world activities. Finally, the scaffolding provided by the amulet slowly diminishes with use to promote Martin's sense of mastery and development of his own competencies, rather than a dependency on the external device.

Summary   Overall, the framework puts emphasis on the need to appropriate naturally occurring experiences as part of the learning transfer which ties together much of the thinking about the fellowship direction. We expect both the answers to framework questions as well as the vision to change markedly as I start collecting data and gain a better understanding the existing practices of our selected population. However, I also expect the framework to continue to be at core of the research questions asked as well as the design challenges faced.

10.3.2 Applying the framework to 'design for reflection' in HCI

As already mentioned in Section 2.3, designing for reflection is becoming an increasingly important part of many HCI systems in a wide range of application domains. However, we and others (cf., Baumer (2015); Baumer et al. (2014); Fleck and Fitzpatrick (2010)) argue there is a substantial gap in our understanding of how the process of reflection can be supported through technology. In fact, an implicit assumption in the majority of existing work seems to be that, just by providing access to well-selected data, in-depth reflection can and will occur. To counter this view, we discuss how the reflective practicum framework helps emphasise—and pinpoint—the complex interplay of factors that seem necessary to facilitate transformative reflection. In particular, these arguments suggest the need to carefully scaffold the process of reflection, rather than simply assume that the capability to reflect is a broadly available trait to be 'triggered' through data.

Links to reflective practicum

The case studies presented in this thesis exemplify how the opportunity for transformative reflection was deeply tied with the underlying experience of the learners; and how such experiences were painstakingly designed for, and orchestrated by, the curriculum setting. Similarly, neither curriculum took the learners' ability to reflect on their experiences for granted and it was instead carefully scaffolded within the experiences through an interplay of curricular components. The framework itself then aimed to abstract the broad set of evidence-based strategies and mechanisms to both generate meaningful 'teachable moments' and scaffold the process of students' reflection on these.

To argue that these notions could travel beyond immediate SEL contexts, we now illustrate how aspects of reflection scaffolding similar to those described in the reflective practicum framework in SEL can also be seen in HCI projects that are exceptions to the 'show users a graph and hope' approach discussed in Section 2.3. To ground the discussion, we focus on three otherwise unrelated HCI projects, coming from areas of diabetes management (Mamykina et al., 2008), healthy eating behaviours (Parker, 2014), and romantic relationships (Thieme et al., 2011)[5].

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[5]We note that a number of other systems across a wide range of domains also manifest similar aspects: for example, Fleck and Fitzpatrick (2009) supporting reflection in teachers' training with SenseCam images, Pina et al. (2014) facilitating in-the-moment support for self-regulation of ADHD parents, Hoque et al. (2013) providing an automated interview training, Bouchard et al. (2012) bio-feedback self-regulation training for soldiers, and others.

We suggest that the framework provides a lens to revisit these studies, helping to identify similarities in the underlying design strategies through which reflection is scaffolded in their localised contexts. Moreover, we conjecture that such similarities in successful designs could reflect shared mechanisms through which transformative reflection might work across domains. That is, similar to how Schön's observations of the learning process for architectural training can be translated to social-emotional learning settings, they might be applicable to a range of other areas that aim for transformative reflection.

In line with the key features of the reflective practicum, each of the three systems is designed to deliberately scaffold particular experiences for users, incorporating active engagement with these as the crucial part of the design for reflection:

⋆ In MAHI (Mamykina et al., 2008), the users are newly diagnosed diabetes patients, enrolled in an educational program helping them manage the new limitations. The MAHI system helped patients capture key measurements (glucose level) associated with what happened (photos of meals) and most importantly engage in sense-making on this experience, with asynchronous feedback from the educators. The authors draw out how this 'articulation work', scaffolded by the system, led to deep reflection and, over time, marked shifts in how patients viewed and understood the implications of their actions (Mamykina, 2009, p121).

⋆ Community Mosaic (Parker, 2014) is designed to help under-privileged communities eat healthy food. The design was driven by a strong collectivistic focus, with the users asked to take photographs and descriptions of food they are preparing to inspire others in the community to eat healthier. Parker draws out the notion of 'reflection-through-performance' as the underlying design principle: she showed how the act of crafting a message for the 'unseen audience' served as a strong scaffolding for reflection, making the participant go through a process of looking at their behaviour from the 'others' perspective.

⋆ Finally, the Lover's box by Thieme et al. (2011) examines how a digital artifact can scaffold reflection for partners in new romantic couples. The design combined a physical artifact (a wooden box) and video messages that participants create for each other, with the support of a video artist. The authors argue that the 'principal vehicle for promoting reflection was the creation, exchange, and sharing of video messages', further mediated by the interaction with the video artist, who served as a crucial 'component

of the reflection system'.

Each of the designs can be interpreted as a combination of explicit, social, and personal components, providing similar mechanisms for the scaffolding of experience and reflection as in the social-emotional contexts:

⋆ The design of the 'task' in MAHI—linking the measurements and food logs with personal annotations—helps users appropriate particular experiences as teachable moments they can reflect on (explicit), while providing specific instances for modelling and support from the mentor (social). The system then relies on the strong inherent motivation of the participants who struggle to accommodate their newly diagnosed illness; and supports the development of their competencies to reflect on and make sense of their experience over time (personal).

⋆ Similarly in the Community Mosaic, the act of 'crafting a photo message for the community' provides a specific task that is tied to the everyday context of food preparation. It brings a particular frame of reference ("what would others think") for the users, scaffolding the ability to detach from own behaviour and reflect on it from an outsiders' perspective (explicit). The 'collectivist' design then facilitates a feeling of belonging and a set of norms emerging from within the community around what eating well means (social). As participants were considering what can and cannot be shared with others, this helped them become more aware and self-analytical about their eating habits (personal).

⋆ Finally, the experience trajectory within Lover's box was explicitly scaffolded to support reflection through the process of creating (and receiving) video messages in the context of an on-going relationship. In the anticipation of the creative session, the users were expected to reflect on the content and purpose of the message-to-be-created for the significant other (explicit); and the interaction with the media artist served as an additional catalyst to promote reflection through active engagement with the media (social). Participants' internal motivation and interest were seen as key enabling factors: participants had to pass an interview with the researcher to be selected into the study (personal).

These observations suggest that even if these authors do not reference each other, work in different contexts, and use different design strategies, seeing their work through the reflective practicum lens can point to similarities in the underlying design strategies

through which transformative reflection is accomplished. As such, these systems can be interpreted as providing additional exemplars of practical instantiations of the strategies underlying reflective practicum, further populating this design space.

Overall, we argue that the reflective practicum design framework developed in this thesis could be also used in contexts beyond SEL, emphasising the need to move past triggering *reflection on data* and toward *scaffolding reflection within experience* if transformative reflection is to arise.

CHAPTER 11

Conclusions

11.1 Introduction

This final and concluding chapter draws together the core strands of this thesis, summarising the empirical findings on the level of individual case studies and the developed framework in the context of the four overarching research questions. It then discusses the limitations and future work opened by the presented research, namely: the work needed to fully validate the framework suggested here, some of the possible extensions to the framework within and outside of the SEL context, and finally the broader implications this work could have for SEL and HCI communities.

11.2 Revisiting the contributions

The aim of this thesis was to investigate the potential of technology in supporting development of social-emotional competencies. We started with the observation that very little is known about what are the key challenges involved in developing SE competencies, if and how technology could meaningfully help address these, and what would be the underlying learning mechanisms and design principles guiding development of such systems.

To address this gap and provide the first step in this novel area for HCI, the thesis research focused on exploring four main research questions that we now summarise below in turn.

RQ1: What are the underlying psychological principles that drive development of SE competencies within existing curricula, and how can these be interpreted for design?

Across the two case studies we saw the reliance on experiential learning as the key learning principle: facilitating students' personal experiences with appropriately 'hot' situations that still allow for reflection and thus 'grasping' the experience as a teachable moment. As shown in Chapters 4-6, this principle manifested itself in SEL in education through multiple ways: the reliance on structured role-plays embedded within in-class lessons; working with recollections of past events with the hope of rekindling the associated emotions; and the use of mental tools together with adult-led coaching as bridges from in-class into everyday situations. The examination of SEL in counselling training then showed how the masters course utilises students' strong reflective skills that are further developed by the curriculum in early stages of the training. This is combined with specifically designed experiences (such as a lesson evoking feelings of shame or practice counselling sessions) that the students can learn from with only little external guidance.

The technology probe in each case study presented example opportunities to re-interpret these contextualised mechanisms into technology-enabled systems. In SEL in education, the designed system showcases the potential of technology to create shared experiences for parents and children, complemented with providing in-the-moment facilitation of the adults' scaffolding role which is necessary for children to grasp the experience as a teachable moment. In contrast, the system in SEL in counselling aimed to further deepen students' reflection practices on peer counselling sessions, through making the reflection work tangible and available for confirmation from the client.

These findings contribute to the understanding of how SE competencies are developed in the specific context of the individual case studies, highlighting how the shared underlying psychological principle (specific application of experiential learning) can be reinterpreted into very different technology designs depending on the surrounding social practices and available curricular components.

RQ2: How are the learning situations for developing SE competencies orchestrated, and what are the general challenges that the learners face within existing curricula?

Similar to RQ1, we again saw the two case studies sharing the underlying goals around orchestrating SE competencies development – grounded in carefully designed experiences for students with the aim of developing well identified SE skills. These have been however manifested in varied ways given the differences of resources available and existing competencies of the students.

In SEL in education, the limited amount of time, the lack of teachers' training, and the competing demands of other parts of school curricula strongly shape the resulting SEL sessions. The teachers are often working with scripted lesson plans with verbatim stories and exercises for students. Extensions beyond these pre-prepared lessons are grounded in a combination of mental tools and rely on adult scaffolding. The implications are that SEL curricula in education struggle to generate 'real-enough' experiences for children in-class and have to opt to appropriate everyday situations into teachable moments. Such everyday situations however do not have any inherent scaffolding that would support students in practising their not yet fully developed SE competencies, and therefore must draw on external help from teachers or other adults.

In contrast, SEL in counselling operates within a course fully dedicated to social-emotional competency development. In particular, we highlighted how the combination of students' existing competencies coupled with available social and explicit components (such as the learning contract or the complex setup around practice counselling sessions) allows the creation of a safe space where strong emotions can be generated while still being available for learning and reflection.

These findings contribute to a more holistic understanding of how the availability of specific learning components affects the broad challenges learners face across the curriculum. Within HCI, this for example suggests implications for technology design for SEL in education, with the aim of making some of the roles that are served by non-technological curricular components in counselling available through technology-based systems (such as generating strong enough emotions through gameplay, or providing in-the-moment support through wearables).

RQ3: Which of such existing challenges can plausibly be addressed by technology in real-world settings and how?

The two technology probes (and the resulting mPath system in counselling) provide examples of the challenges that technology could plausibly support: be that in-the-moment support for untrained adults to (at least partially) bridge the home-school gap and include parents into the programme; or the scaffolding for an in-depth analysis and reflection on video-taped traces of teachable moments, thus responding to the challenge of extending the learning from otherwise ephemeral SE situations. Moreover, the two follow-up projects discussed in the Chapter 10 outline further instances of the potential technology could have in this space.

We argue, however, that these exemplars only scratch the surface of what could be possible (cf., the TOCHI review paper in Chapter 4), and we hope the research in this thesis can serve as a stepping stone and inspiration for such future work. As further discussed in the next section, we see, for example, a particular potential of ubiquitous and wearable technologies in addressing the key challenge of extending the learning from in-class settings into the situated, real-world experiences where much of SE-related teachable moments naturally appear.

RQ4: Moving beyond the context of individual curricula, can we abstract a set of concepts guiding design of technology-enabled SEL systems more broadly?

In starting to answer this question, the methodology chapter drew on Cartwright's work to outline one possible philosophy-of-science grounding for what such a set of concepts could hope to achieve. In particular, it oriented us to focus on identifying the assumed 'causal mechanisms' that underpin the learning as well as emphasise their interdependence on localised support factors that play a key role in the individual learning instances.

Comparing such observations across the two studies and existing experiential learning literature, the argumentation developed in Chapters 9 and 10 then identified a conceptual framework that abstracts the localised mechanisms into a set of more broadly applicable sensitising concepts. The key contributions include: (i) the analysis of what 'real-enough but not-too-real' experiences are in the context of SEL as the core principle of successful learning; (ii) the identification of the types of structural components the existing curricula

use to generate such experiences (explicit, social and personal); and (iii) the articulation of a set of guiding questions and the associated roles technology could play in this space. The last part of chapter 10 then presents examples of how these abstracted principles could be applied and appropriated within other contexts, including two follow-up projects and an extension of the framework towards designing for reflection more broadly.

Overall, the articulated framework can sensitise both HCI and SEL research to the new possibilities available at the intersection of these fields, as will be discussed in more detail in the Future Work section we turn to now.

11.3 Limitations and Future Work

The main contribution of this thesis was to open a new design space at the intersection of HCI and SEL research, mapping out the key opportunities and challenges for technologies, and providing a conceptual framework to allow for further exploration. As such, this research opens new areas of inquiry while providing an initial 'signpost' that can help others orient in this space and suggest possible direction where to start working in this under-researched area.

In the rest of this chapter, we will first focus on what work would still be needed to understand the roles that the proposed framework could play. We also highlight the need for future work to move from design exploration presented here towards fully developed and rigorously evaluated systems as research in this area matures. We will then discuss how the framework could extended both within and outside of SEL contexts. Finally, we outline some of the implications that the research presented here could hold for existing HCI and SEL communities.

Validation of the framework

Given the positioning of the framework as a set of sensitising concepts, any validation of its usefulness essentially rests on whether other researchers, both across HCI and SEL, find the articulation useful in their own work. A secondary step is then showing that the localised instantiations of the suggested learning mechanisms, underpinning the framework, operate within such new settings.

As the framework is the final output of the thesis research so far and will be formally

published in CHI'17 only after the thesis submission, the first step of the evaluation is not yet available beyond (i) the illustrations of its fit and usefulness within our own projects; and (ii) argumentation of how it can extend approaches to designing for reflection within existing HCI work. While these two examples support the case for the validity of the framework and the Best Paper nomination for the CHI'17 paper suggests these thoughts resonate within the HCI community, the uptake of the framework by other researchers is an open question that will need to be answered over time.

Similarly, showing whether or not the assumed learning mechanisms behind the reflective practicum framework actually operate in other SEL contexts is another important direction for future work. As already mentioned in the methodology section, the ideas of identifying causal mechanisms rely on a combination of qualitative and quantitative research, including the need to show that the designed intervention does 'work' as expected in the designed-for settings. However, to be able to provide the evidence of the effectivity of an intervention, such as changes in competencies and associated behavioural indicators, fully developed and contextualised interventions/prototypes are required.

The research in this thesis has instead deliberately emphasised the use of technology probe-like methods, as a way further exploring and understanding the possibilities of the design space. While this allowed me to reach an in-depth understanding of the challenges and learning approaches available across the two case studies, it has not been conducive to designing, developing, and deploying a full fledged intervention (that then would be necessarily focused on a highly specific sub-problem). Apart from the need to map out a completely unknown design space, this choice of design exploration rather than evaluation was also motivated by the known pragmatic challenges of testing such SE intervention in real-world settings: for example, even a quasi-experimental study in SEL in education would likely require multiple schools within a multi-year project, which was not feasible given the PhD funding constraints.

Possible extensions of the framework

Chapter 4 outlines a number of different domains where social-emotional learning is key, including healthcare, therapeutic, or the workplace settings. We expect that the core mechanisms described by the framework could be applicable across these contexts. This opens interesting questions around the differences and similarities of the localised

learning mechanisms within these settings, and the resulting implications for design. For example, would nurses or oncologists find systems such as mPath useful for training their communications skills, perhaps combined with bio-sensing wearables to help monitor and develop their emotional resilience necessary for the taxing working environment? Alternatively, would managers and office workers be interested in developing SE competencies such as active listening or cooperation skills through a sensor-based training that is fully embedded within their everyday meetings and work arrangements, similar to the Minecraft conflict resolution development being embedded in-game? In each of these and other possible scenarios, we imagine that the framework could provide initial structure to help understand the design space as well as the psychological characteristics of experiences most conductive to learning. The resulting design might then draw on the broad roles and strategies mapped out in the framework, with particular interest in how these general mechanisms become instantiated to complement the existing support factors and social practices operating in each setting.

Going beyond SEL, it will be interesting to explore how such learning mechanisms might be applicable to areas where the aim is to develop procedural competencies; such as any sufficiently expert activity (cf., Ericsson et al. (1993)). One such example might be exploring how the reflective framework could inform and shape novel research around behaviour change, such as that focussed on supporting personal activity and fitness. We imagine that one important implication would be the emphasis on 'abilities' rather that 'output': for example, the focus on improving the technique of running, rather than focus on a certain number of miles ran per day.

In such as a case, we expect that the core focus on the need to carefully scaffold the 'right sort of' experience and the associated process of reflection will still be important. However, the interpretation of what 'real-enough but not-too-real' experiences mean within this context will likely differ: instead of balancing 'real-enough' emotions, the sport curricula might emphasise aspects such as 'real-enough' movement, body exertion, or granularity of technique taught. Physical skills are also much easier to sense and repeatedly practise than skills underpinning SE competencies. As such, they are likely to be conducive to intricate and highly effective reflection scaffolding. Indeed top athletes and sports teams are already using similar track-and-reflect approaches (see e.g., Tholander and Nylander (2015) for an initial HCI exploration) to hone their expertise, providing a useful test-bed to explore and understand reflective practica in these contexts.

Implications for future HCI and SEL research more broadly

SEL research   As we saw throughout the thesis, existing SEL interventions still lack scalable mechanisms to engage and support learners beyond the in-class and in-person teaching strategies. It is our hope that the exemplary technology designs and the reflective practicum framework resulting from this thesis can provide a stepping stone to bridge this gap and perhaps help fundamentally re-think the existing curricular and intervention delivery methods in Prevention Science more broadly. To help achieve this goal, the role of the framework at this disciplinary intersection can be seen as that of a boundary object (Star and Griesemer, 1989): providing a common language and a set of aims so that SEL researchers can more readily collaborate with computer scientists and designers, understanding the intertwined challenges and opportunities across both fields.

The two follow-up projects illustrate the potential of such technology to disrupt the status quo and bring in innovative approaches: The preliminary positive results of the Minecraft project suggest that in-game interaction could become a powerful vehicle for teaching SE competencies in ways that take advantage of the affordances of such fully virtual, computer generated online gaming spaces. On the other side of the spectrum, the TESS project presents a vision of technology taking up parts of the adult coaching role that is so important—and hard to achieve—in children's everyday encounters with potential teachable moments. If successful, such systems would exemplify the power that current technology can have to empower learners and extend the opportunity for training into their lived, real-world experiences *when* the technology intervention is grounded in an in-depth understanding of the underlying psychological mechanisms of learning and embeds these well within the existing social practices.

HCI research   Beyond the focus on SEL directly discussed in previous subsections, we hope that the developed framework can sensitise existing HCI communities towards design directions that have not been addressed so far. For example, Section 10.3.2 already outlines how the framework can foreground the need of transformative reflection to be directly tied to and relying on the 'right sort of' experiences for the learners. This can then re-orient the designer from considering how to 'trigger reflection through data' towards the importance of carefully scaffolding the reflection process and curating the experiences the users will be expected to reflect on. Similarly, the focus on the importance of people's own active interpretation and engagement with their experiences, even if

these are mediated by sensors, can suggest novel applications in areas such as Affective Computing or Social Signals Processing. These have so far relied on algorithmically processed data, as if coming from the 'objective expert' that is informing people about their states, rather than offering suggestions and a structure for the people to learn from and work with the newly available data for themselves (cf., Boehner et al. (2007)). The reflective practicum could provide a thinking framework to inspire such future work.

11.4 Postscript

I may be at the end of my thesis journey but I feel that I am actually only beginning to see the possibilities in this emerging research field. So even after more than 5 years of work at the intersection of HCI and SEL—when I 'should' be glad to move onto something different—I am instead getting more and more thrilled by the opportunities opened by this research. I am looking forward to spending at least another 5 years exploring this interesting and societally impactful area; and I hope that this and future research will inspire others across HCI and SEL to join me.

List of Figures

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Appendix A: Exemplars of the research process

Figure 1: The workspace with thematic analysis in progress (synthesising SEL and HCI research for the TOCHI review paper presented in Chapter 4).

Parents Remote interview questions

- hear their stories around how they did the activity and what they thought/felt about it
- understand what they consider as key SE skills their child/children struggle with
- explore what they see as enjoyable, fun activities with their children

In line with the standard interviewing practice, I aim to get interviewees to tell me stories about specific instances with a lot of detail, rather then having them 'generalise' (i.e., "tell me about the last time you …", rather than "tell me how you usually …")

-------- ACTIVITY INFO ----------------
<< how did the activity 'work', any outcomes >>

Start with a recalled walkthrough of the activity:
-- how did you find out about the card?
-- when was it?
-- what did you do then?
-- what did you child do?
-- how did you feel when you were doing it?
-- did anyone else in the family get involved?
-- was there anything you personally learnt from the activity?
-- where is the magnet located now?

Can you recall the calming-down steps?
If so, tell me about the last time you remember your child using Calming down steps apart of the activity, if at all?

--------- WHAT ARE IMPORTANT SKILLS ----------
<< which SE skills they perceive as most important for their child to develop >>

Moving on … did you know that the SecondStep is taught at school?
What are your thoughts on that?
(assume they mention 'importance/worthlessness' of SE skills) — can you tell me more about why?

What do you consider the most important <SE skills> for your child to learn?
(For example, this activity helps your child practice how to calm down. What are other important skills you'd like your child to develop,and why?)

Are you working with your child on any of these skills?
Can you tell me about the last time?
(and a time you think you really helped your child learn/develop such a skill?)
(and a time/skill one of you struggled with?)

--------- VALUES HOPES -- FUN ----------
<< what is fun for parents and kids to do together >>

Tell me about a time you did something really fun with your child at home.
(what do you think made it so much fun for you both)

Can you give me an example of a (digital) game you and your child enjoy playing together, if any?

Just to finish, and I know this is a hard question, but what would you say is the one thing you are most proud of, as a parent?
And if you wanted to talk about it, what would you like to still work on, if you had the chance to do so?

---------- FINAL DEMOGRAPHICS ----------

Child age, parent age

Can we contact you if we have follow-up activities you could try out?

Figure 2: Example interview guide for phone interviews with parents, exploring their experiences with the technology probe presented in Chapter 6.

Figure 3: Snapshot of the thematic analysis process of Counselling interviews carried out within the Dedoose software package (Chapter 8).
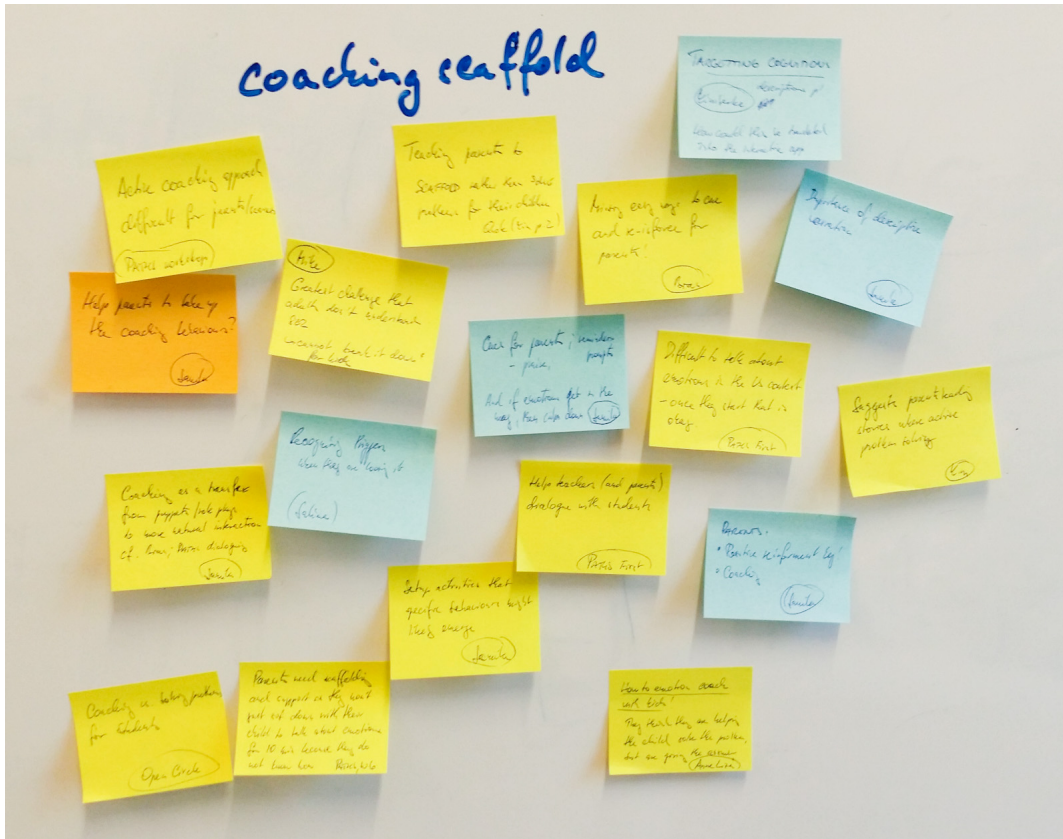
Figure 4: Clustering of initial themes from interviews, utilising Post-Its and extended whiteboard space (SEL experts interviews from Chapter 5).

Figure 5: I have heavily relied on mindmaps to move from the multi-dimensional clustered themes toward a linear story flow necessary for the write-up (preparing the argumentation flow for the CHI'17 paper).

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SEL Study – Online Conditions (MTurk, Meetup.org)

This academic study explores **how children can practice crucial skills such as calming down and how parents can help with this**. It is run by <u>Vienna University of Technology</u> in collaboration with <u>Committee for Children</u>.

To be eligible for this HIT, you must

- be a parent of a 6-9 years old child;
- be willing to try a simple <u>activity</u> with him or her on your iOS or Android smartphone;
- install an app that enables the facilitation of the user study (<u>UserZoom</u>).

We will ask you to play an activity with your child and tell us what you thought about it. Overall, the whole HIT will take at most 20 minutes including instructions.

While you and your child are going through the activity, we need to record
- your phone screen,
- what you and your child say, and
- the video from your phone camera.

This will help us understand which parts of the activity work well, and which still need improving. It will also make your job easier as you can just tell us what you think rather than typing it. The recording will be kept secure and kept only with your permission -- you can contact us with your personal code ${code} at any time at <u>pslovak@cfchildren.org</u> and we will delete the video as soon as it has been processed (that is, in at most 3 days from your request). No one apart from this research team will have any access to it under any circumstances. Aggregate or anonymous data may be shared and used in research publications.

To start the HIT, make sure you and your child are ready and open the link below on your mobile phone. You will asked to install the UserZoom app. The activity will start immediately once you open the app. The app will guide you through the activity process. **You may uninstall the UserZoom app once you finish the activity**.

Make sure to leave this window open as you complete the survey. When you are finished, you will return to this page to paste the code into the box.

Please note that you may not do this HIT more than once. Multiple submissions will not be approved.

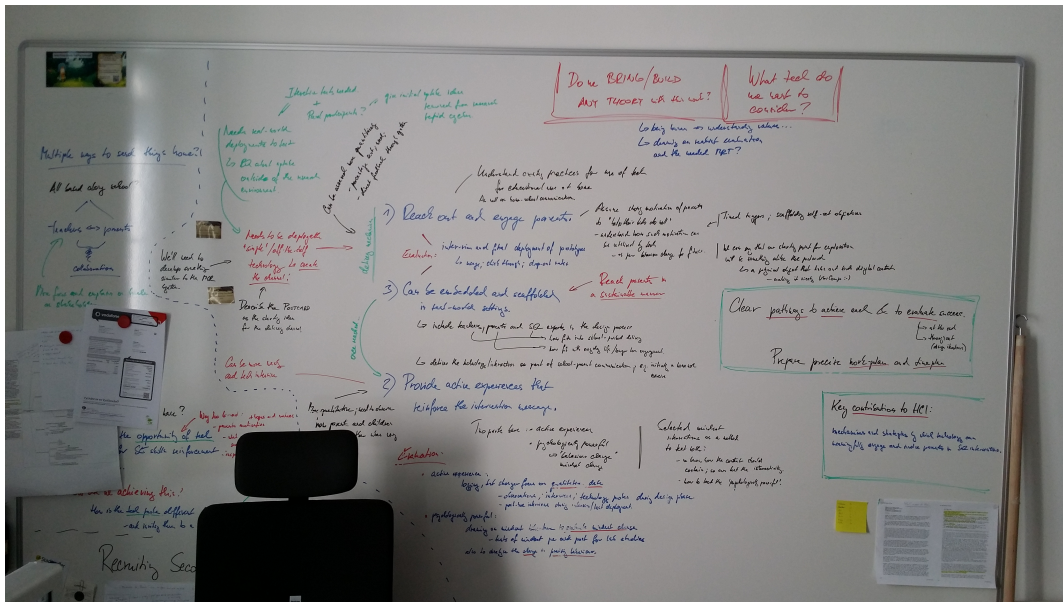**Figure 6:** Example consent form (mTurk study from Chapter 6).

Figure 7: Illustration of a writing phase: using the whiteboard to draw out the key arguments for a post-doctoral grant proposal.