DISSERTATION

Elearning for the Austrian Pharmacy Apprentice: A Comparative Study of Linear Text vs. Hypermedia Interface Program Design and Delivery

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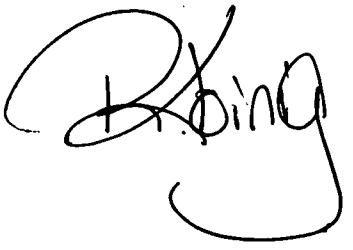

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Abstrakt- Deutsch

Im Zuge der vorliegenden Dissertation wurden elektronische Lernprogramme zur Ausbildung, von Apothekerlehrlingen untersucht. E-Learning und Technologiegestütztes Lernen wird von regionalen und internationalen Organisationen sowohl finanziell als auch durch Reformen unterstützt. Aus diesem Grund einerseits und dem Mangel an spezifischen Lernprogrammen für Lehrlinge andererseits konzentriert sich diese Studie auf die Entwicklung von effizienten E-Learning- Methoden für unterschiedliche Lernbedürfnisse.

Zu diesem Zweck wurden ganz spezifisch zwei verschiedene E-Learning- Programme verglichen, mit besonderem Hinblick darauf, welches der beiden bei österreichischen Apothekerlehrlingen größeren Anklang findet. Während die beiden Programme hinsichtlich der Kundengespräche ident sind, handelt es sich bei dem ersten um ein Lineartext-Modell in PDF- Format, beim zweiten hingegen um ein interaktives Hypermedia- Programm auf Hypertextbasis. Die Auswahl dieser zwei Modelle gründet sich auf der Ähnlichkeit mit traditionellen Lernmethoden im ersten Fall sowie dem Argument der Vorteilhaftigkeit interaktiver Programme im zweiten Fall. Die Untersuchung ergab bei Apothekerlehrlingen allgemein eine leicht stärkere Neigung zum interaktiven Hypermedia- Programm. Weiters zeigte sich, dass die Herausforderungen der Entwicklung geeigneter E-Learning- Programme für diese Anwendergruppe offenbar nicht nur in Design und Übermittlung bestehen, sondern weit mehr Faktoren mit einbeziehen.

Die Arbeit ist in einzelne Abschnitte unterteilt, in denen die grundlegenden Komponenten dieser Studie hervorgehoben und erläutert werden. Die Gestaltung und der Einsatz der beiden zu vergleichenden E-Learning- Programme basieren auf umfangreichen Literaturrecherchen zu allen relevanten Faktoren. Der Forschungs- und Evaluierungsprozess beinhaltete unter anderem Bevölkerungs- und Hintergrundanalysen, Bedarfsanalysen, die Erstellung von Programmskizzen zu Hypermedia- basiertem E-Learning, Experten- Walkthroughs und –Analysen, Interface-Design-Forschung, Interviews, informelle Evaluierung potentieller Nutzer, Ausarbeitung sowie Implementierung von Prototypversionen und der endgültigen Version sowie Analyse sowohl auf qualitativer und quantitativer Basis.

In Abschnitt 1 der Literaturrecherche werden bildungsrelevante Aspekte der Studie herausgearbeitet. In diesem Zusammenhang wird das in seiner Organisation einzigartige

österreichische Bildungssystem, mit Schwerpunkt auf dem dualen System für die Berufsausbildung von Lehrlingen, unter das auch Apothekerlehrlinge fallen, vorgestellt. Letztere werden von der österreichischen Regierung und relevanten Organisationen massiv gefördert. In weiterer Folge geht es um die im Laufe der Jahre unternommenen Versuche, ein Umdenken einzuleiten und ein Gleichgewicht in einem Lehrlingsausbildungssystem zu schaffen, das einer wachsenden Wirtschaft und einem leistungsfähigen Arbeitskräftepotential gerecht wird. Dabei wird der Einsatz des Staates für eine zukunftsweisende Ausbildung dieser Berufsgruppe erneut hervorgehoben.

Abschnitt 2 gibt detaillierteren Aufschluss über die Verwendung und Bedeutung von elektronischem Lehrmaterial speziell in der Lehrlingsausbildung. Hervorgehoben werden dabei die in Österreich unternommenen Bemühungen, Lehrlinge durch innovative, technologiegestützte Lehrprogramme zu unterstützen. Es folgt ein kurzer Überblick über die Geschichte der Berufsausbildung bis hin zur Gegenwart sowie verschiedene Reformen und vor allem EU- und Österreich-weite Technologieprojekte. Zahlreiche Initiativen und Programme verdeutlichen die bevorzugte Stellung, die Lernen, Ausbildung und neue Technologien in Österreich genießen. Den Abschluss bilden eine Reihe von Studien im Bereich Berufsausbildung und E-Learning mit spezifischen Verbindungen zu konstruktivistischen Theorien. Zusammengefasst begründen die hier präsentierten Informationen die Relevanz dieses Forschungsprojekts.

In Abschnitt 3 wird näher auf die Themen Bildung und elektronisches Lernen eingegangen. Die in diesem Zusammenhang erhobenen Informationen bilden die Grundlage für eine Reihe von Entscheidungen, die für dieses Forschungsprojekt von Bedeutung waren. Zum einen werden E-Learning- Begriffe sowie die besonders signifikanten Faktoren des Lernprozesses und der lernenden Person präsentiert, zum anderen werden verschiedene in den E-Learning-Prozess involvierte Technologien hinsichtlich Übermittlung, Umsetzung und Kommunikationstechnologien verglichen. Einem anschließenden Überblick über die Entwicklung von E-Learning- Strukturen in den letzten Jahren folgt eine Gegenüberstellung der Vor- und Nachteile bei der Arbeit mit E-Learning.

In Abschnitt 4 werden eine Reihe von Daten aus Literaturrecherchen zum Thema E-Learning und dabei besonders Multimedia-Elemente, die beim Hypermedia- Design möglich sind, präsentiert. Ausgehend vom Lernenden im Zentrum werden hier Themen wie Theorien im

Sinne von multipler Intelligenz, empirischer Forschung und dem Erwerb von Soft Skills behandelt. Darüber hinaus geht es um Motivationsfaktoren mit Einfluss auf den Lernerfolg beim E-Learning, wie Theorie, Authentizität, Interaktion und zeitliche Koordination, Kreativität, spielerische Elemente und künstliche Intelligenz. Besondere Aufmerksamkeit wird dabei dem Design und der Umsetzung gewidmet, einschließlich Multimedia-Elementen wie Visualisierung, Text und Grafik, Farbgestaltung sowie Audio- und Zeichenstil. Dem folgen eine Einführung in lineare und Hypertextgestaltung und –Forschung sowie ein Beitrag über redundante Elemente oder sogenannte „seductive augmentation suspects". In diesem Abschnitt sollen somit Gestaltung und theoretische Entscheidungen im Rahmen des Forschungsprojekts und damit zusammenhängend die Relevanz der Dissertation nachvollziehbar begründet werden.

Eines der Kernziele dieser Dissertation besteht in der nachvollziehbaren und zuverlässigen Evaluierung der Studien. Abschnitt 5 begründet und rechtfertigt daher die Notwendigkeit der Planung und erfolgreichen Umsetzung von Evaluierungsschemen. Weiters werden Herausforderungen im Zusammenhang mit E-Learning und dessen Anwendern sowie Normen und Evaluierungsschemen auf verschiedenen Ebenen behandelt. Es folgen Vorschläge zur Schaffung geeigneter Rahmenbedingungen für Evaluierung, Feedback (durch Einbeziehen der Anwender, Fragebögen, Interviews, Beobachtungen, Prototypen und Pilottests) und Datenanalyse und –Interpretation, wobei verschiedene Hilfsmittel zur Evaluierung vorgestellt werden. Ein weiterer Teil befasst sich mit effektiver Datenanalyse und –Interpretation.

In Abschnitt 6 geht es ausschließlich um vergleichende Studien ausgehend von Informationen aus Literaturrecherchen, die schon in vorangegangenen Abschnitten präsentiert wurden. Hier geht es um die beiden für die vorliegende Arbeit konzipierten E-Learning- Programme, Methoden der Evaluierung und Datenerhebung, Forschungshypothesen und Ergebnisse. Letztere sind nach den drei Testphasen - die Vorbereitungsphase, den Pilottest und den abschließenden Anwendertest– unterteilt. Jeder Abschnitt erläutert detailliert die verwendeten Forschungsmethoden, die getestete Bevölkerungsgruppe und die Ergebnisse.

Abschnitt 7 enthält Schlussbemerkungen zur Forschungsarbeit und der Literaturrecherche, wie eine erneute Auflistung der Argumente für die Relevanz und Glaubhaftigkeit des Projekts und dessen Ergebnisse, Faktoren für die erfolgreiche Weiterführung des Projekts und eine Diskussion über weitere mögliche Einsatzgebiete in der Zukunft. Abschnitt 8 schließlich gibt

einen detaillierten Einblick in die spezifisch für die Studie herangezogenen Dokumente und Unterlagen.

Die Abschlussergebnisse gaben klaren Aufschluss über die der Studie zugrunde liegenden Fragen. Die Hauptstudie wurde bei 36 Apothekerlehrlingen durchgeführt, die der typischen Bevölkerungsgruppe entsprachen. Die Lehrlinge wurden in drei Gruppen zu jeweils 12 Testpersonen geteilt. Eine Gruppe besuchte die Berufsschule, die einen Teil der Ausbildungszeit umfasst, eine weitere Gruppe arbeitete bereits in einer Apotheke, wo der zweite Teil der Ausbildungszeit absolviert wird. Die weiteren 12 wurden am WIFI Wien, einer von der Wirtschaftskammer Österreich geförderten Alternative zu traditionellen Berufsschulen, getestet. In allen drei Fällen wurden die Lehrlinge in zwei Lerngruppen geteilt und absolvierten alternierend die beiden E-Learning- Programme. Eine Gruppe verwendete zuerst das Hypermedia- Programm, gefolgt von einem Fragebogen, und danach das Lineartext- Programm mit einem anschließenden Fragebogen. Die zweite Gruppe arbeitete in umgekehrter Reihenfolge.

Kernpunkt der Studie war die Frage nach dem hinsichtlich Design und Übermittlung attraktiveren Programm. Die Beantwortung erfolgte mittels detaillierter Untersuchung und Auswertung der einzelnen Details der beiden E-Learning- Programme, angefangen von der Zeilenlänge, über die Schriftgröße bis hin zu Stimmungszustand, Farbe der Kleidung und Konturen der abgebildeten Personen. Zwecks qualitativer und quantitativer Datenerhebung wurden die Lehrlinge aufgefordert, einen Likert- Fragebogen auszufüllen und sowohl an einer informellen Gruppendiskussion als auch an einem persönlichen Interview teilzunehmen. Übermittlung und Design der Programme wurden anhand verschiedener Details aus der Literaturrecherche bewertet. Speziell wurde dabei auf Faktoren wie Motivation, Technologie und Lehrinhalt eingegangen, die durch zusätzliche Evaluierungsfragen nach Art und Ausmaß des übermittelten Inhalts ergänzt wurden.

Wie die Untersuchung der quantitativen Daten ergab, bewerteten die Lehrlinge die interaktive Hypermedia- Version generell nur geringfügig besser als Lineartext-Version. Es konnten keine signifikanten Unterschiede nach Geschlecht, Alter, Lehrjahr oder Lerntyp festgestellt werden. Das Ergebnis war weniger signifikant als ursprünglich erwartet. Die spezielle qualitative Datenanalyse zeigte, dass Lehrlinge üblicherweise anhand von Textmaterialien lernen, weshalb ihre Präferenz für das Lineartext- Programm signifikanter ist. Gemeinsam mit

einem grundsätzlichen Mangel an abwechslungsreichen Lernunterlagen und Technologie-gestütztem Lehrmaterial für Apothekerlehrlinge zum Thema Kundengespräche war diese Tatsache mitausschlaggebend für die Ergebnisse.

Signifikante Ergebnisse zeigten sich jedoch beim Vergleich der verschiedenen Umgebungen, in denen die drei Gruppen ihren jeweiligen Teil der Lehre absolvierten. Obwohl alle 36 Lehrlinge an ein und demselben Lehrprogramm teilnahmen, schien die Umgebung, in der sie getestet wurden und die sie somit mit dem jeweiligen Programm assoziierten, die Bewertung signifikant beeinflusst zu haben. Die Lehrlinge in Apotheken standen beiden Programmen grundsätzlich kritischer gegenüber, trotz der Unterstützung einer praxisnahen Ausbildung durch die Apothekenbesitzer oder –Betreiber. An der Berufsschule lernende Testpersonen beurteilten das interaktive Hypermedia- Programm generell positiver, während die Lehrlinge am WIFI dem Linertext-Programm den Vorzug gaben. Qualitative Daten untermauerten diese Ergebnisse zusätzlich.

Die durchgeführten Studien und Literaturrecherchen hatten Einfluss auf weitere Bemühungen für den Einsatz attraktiver E-Learning- Methoden für Apothekerlehrlinge in Österreich. Die vorliegende Arbeit hat deutlich gezeigt, dass E-Learning als durchwegs positive Lernmethode von großer Bedeutung ist. Verschiedene Organisationen wie Berufsschule, WIFI, Wirtschaftskammer Österreich, private Apotheken und Pharmaunternehmen zeigten großes Interesse daran, dass E-Learning- Programme in Zukunft weitergeführt und gefördert werden. Die Ergebnisse der Studie legten nahe das für die jeweiligen Bedürfnisse der Lehrlinge und der Ausbildungsumgebung attraktivste E-Learning- Modell sowohl auf Lineartext als auch auf Hypermedia- Basis weiterzuführen.

Aufgrund dieser spezifischen Anwendergruppe können die Studie und ihre Ergebnisse als glaubwürdige und zuverlässige Informationsquelle für zukünftige Forschungen auf diesem Gebiet betrachtet werden. Besonderer Wert wurde der Einbeziehung von Faktoren auf verschiedenen Ebenen beigemessen, wie etwa der Geschichte der Lehre in Österreich, Forschungsergebnisse zum Thema E-Learning und dessen Anwender, Verwendung neuer Technologien oder EU- und Österreichweiten Technologiereformen und Bestimmungen. Darüber hinaus wurde die Studie durch umfangreiche Evaluierungen und Analysen auf verschiedensten Ebenen begleitet. Die Daten wurden mittels Fragebögen, Bedürfnisanalysen, Interviews, Walk- throughs, Pilot- und Haupttests, Aussagen involvierter Personen, Umwelt-

bzw. Umgebungsanalysen und der Unterstützung durch verschiedene Unternehmen und Organisationen ermittelt und evaluiert. Somit können die Ergebnisse und deren Interpretation für den Entwurf und die Implementierung von E-Learning- Systemen für Apothekerlehrlinge in Österreich herangezogen werden.

Abstract- English

The following research and dissertation has been developed around discussion concerning electronic learning programs for vocational education students, particularly pharmacy apprentices. Local and international organizations continue to heavily support elearning and technology-based learning through funding and reform. Due to this, in addition to the scarcity of apprentice-specific programs, this study attempts to effectively develop appropriate elearning for relevant learner needs.

The research study here specifically compares two elearning delivery methods for pharmacy apprentices and answers the question; which elearning design and delivery method is more attractive for Austrian pharmacy apprentices- linear text or hypermedia? Both elearning programs contain the same content in the area of appropriate customer communication methods. The first program is a PDF based linear text elearning method, and the second program is an interactive hypermedia based program using hypertext. These two methods were chosen due to; likeness with the population's current traditional learning methods, and contended benefits of interactive-based programs, respectively. The subsequent results of the study showed pharmacy apprentices held a slightly more positive inclination toward interactive hypermedia based elearning overall. Results also showed that the challenges involved in developing appropriate elearning programs for this population may lie deeper than a question of design and delivery.

The study is divided into various sections that highlight and explain the most vital components associated with this research. Extensive literature reviews on all factors supported the foundation for the initial design and implementation of the two comparable elearning programs. The research and evaluation process included such steps as initial population and background research, needs assessment for the population, hypermedia elearning program blueprinting, expert walkthroughs and analysis, interface design research, interviews, informal potential user evaluations, edits, and pilot/final implementations and analysis, both on a qualitative and quantitative basis.

Section one of the literature review develops the relevancy and importance of this study from an educational perspective. Here, an introduction to the unique Austrian educational system with particular emphasis on the dual system for vocational education learners is presented.

Apprentices (and thus pharmacy apprentices) fall under this stream of learners. The Austrian government and interested organizations offer strong support to such vocational learners. A discussion is developed emphasizing the idea that throughout the years, attempts have been made to balance and re-think the apprenticeship system to support a growing economy and successful workforce through innovative means. This section reiterates the importance the country holds on furthering the education of this population for the future.

Section two continues to develop relevancy specifically in the areas of vocational education streams and the use of electronic learning materials and environments. The objective of this section is to highlight Austria's commitment to support their apprentice force with innovative, technologically based and delivered learning programs. Here, the history of vocational education and electronic learning is shortly documented up to the present time. Next, various reforms and specifically EU/Austria-wide technology missions are elaborated. Multiple related initiatives and programs further reiterate the priority of learning, training and new technologies in Austria. This section concludes with numerous studies of research done in the area of vocational education and electronic learning, as well as specific connections to constructivist theory. Together, the information organized in these sections support the base line relevancy of this dissertation research project.

Section three further establishes the topic of education and electronic learning. Here the information gathered supports various decisions made for the dissertation research project. This section opens the conversation into areas of elearning terms and vocabularies, as well as the particularly significant learning/learner factor. Secondly, various technologies involved in the elearning processes are compared- from methods of delivery, implementation options and communication technologies. A development of elearning structures over the last years is given, and a presentation of benefits and challenges to elearning environments is constructed.

Section four includes a multitude of data from literature reviews on elearning and specifically multimedia elements in hypermedia design. Naturally beginning with the core priority of the elearner, this section develops topics relating to learner theory in terms of multiple intelligences, empirical research and soft skills learning. Second, motivational factors affecting learner success in these environments is uncovered including; theory, authenticity, interaction and timing, creativity, gaming integration, and artificial intelligence agents. Design and implementation topics are particularly noted, and include multimedia elements

such as visualization, text and graphics, color, audio and drawing styles. In addition, an introduction to linear text composition and hypertext composition and research is given, as well as a section on seductive augmentation suspects. This section was developed in order to credibly base design and theoretical decisions for the dissertation research project.

Evaluation of the project in a credible and reliable fashion was a priority in this research project. For that reason, section five rationalizes and justifies the importance of successfully planned and implemented evaluation schemes. Challenges associated with elearning/elearner evaluations are covered. Standards and evaluation consortiums on various levels are listed, and suggestions on developing successful evaluation frameworks, feedbacks (from user involvement, questionnaires, interviews, observations, prototypes and pilot tests), and data analysis and interpretations are discussed. Various evaluation toolkits are referred to, and a section on effective data analysis and interpretation is unfolded.

Section six deals solely with the comparative research study of this dissertation built on information from previous literature sections in this paper. The section is divided into an explanation of the two elearning programs designed for the research, evaluation and data collection methods used, research hypothesis, and study results. The study results are subsequently divided into the three test phases of the study, from the initial study, to the pilot test to the final user testing. In each section, an explanation of the study methods used, population tested, and results are given.

Section seven then discusses several conclusive remarks pertaining to the research study and literature review. An argument is reiterated verifying the relevance and credibility of the project and its results. Necessary elements for the continued success of this research project are uncovered, as well as a discussion on potential areas of expansion in the future. Finally, section eight offers more detailed insights on the specific research documents used throughout the studies.

The final user study results shed significant light on the research question. The final study was implemented with 36 pharmacy apprentice elearners who reflected the population sample. These 36 apprentices were tested in three groups of 12- one group at the Berufsschule were they spend part of their learning time in a traditional vocational education school-based environment, 12 at actual pharmacies were they spend the other half of their

apprenticeships, and 12 at the Vienna based WIFI, a Wirkschaftskammer Österreich supported alternative to the traditional Berufsschule. In all three cases, learners were separated into two study groups and navigated through alternating elearning programs. One group initially dealt with the hypermedia program first followed by a questionnaire, then linear text also followed by a questionnaire. The other group likewise dealt with the linear text program first, then hypermedia.

Isolating the research question, "which program is more attractive for design and delivery?" was a top priority in this study. This was accomplished by detailed research and evaluation of every detail possible within the two elearning programs- from line length and font size, to character expression, clothing color and line drawing style. Learners were encouraged to complete a Likert questionnaire as well as participate in an informal group discussion and individual interviews for both qualitative and quantitative data collection. The delivery and design attractiveness of the programs was based on rating various elements adopted from the literature review. These elements included specifically motivational, technological, learner and content details, in addition to answering evaluatory questions on what and to what extent content was delivered to the learner.

Quantitative data results proved the apprentice population in general rated the interactive hypermedia learning environment only slightly higher than the linear text program for their learning needs. There were no significant differences between gender, age, apprenticeship year, or learning type. This conclusion was not as significant as was expected. Specific qualitative data analysis uncovered that apprentices traditionally learn with text-based materials, making their preference to the linear text based program more significant. This, in addition to an overall lack of variety in learning materials and technology-based learning materials for customer communication studies in the pharmacy apprentice program also determined data results.

Significant results did become apparent in the comparison of the learning environments of the three study groups. Although all 36 apprentices participated in the same apprenticeship program, the environment in which they were tested, thus the environment they associated with using the programs, seemed to have a significant effect on their opinions. The pharmacy-based apprentices were significantly more critical of both programs in general, despite the support for on-the-job learning opportunities from pharmacy managers/owners.

Apprentices based at the Berufsschule generally rated the interactive hypermedia program positively, while apprentices based at WIFI rated the linear text program more positively. These results were additionally supported by qualitative data as well.

This research study and literature review had various implications for further efforts in supporting attractive elearning delivery for pharmacy apprentices in Austria. This research determined that elearning is relevant, and can be an overall positive learning tool. Various related parties and organizations including the Berufsschule, WIFI, Wirtschaftskammer Österreich, private pharmacists, and related pharmacy product firms expressed great interest in continuing to support the implementation of the elearning programs designed for this study for future use. Due to the data results, further development of the most attractive elearning environment for Austrian pharmacy apprentices will continue to include possibilities for both linear text and hypermedia formats, depending on learner need and learning environment.

Given this particular user population, the research conducted and the data extracted from this study was a credible and reliable source of information for future use. Emphasis was put on basing the study on priorities from various levels. These included Austrian apprentice history, research from elearning and elearners, implementation of new technologies, and EU/Austrian technological regulations and reforms. In addition, the research study was supported on various levels by multifaceted evaluation and analysis. Data was collected in the form of questionnaires, needs analysis, interviews, walkthroughs, pilot and final tests, quotes, testing environment analysis, and professional support of various related parties. From this, final interpretations given in this research may be used for the design and implementation of elearning delivery systems for Austrian pharmacy apprentices.

1 Austrian Education and the Dual System

The elearning programs for this research project were designed from a great deal of information gathered and presented in coming chapters. The basis for this research deals specifically with the Austrian apprentice. For that reason, the following section outlines Austria's dedication to educational excellence, the educational system, and the importance put on vocational streams.

Austria is dedicated to having one of the most unique and practical educational systems in the world. History shows that even in times of political unrest and changing economies, Austria has put great emphasis on continuously modernizing its educational system for the sake of all its inhabitants[1]. This history continues today. The vast support of related Austrian participating bodies, all working cooperatively to move Austrian education forward in time with ever growing economic needs, is the foundation for the success of these programs. Innovative governmental reforms, cooperative social partnerships, and extensive funding[2] ensure steady developments.

One of the main ideas driving the Austrian educational system is implementing programs and high standards that directly parallel Austrian labor and economy. Even now, Austria is continuing to re-evaluate and develop education to match changing times to come. According to the Bundesministerium für Wirtschaft und Arbeit (BMWA), the European internal market is increasingly eliminating national boarders for goods and services, especially with the continuing expansion of EU boarders[3]. This means countries will be required to have their own qualified workforce in order to fully take advantage and develop these opportunities. Challenges such as these form the basis for prioritizing two very successful educational streams in Austria; general and vocational/technical.

General streams guide skilled learners toward professional jobs in academic and medically related fields. Carefully designed and implemented vocational streams make up the majority of Austrian learners, and connect educational objectives directly with business and industry

[1] Cohen (1996). Cohen firmly establishes Austria's interest in expanding advanced education to all ethnic and religious groups of varying economic backgrounds soon after 1850.
[2] OECD (2001). In 1999, Austria tied with the US for the highest percentage of GDP expenditure for public and private educational institutions at 6.40%.
[3] BMWA (2004). http://www.bmwa.gv.at/BMWA/default.htm

through the classroom as well as the workplace. The result of these efforts is an ever-growing competent force of highly skilled, practice-orientated workers.

The Austrian vocational educational system marks the foundation for the research presented in this paper. For that reason, a clarification of vocational education streams is warranted, and illustrated in Figure 1: *Austrian Vocational Education Streams*. In combination with general learning objectives, vocational education supports professionally specialized training through higher trade schools, technical and vocational schools and colleges, and apprenticeship programs. Now, thanks to various forward-thinking educational reforms[4], learners are no longer permanently committed to one track or the other. Mechanical engineering, for one, offers no less than 10 different forms of specified training. After certain specific leaving requirements are met in any of the general or vocational educational programs, options are available for all through many public and private institutions in order to hone vocational career skills further or attend higher education institutions such as universities. Almost three-fourths of all Austrians take advantage of the wide choice of vocational and higher educational options[5]. To better understand the education possibilities available to learners, and to trace specifically the role of vocational education streams, an overview of the Austrian school system is necessary.

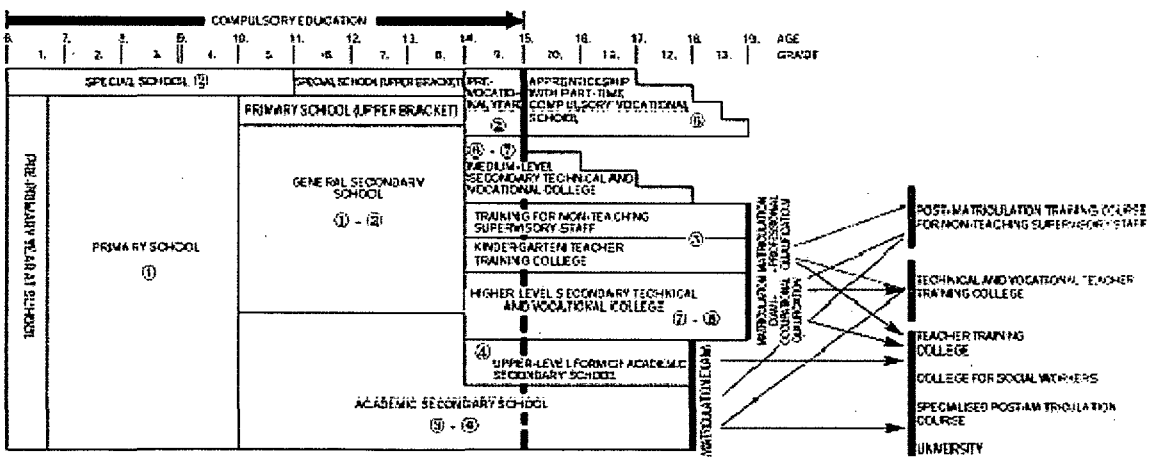

Figure 1: Austrian Vocational Education Streams[6]

1.1 The Austrian School System

[4] Section 2.1 *Elearning Austria.*
[5] Austrian Business Agency (2004). http://www.aba.gv.at/de/pages/
[6] Federal Ministry of Education and Cultural Affairs, Austria (2000). Information on Educational Opportunities in Austria, 47th Ed., Eugen Ketterl GesmbH Verlag.

The Austrian school system is designed to make the most out of the interests and capabilities of the learner, as well as prepare them for individually complimentary positions within the workforce. For that reason, the school schema begins with the non-obligatory pre-school at age 5, and obligatory primary school, or Volksschule from ages 6-10, to the more complicated options available after age 14. German is the main language of instruction, although Austria leads the European Nation in emphasis on foreign language knowledge, most significantly English[7].

Grade school education, first introduced in Austria in 1869[8] begins to divide at age 10, where students choose a Hauptschule. These are divided between the lower less academic secondary school, known as the Mittlere Grundschule (MGS), or the Allgemeinbildende Höhere Schule (lower academic secondary school), or Unterstufe (AGS)[9].

Currently, primary and secondary educational systems are both based on the Austrian School Law of 1962. Before the 1962 reform, a rigid two-track system in the compulsory levels kept over 90% of school children in the Hauptschule. Here, students were directed according to academic performance as well as parental background, income, and social status to follow apprentice and technical tracks[10] without access to other educational streams. Naturally, most learners in the university tended to be boys that came from upper-middle to upper class families. The majority of the population of farmers and middle to lower class families were then grossly underrepresented. This antique educational system tended only to reinforce traditional social structures rather than encourage social mobility.

Since 1962, all state-funded schools must cater to learners regardless of birth, gender, race, status, class, language or religion, which has subsequently affected the incredible flexibility and mobility unique to the system today. No longer are such extremely rigid tracks used, and enrollments have shifted to include a greater population of female graduates.

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[7] According to the BMWBK (2003). Austria was well prepared for the 2001 "European Year of Language Learning" ahead of time. Since 2000, 96% of 10-19 year olds are trained in at least one foreign language. Pre-vocational year graduates have received an average of 800 hours of English training. Ever since the 1996/1997 school year, English lessons are an obligatory part of all apprentice programs.

[8] Austria Café (2003). http://www.austria-cafe.com/education.htm

[9] The lower level AHS further offers three educational divisions; general education, or Gymnasium, science-based, or Real gymnasium, or home economics based, or Wirtschaftskundlisches Real gymnasium.

[10] These tracks were divided between the „A Group" which were directed to 2-4 year vocational technical training schools, and the „B Group", who were directed to an additional year of compulsory education and then to an apprenticeship program or to the workforce.

Despite the high percentage of AGS learners concentrated around Vienna[11], 2/3rds of all learners in federal Austria attend MGS-type schools. To account for this, streaming decisions are sometimes also formulated around geographical location, as distance between house and school plays a significant factor outside the major Austrian cities[12]. In rural regions, 80-90% of grade schools are MGS related, while major cities have extremely high percentages of AGS enrollment mostly due to learners who are able to commute into the city to attend AGS schools. Both AGS and MGS students are required to attend school until age 14.

At the same time, students with special needs have access from age 6 to 13 to the Sonderschule, after which they may choose to attend a pre-vocational, one year Lehrgänge program at the Polytechnische Schule. The Polytechnische Schule is also often attended by those students, mostly from regular education MGS and special education streams interested in vocational education positions such as apprenticeships. This year acts as the "final touch" of general education, and offers information on various types of professions as well as practical lessons in workshops. Students receive an overview of practical preparatory needs for employment, while at the same time finalize their compulsory education. Other options for the last obligatory school year may be fulfilled by a first year of technical college, one year trade schools, or first year AGS- Oberstufe[13].

1.1.1 Post-Secondary Options

After the completion of lower secondary schools, most learners are offered, according to needs, abilities, and interests, four main educational programs within the regular education and more popular vocational educational systems: upper level academic secondary, a variety of technical vocational colleges, trade technical/vocational schools (TVE's) and dual-system apprenticeships.

Upper level academic secondary is for those students most likely coming from the AGS-Unterstufe[14]. This population comprises approximately 19% of learners[15]. Non-university

[11] Schmidt (2003). Approximately 50% as of 2001.
[12] Flippo (2003).
[13] There are also other options including programs for kindergarten teacher training and non-teacher supervisory staff careers (BMBWK, 2004).
[14] Schmid (2003). Approximately 70-80% are fed by AGS schools.
[15] ISCED (1996). http://www.statistik.at/fachbereich_03/bildung_tab4.shtml

studies are more directed to technical and vocational interests. There is also an extensive amount of adult and post-secondary vocational options for learners and professionals of all types.

Other popular post-secondary options for learners holding the necessary leaving certificates include specific training colleges such as Pädagogische Akademien, or teacher training non-traditional studies such as Seniorenstudium for senior citizen directed courses or Fernstudien (distance education). Fernstudien has been provided in Austria since 1979 by the Interuniversitäres Forschungsinstitut für Fernstudien[16]. This institution has direct links with all universities, and provides special distance learning classes for adults seeking jobs. Learners interested in distance learning options may also study through the Fernuniversität Hagen, which offers various degree courses at Austrian based centers in Linz, Bregenz and Vienna.

The Fachhochschulen-Studiengänge, or Higher Vocational Program college was introduced in 1994. Learners train to become high level technicians in fields such as electronics, international business, software engineering, assembly automation and multimedia. During the 2003/2004 winter semester, Fachhochschulen offered 141 courses attended by 20,591 students. Since 1995, approximately 10,000 students have successfully completed the program.

1.1.2 Austrian Vocational Education Streams

For the rest and majority of learners with heightened interests or capabilities in vocational education training (VET), a wide array of other possibilities are available within the Austrian higher school system. According to Arthur Schneeberger, expert from the Institut für Bildungsforschung der Wirtschaft (IBW), the Austrian vocational system is not only a known but a documented success, due in part to international comparison data gathered by the Organization for Economic Co-operation and Development (OECD) research program. Austria holds the highest attendance in the VET streams of any other European country with 81%[17]. Within Europe, Austria also has the highest participation rate of VET students ages 15-18, at an average of 67%. For the last two decades, VET schools and colleges have continued to experience a steady rise in student enrolment, due to carefully organized

[16] Under the University Studies Act (1999). Austrian universities can also implement distance learning classes.
[17] Schmid (2003). Leaving Vienna aside, between 79-85% of all learners choose vocational streams as of 2003.

curricula, an array of various stream possibilities and on-the-job experience. Standings such as these support the impressively low rate of youth unemployment in Austria[18].

Technical and vocational schools and colleges may be attended directly after the 8th year of compulsory education, or with a grade 9 leaving exam from a bridge-gaping school such as the Polytechnische Schule. Almost 90% of learners that attend these schools and colleges come directly from MGS grade schools[19]. The main objective of VET schools is to focus on initial vocational training learners can use to move further in education or more oft, join the world of work. In most cases, these schools can be used for full-time study, ½ time study, post-secondary study, or evening classes for the unemployed. Popularity of these schools seems to be regional. As of 2001, percentages differed from a relatively low 25% in Burgenland, to a relatively high of 45% in Tyrol. Adults have additional access to VET open and distance learning classes, which may more conveniently meet time and personal responsibility needs. All in all, VET school streams can be divided into three main sectors: VET colleges, TVE, and dual system apprenticeship programs, which are specifically further emphasized in the following section.

Technical/vocational colleges include 5-year, secondary upper-level programs that are offered mostly at technical colleges, or Handelsakademien. Technical colleges have recently been gaining popularity, and approximately 23% of current Austrian teenagers opt for this stream[20]. These programs, known as Höhere Berufbildende Schulen (BHS), offer various options in study emphasis. Students from both the lower secondary school, but also the lower academic secondary school usually attend these programs[21]. These schools offer general education, technical theory and practical training in a workshop, laboratory, kitchen or enterprise. Students are also required to spend time in a work placement for approximately 4-24 weeks. The education here presents graduates the qualifications they need to enter the workforce directly or enter the university or post-secondary options previously explained. To do so, graduates must most commonly complete their Matura and Reifeprüfung[22] at the end of their studies.

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[18] EUROSTAT (2003). http://www.eudatashop.gov.uk/coverage/austria.asp
[19] Schmid (2003).
[20] BMBWK (2004). Despite the popularity, approximately 45% of enrolled students drop out of these programs.
[21] Although most educational streams run directly through the school system plan, it is possible, but unusual, for learners to work through on a less liner path (e.g. Hauptschule to upper secondary academic).
[22] AACRAO Handbook (2001). Entrance requirements may also include Berufsreifeprüfung, Studienberechtigungsprüfung, or other qualifying exams such as in the arts. http://www.aacrao.org/

TVE's include programs that usually bridge the gap between compulsory education and further training. Examples include Haushaltungs-, and Hauswirtschaftsschulen (home economics school), that lead to further training mainly in the service and health sectors, Land- und forstwirtschaftliche mittlere Schulen- weiterführend (further domestic middle school) for farming, forestry and agriculture, and Mittlere Berufsbildende Schulen (occupational middle school). Mittlere Berufsbildende Schulen are full-time vocational training programs for those interested in technical, crafts, commercial or service sectors, and comprise the majority of trade school type streams. In most cases, these programs include a summer placement in an enterprise to enhance theoretical and technical knowledge gained in the classroom.

1.2 Apprentices

Apprenticeships in one form or another have been around since the Middle Ages, mostly in the popular form of young males under the supervision of their Master craftsmen. Skill guilds formulated stipulations for these learners, and in time experience and knowledge would support their advancement to Journeymen and Masters themselves.

During the 19th century, the Austro-Hungarian Empire created organized academies of commerce from traditional apprenticeship occupations. These Musterkontor or practice offices allowed students to carry out career-related duties, and practice future responsibilities[23]. Schools such as these were then seen as "sensible supplements" to apprenticeship training rather than required institutions, but clearly lent to the Austrian antecedence to vocational education. Soon after, part-time vocational education schools were formed, and by the early 20th century, became an obligatory part of apprenticeship programs. Priorities such as these continue to form a strong history of support for Austrian education and labor throughout the last few centuries. Since then, Austria has developed high standards of excellence and open interest party collaboration in order to continue the process. Alongside Germany and Switzerland, Austria shares one of the most regulated apprentice systems in the world, which underlines the commitment and dedication given to these programs[24].

Although apprenticeship training in Austria has seen diminishing enrollment since 1981, figures began to rise again beginning in 1997 after the Lehrstellenlücke (apprenticeship

[23] Swartzberg (2000).
[24] Lassnigg & Schneeberger (1997).

crisis). During the Lehrstellenlücke, the gap between apprenticeship openings in companies and those in demand increased significantly. Concerns included ideas that the apprenticeship system was too complex and inflexible to the needs of future labor market changes[25]. Now, the Austrian apprenticeship training programs are open to anyone who has completed compulsory school. As of 1998, an additional unique apprenticeship path was introduced for those with special needs. The pre-apprenticeship, or Vorlehre, extends the first apprentice year into two, allowing special emphasis on transitional needs. These years are also directed towards graduates of the Sonderschule, or those who rated poorly on final compulsory school exams. As of 2003, some 42% of these learners came from polytechnic schools and 1/5th directly from the Volksschule[26].

In all, approximately 40% of all vocational education learners across Austria enter dual system apprentice programs, also known as Lehre-Ausbildung[27]. Here, students are trained as apprentices for specific occupations and acquire knowledge and experience both in the school and on the job, thus the name "dual system". This system supports the learner by binding them under a legally recognized contract to the school and the company, where they are employed and paid.

1.2.1 Apprenticeships

Apprentices are only allowed to be trained in legally recognized trades published by the Bundesministerium für Bildung, Wissenschaft und Kultur (BMBWK) in collaboration with the Bundesministerium für Gesundheit, Arbeit und Socializmus (BMGS). This Lehrberufsliste, is developed by additional cooperation from the Bundesministerium für soziale Sicherheit, Generationen und Konsumentenschutz (BMSG). Occupational lines include technical, commercial, craft, service, agricultural and forestry fields. Despite the current 275[28] accredited apprenticeships, about 90% are trained in only 50 occupations[29]. Among these apprenticeships, gender segregation is extremely high. Many male apprentices

[25] Hofer & Lietz (2002). The BMWA does also note that apprenticeship data follows birth-rate numbers during these years.
[26] Schmidt (2003). The remaining 28% came from other school forms, were repeaters or had changed apprentice foci.
[27] Hofer & Lietz (2002). As of 2003, Styria held the highest percentage of apprenticeship learners at 60%, followed by Tyrol, Upper Austria and Vorarlberg.
[28] There are an additional 14 legally recognized apprenticeships in the forestry and agriculture sectors not listed.
[29] BMWA (2002).

choose more product orientated occupations, while the 36.9% of females[30] usually choose sales and service related programs. More specifically, about 70% of all female and 42% of all male apprentices are trained in only 10 trades.[31]

An apprenticeship program begins with the signing of a Lehrlingspakt in accordance with §30 of the Berufsausbildungsgesetz (BAG), or Vocational Training Act. Despite the emphasis on the agreement, qualification requirements for each occupation are continually subject to change. This more dynamic formulation allows companies and schools to adjust training to parallel technological and pedagogical changes as they occur. Most students in their Volkschule years already secure an apprenticeship placement through the Arbeitsmarktservice (AMS). Further assistance may be gained through the Lehrlingsstellen (apprenticeship offices) or through the Wirtschaftskammern (regional economic chambers).

1.2.1.1 School and Work

Full descriptions of apprenticeship career options, known as Berufsbild define specifics of each of the occupations and program lengths. Approximately 50% of learners are in two to three year apprentice programs[32], although those students with prior experience and certification may have their programs reduced[33]. The majority of apprenticeship programs last three years[34].

Learning takes place both in the workplace for approximately 75-90% of the time, and in a part time vocational education school for one or two days a week, for two-five years. Companies have the responsibility to train apprentices when at their facility. Approximately 40,000 companies of various sizes train some 120,000 apprentices, with more than 50% of these programs leading to craftsman trades[35].

Vocational schools, or Berufsschule, must be attended on a part-time basis by apprentices according to the training agreement and the Schulpflichtgesetz, or Compulsory Schooling Act.

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[30] Nowak (2001).
[31] BWMA (2002). Great efforts are being made to increase vocational guidance and information, and revisit occupational profiles in order to smooth this gender gap.
[32] BMBWK (2004).
[33] BWMA (2002). Since 1987, students with a prior Reifeprüfung certificate are allowed reduced terms and sometimes greater occupational choices.
[34] BMWA (2002).
[35] BMBWK (2004). Other significant apprentice populations include commerce (16%), industry (11%) and tourism and leisure (10%).

Schools are designed in three different forms; the day-release, where students attend for a full, or two half-days per week[36] for an academic year; block-release, that have classes for four to eight weeks in a year; or the seasonal-release, where classes are only in a specified season. The aim of these schools is to provide theoretical, focus-orientated knowledge as well as information that will compliment students on the job experience. In addition, schools must prioritize preparation for the final completion exam throughout the curriculum. Overall program objectives include civics, business education, and occupational related studies. Many amendments to the School Act have been made to improve the educational system over the years. During the school year 1990/1991, "occupation-related foreign language" (English) was made obligatory for all apprenticeship occupations. Two years later, "German and communication" was also introduced in hopes to increase native language skills.

1.2.1.2 Leaving

After the contracted apprenticeship training time, learners participate in the Berufsreifeprüfung. This external exam consists of four parts; German, mathematics, foreign language and the occupational subject[37]. These documents allow holders to enter additional programs of interest if they so choose.

Apprenticeship graduates also have the luxury of mobility. The Lehrabschlussprüfung, or Apprenticeship Leave Exam[38], can be used as a prerequisite to the Master Craftsman Exam, and also the TVE exam[39] that allow access to post-secondary college classes, courses, Fachhochschulen, and even later universities. The Internationaler Fachkräfteaustausch (IFA) is also entrusted with various incentive program guidelines to encourage both those learners choosing apprenticeship programs, and those who have completed their learning. As of a 2002 micro-census "Statistik Österreich" study on traditional apprenticeship leaving activity, 28.5% of graduated apprentices are skilled specialized workers, 23% have white collar positions, 11% are self-employed or assisting self-employed, and another 11% are semi-skilled workers. Only about 4% of former apprentices are documented as unskilled.

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[36] Either 9 hours on one day, or up to 12 hours twice a week.
[37] The occupational subject test may be waived on presenting a Master Craftsperson Diploma, a certificate of part-time industrial master colleges or a certification from a specialist college or Fachakademie.
[38] This exam is completed in oral and written form, and covers practical and theoretical knowledge.
[39] Or also with the Higher Education Entrance Exam.

2 Vocational Education and Electronic Learning

Clearly, Austria exhibits a history of commitment toward the best education possible for its inhabitants. With this in mind, it is not surprising that technology now plays a significant role in this process. Austria promotes learning through technology in many facets and to various populations. This promotion has come through commitments by individuals, universities, and organizations as well as governmental funding and reforms. Such programs provide opportunities for learners to not only learn for present need but also to ignite an interest for continued learning for the future. A will to learn beyond formal education is essential for a knowledgeable society at all stages and levels, and is most commonly referred to as life-long learning.

In the vocational education sector, elearning has had particular impact. Various types of elearning programs and systems have been implemented to support life-long learning from first year apprentices to adult learners and continuing students. Elearning has further made the transition to the work place through regular reference and training programs as well.

2.1 Elearning and Life-Long Learning

Austria has shown a deep commitment to life-long learning and new technologies. Many agree that elearning is in particular an essential element to the future of life-long learning[40]. These efforts support successful and effective learning innovations for general and especially vocational education streams. Life-long learning is a key component to a knowledgeable society[41]. In the past education was seen as separate from the rest of a persons' life. When formal education stopped, a work career began. Since then, societies have realized the speed of knowledge makes previous formal education obsolete, and a growing population of creatively thoughtful, continuously knowledgeable citizens are needed[42]. This transcends life-long learning into not only a consistent variable in a society, but also a life-time career in itself. Life-long learning must be encouraged and motivated, self-regulated, and expected for it to continue as a normal necessity of a knowledgeable society.

[40] Rebernig (2000), Magnus (2001).
[41] Fischer (2000).
[42] Gardner (1991).

Elearning environments in particular can play a significant role in allowing citizens access to life-long learning skills on many levels. Diverse population groups can find and use material relevant to their own needs and personal goals. Additionally, elearning environments can provide variations for multiple intelligences[43] and meaningful career-related tasks and cognitive development skills. Fischer[44] has organized a list of various ways elearning and technology-based learning environments can support life-long learning. These include:

- Allowing learners to set some of their own goals
- Integrating real-world vocabulary, practices and environments into the system
- Attaining learning objectives through fulfilling commitments and problem-solving
- Having tasks and activities that reflect real-world situations
- Ensuring expert resources are at hand
- The inclusion of case-study like similar situations on which to refer back to
- Developing situations to allow re-visitation and reflection
- Integrating interactions among people and characters
- Supporting individual performance as well as cooperation

Due to the fact that life-long learning is a continuous process, any elearning environments should likewise be designed with an open-endedness in mind. Naturally, this means such environments should be solidly grounded in learner theory and design research. In addition though, these environments must not confine the learner to tight virtual walls, but support their desire to continue life-long learning goals for their own. Such environments should then allow designers to make additions and refinements to learning systems that reflect the development of the learner.

With the continuously growing use of elearning programs and technologies, life-long learning is becoming more accessible to all. By becoming more accessible, and likewise more commonplace and understandable, elearning environments are motivating more learners than ever. In turn, this supports the motivation necessary to drive increased knowledge and broader understanding throughout one's life. Governmental initiatives that support life-long learning efforts in Europe are now one of the most committed and strong in the world[45].

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[43] The topic of multiple intelligences continues in section 4.2.2 *Multiple Intelligences.*
[44] (2000).
[45] Dunn (2001).

Concerns about a weakness in information and communication technology throughout Europe's citizens formally encouraged discussion conferences at Lisbon in March of 2000, Stockholm in March 2001, and Barcelona in March of 2002. These conferences ignited the "eEurope 2002-action plan" their aims were outlined which included; all state members must support internet access and multimedia education material, all must ensure faculty staff are trained and qualified in internet and multimedia material, and all schools must be connected to a trans-European high-speed internet email access[46].

On May 5th, 2003 the European Commission published findings from the "Eurobarometer"- a European survey on life-long learning implemented between January 15th and February 28th[47]. The study looked at 15 countries and recorded more than 18,000 face-to-face interview results. At that time, the Commission found that while 90% of respondents considered life-long learning very important, many thought they did not have the time or money to become involved in such efforts. Many preferred to have life-long learning options at home in a non-formal context. Although these findings would support elearning implementation, half of the respondents said they could not use the Internet and only 58% said they were comfortably able to use a computer system. Due to these results, the Commission requested Member States to submit national reports marking related life-long learning data in their countries. These papers were compiled together in November 2003. Further data collection and analysis should continue to encourage and support life-long learning efforts for the future.

2.1.1 Austrian Education and Electronic Learning

Quite at the onset of elearning history, forward thinking Austrians such as Dr. Walter Berger already began to contemplate the benefits of education and electronic learning. In 1987 Berger wrote *England's Open University* as part of a longer series entitled, "Schriftenreihe Fernstudien als Universitäten". In his piece, Berger discussed distance learning and open universities, but more specifically in terms of Austrian opportunities and needs. Through the text, Berger summarized the concept of engaging a large number of learners with limited academic experience and pondered ways curricular and technical developments could support those learners. Berger went on to develop a theoretical plan for a successful working distance

[46] Eurydice (2004). http://www.eurydice.org/
[47] Elearning Europa (2004). http://www.elearningeuropa.info

learning program in Austria[48]. The argument for his plan was developed in terms of educating a needed population of industry workers for now and into the future, further emphasizing the commitment to life-long learning.

Since then, Austria has made great efforts to develop and implement successful, relevant elearning for many different population groups in various areas. Many of these efforts hold a foundation in the national and international reforms. Yet even before most distance learning conferences became popular, Austria began actions that continue to support elearning today. In 1970 the Österreichischen Fernschulverband (ÖFV) was founded to support the development of government and proprietary distance training in Austria. With the evolution of technology, the ÖFV also moved forward to support elearning as well. From its founding, the ÖFV has strongly supported high standards and quality. Currently, nine member organizations fall into the category of distance learning, which now include all aspects of elearning.

These members include: Berufsförderungsinstitut Wien (BFI)- a distance education college for the Austrian Council of Trade Unions, Rehabilitations Zentrum Linz (BBRZ)- distance learning facility for people with challenging needs, SPIDI- a distance learning provider for the Austrian Employers Federation that closed in September 1997, Bundesministerium für Landesverteidigung (Defense Ministry)- distance learning for military, related staff, Red Cross and fire brigades, The Fernunterricht im Österreichescher Bundesheer (Austrian Federal Military Distance Education Institute) who did voice to the European distance training research project (VOCADE) that distance learning should reported, and should not be considered an alternative, but instead a complement to traditional face-to-face learning, Ferntechnikum Bregenz- a technical college that closed its distance learning program in 1997, Technik und Informatik (IBZ)- the Austrian branch of a Swiss distance learning provider, The Institut Fernkurs für Theologische Bildung- a church owned distance learning program, Maturaschule Dr Roland- private distance learning college that adopted SPIDI courses in 1997, and the Verband Wiener Volksbildung (VWV)- a distance learning program that also has elearning supported by city of Vienna[49].

[48] Benham (1990). Berger even goes so far as to suggest the Klagenfurt Center for the Study of Educational Economy and Sociology as an appropriate location in Austria.
[49] The largest Austrian distance learning provider, Humbolt Institute, is not a ÖFV member.

Elearning innovation and interest in Austria has continued to increase over the last few years. According to the International Data Collection (IDC), Austria grew from an elearning skills training market value of 80 million ATS in 1999 to approximately 2.7 billion ATS in 2004[50]. In 2001 alone, over 52% of Austrian households reported having at least one PC[51]. The Austrian Federal Government and the City of Vienna have developed the Österreicher Zentrum für Selbststudium und Fernunterricht (ÖZSF) that attempts to establish both distance learning and elearning for public interest. Now too, the ÖZSF has extended to link resources with the Verband Wiener Volksbildung (VWV), a distance learning division of the Vienna Popular Education Association.

Numerous programs and platforms have been developed in diverse areas to support elearning for Austrian citizens. The Universität Krems provides a "Green Academy" that offers 60% of its program through elearning. St. Anna Children's Hospital in Vienna implemented the project, "E-Learning for Children with Cancer". This project allows in-patients to "attend" regular classes with peers with elearning technology. Also for the past two years, Austria has implemented Telelernen für Haftinsassen (TELFI), allowing inmates the opportunity to develop themselves positively as well.

2.1.2 In Support of Goal 2010

Since similar recognized concerns from conferences in Lisbon, Stockholm, and Barcelona, European Commissioner Viviane Reding proposed 36 million EURO funding over the period of three years for the eLearning Programme in EU education. This would help integrate information and communication technologies through elearning methods throughout Europe and the world. This was supported by the eLearning website portal unveiled at the "Learntec 2003" conference in Karlsruhe on February 4th of 2003. The portal provides information for elearning users and content providers on EU initiatives and links to public and private sector elearning initiatives around Europe, expert assistance, information on events and conferences, contacts and glossaries. Continuing on this objective, the Commission also adopted a proposal on December 19th, 2003 to energetically enforce the use of new information and communication technologies (NICT) in order to improve access and quality of elearning-based education and training.

[50] Bankhamer (2001).
[51] Nielson (2001).

In support of the 2010 EU goal to be a "world quality reference for education", many programs and initiatives have begun. These programs fund education and training EU-wide and are supervised by decentralized governing parties, with national counterparts in each participating country. The Socrates program for example is divided into several parts, one of which is the Minerva[52], which focuses on open and distance learning, multimedia and the use of Information Communication Technologies in education in order to improve learner knowledge, skills and competences.

The Ministry of Education and Training in Austria has also developed a large-scale IT initiative called "eFit Austria". The mission of this project is to tap new technologies, that mainly concern elearning with a vision to upgrade teaching and learning, so knowledge is accessible at any time at any place and prepares young people for future IT careers. In the educational fields, the dimension of elearning encompasses, "learning, teaching, research for a networked knowledge-based society". A total of EUR 1 million has been spent by 2001 on the 87 projects approved from 140 applicants. This action ran until mid 2003. The "eLearning and eTeaching in notebook/PC classes" program is also proving increasingly popular. 2,500 students have enrolled in 90 notebook classes at over 60 schools through 2001-2002, and are to be joined by 10 vocational schools with a particular bias towards commercial occupations in fall 2002.

The eEurope 2002 action plan lead the Austrian government to form the idea of "eAustria" with the motto, "Learn-Teach-Research for a networked knowledge society". This project was aimed to further technology research in Austria and create a databank of such activities from 2001 to 2003. eAustria has 8 project focuses to accomplish their aims; teaching new media forms, supporting IT education, the e-learning portal and electronically supported curriculum materials, science and research in the IT field, further training in elearning areas, a growing cyberspace culture, e-government in education, and a clear IT infrastructure[53].

2.2 Vocational Education Reform and Administration

A very important feature of the Austrian apprenticeship system is its institutional framework developed from a history of commitment to educational excellence. This history supports the

[52] Europa (2004). http://europa.eu.int/comm/education/programmes/socrates/socrates_en.html
[53] Eurydice (2004). http://www.eurydice.org

strong ties between vocational education and elearning today. Dating even before the 1365 establishment of the Vienna University, steps have been made to encourage quality and advancement of learning streams through careful administration, legal guidelines and amendments. Today, a large number of bodies are involved in the decision making process concerning vocational training and education in Austria. The following timeline explains the most significant dates in Austrian education development with a particular emphasis on vocational education.

2.2.1 A Vocational Timeline

Due to the necessity of vocationally trained workers for a growing, stable economic development, vocational education interests have been intertwined within learning laws in Austria since the time of Empress Maria Theresa. For many years before that, guilds supported the skilled apprentice worker, and held their own regulations and standards for specific occupations. In 1774, the first General School Regulations were formed. By 1859, the Gewerbeordnung (Industrial Code) required self-employed workers in specific occupations to pass certain qualifications of excellence in order to continue practicing- supporting the idea of professional excellence while weeding out apprentices with questionable skills. During the same time, full time vocational education schools were organized as non-obligatory streams for those interested in work-related tracks or as a supplement to apprenticeship training.

The Compulsory Education Act of 1869 for learners in both primary and secondary school was a changing point in educational history, mandating schooling for all. Although part time vocational education schools became mandatory supplements to on-the-job training in the latter part of the 19th century, the strict two-track academic/vocational system was still very much in play up until the early 1900's.

At this point, vocational reform and law began to change, most significantly with the 1962 School Law, which finally set the legal basis from the Compulsory Education Act. Within this Law, the role of vocational schools was legally secured in §46 of the 16th Amendment of the Schulorganisationsgesetz (School Organization Act). After the Schulorganisationsgesetz, general and vocational reform acted as supporting bodies for each other, and many amendments and concerns in one area held water in the other. The 1966 General Law for

University Education and the 1975 University Organization Law both developed a legal framework for university education that helps support institutions within the vocational sector, such as Fachhochschulen, developed in 1994.

Two Acts, also in 1994, played a significant role in increasing interest in the vocational sector. The Kinder und Jugendlichen- beschäfligungsgesetz (Children and Young People's Employment Act) protected apprentices with age restrictions. The Ausländerbeschäftigungesetz (Employment of Foreign Nationals Act) laid specific conditions for foreign employment. Along this background, the Vocational Training Act of 1969 created a solid foundational basis for the importance of vocational training in Austria on the whole. That, in addition to the 1995 inscription of Austria as an European Union member, launched an explosion of vocational developments and collaborative efforts, with many of the current reforms building off these initial themes to this day.

Despite national, and EU member cooperation for vocational concerns, the apprenticeship sector in particular hit an all time drastic low during 1997, commonly known as the Lehrstellenlücke. This drop in apprenticeship interest was countered by a number of efforts to assist the forward movement of vocational education as well as economy. During the year 1997, the New University Education Act proposed to allow representatives of management and labor in university decision making processes as social partners. CEDEFOP launched its first EU vocational education study on financial profiles of individual countries in hopes to shed better light on strengths and challenge areas. Also, the Austrian government in partnership with social partners introduced the first modern wave of new apprenticeship occupations in hopes to build interest in this vocational area. Profiles were introduced with reduced time durations of only two years[54], and a training initiative called "der Jungend eine Chance" supported issues such as; financial support for small to medium sized enterprises, additional courses, more seats in secondary technical colleges and schools, more places in training institutions, and more apprentice occupations in the public sector.

Since this time, the momentum of reform in the vocational education sector has not ceased. In 1998, Austria introduced an introductory year for those persons with special needs interested in apprenticeship careers. The National Employment Initiative introduced a series of new measures and a continuation of proven measures for apprenticeship quality. These

[54] Still under great criticism, these shortened apprentice occupations mostly failed until 2000.

included provincial laws for the support of employees and promotion of continuing vocational training at the regional level. The Jungendausbildungssicherungsgesetz (Youth Training Protection Act) created reasonable measures to protect youth within the framework of the National Employment Initiative.

As touched on briefly in section 2.1 *Elearning and Life-Long Learning*, 1999 brought with it perhaps the most significant modern development proposal for vocational education both nationally and for the EU community. On June 29th, various country representatives including Austria met in Bologna to discuss making the EU the best example of education in the world by the year 2010. This statement created a surge of additional conferences and councils, motivated by the will to develop national quality and standards in order to fulfill the Bologna mission statement.

In March of 2000, the European Council in Lisbon worked off the initial wishes of Bologna to set goals for the EU to become "the most competitive and dynamic knowledge based economy in the world". Various follow-ups to this conference included the 2001 Communication on Life-Long Learning, a 2002 Objectives Report, and the combined 2001 Bruges-Initiative with the 2002 Copenhagen conference. Here, goals included the establishment of a European education and training area, and the establishment of the EU as a world reference for modernization and elearning as a change tool to achieve goals. This included the launch of the eLearning initiative and the elearning Action Plan. Lisbon was echoed by Austria's National Action Plan of the same year. Here, in response to EU employment guidelines as mentioned at Lisbon, the Lehrlingspakt was created as a contract guideline for apprenticeships in addition to the second modern wave of 17 new apprenticeship occupations.

A Barcelona EU Council meeting in March of 2002 continued to underline Lisbon and set objectives to make education and training systems in the EU world quality references by 2010. Continuing efforts in the march toward 2010 have included a September 2003 review of Bologna in Berlin to set specific priorities. These included higher educational access for all- including vocational streams, more study abroad grants, removal of all mobility obstacles, quality assurance, recognition of all degrees and vocational certificates and closer links between education and research. 11 additional countries accompanied the initial 23 at this meeting. A second review is set for May of 2005 in Bergen, Norway.

Considerable advancements have continued through the past year. In October of 2003, the EU Parliament granted 44 million EURO for the eLearning program for the years 2004 through 2006, including general and vocational efforts throughout membership states. In November, the Declaration of the European Ministries of Vocational Education and the European Commission, or "Copenhagen Declaration" supported Barcelona/Bologna on the 2010 goal and developed a commitment to promote trust, transparency and recognition of vocational competence. In December of 2003, the EU Commission adopted a proposal for the use of new information and communication technologies (NICT) to improve quality of and access to education and training vie "elearning". The Commission hopes to allocate 36 million EURO over the next three years, responding to Lisbon, Stockholm, and Barcelona EU Councils specifically for better use of NICT in education and training for social cohesion and EU 2010.

2.3 Vocational Education and Technology

It has been previously mentioned that many of the first attempts at distance education were driven by vocational needs. Since the time miners received safety information through penny post correspondence, much has developed in terms of technological delivery. In the early years, many vocational programs hesitantly began using limited forms of elearning technologies. Cognitive Training Associates, Inc. used the Internet to distribute technology-based training applications such as core skills, reinforcement, knowledge transfer and sharing, and on-demand expertise[55]. Specific schools in Finland and Israel have participated in real-time conferences and discussions concerning farm subsidies, importing, trade issues, and the EU[56]. These new innovations continue to play a large role in vocational education for the future, yet initial challenges to implementing technological learning systems still seem apparent. According to Seguin and Seguin, "The Internet's usefulness is limited only by our level of commitment. We first have to get plugged in before we can get turned on. Then we can help our profession by using our imagination to create a vocational educator's Dream Net in the years to come."[57]

2.3.1 Research in Career and Technical Education and Elearning

[55] Brown (1995).
[56] Rainwater (1995).
[57] (1995).

Over 20 years ago scholars began publishing recommendations that more research in the area of career and technical education (CTE) was needed[58]. Wonacott[59] has recently made a point that specific areas of accessibility, costs, effectiveness and appropriateness are necessary research topics. In a 2003 study[60], of 71 literature articles on CTE, only 5 mentioned quantifiable variables, while most studies examined student access, demographic characteristics, and learner perceptions. More recently, studies have been done concerning teaching CTE and teacher education programs[61].

Research has shown that a great many vocational education students that choose electronic learning methods are women[62], slightly older than those choosing traditional campus classes[63]. There has been documented literature of vocational education learner perceptions- both positive[64] and negative[65]. Much of this research has presented positive results[66], with a few producing mixed learner perceptions[67].

2.3.2 Vocational Education, Constructivism and ZPD

There are theories and learning models that also reflect vocational education and elearning together. Parnell[68] has noted that the philosophical position of academic learning is that learning to know is more important than applying that knowledge. In comparison, vocational education first supports doing the task, and assumes knowledge will come later. Recent research in vocational education reveals that most learning situations are grounded in constructivist, situated learning or cognitive apprenticeship theory[69], as further discussed in section 4 *Designing Elearning Environments*. Most elements of constructivism are seen in technical preparation courses, school-to-work programs, and blended vocational and academic education. Studies have shown that when learners were presented with complex or difficult

[58] Oliveira & Rumble (1982).
[59] (2001).
[60] Zirkle (2003).
[61] Bruening, Scanlon, Hodes, Dhital, Shao, & Liu (2001a, 2001b).
[62] Thompson, Orr, Brooks, & Thompson (2000).
[63] Tucker (2000).
[64] Hilgenberg & Tolone (2000), Wagner, Werner, & Schramm (2002).
[65] Bower, Kamata, & Ritchie (2001), Rivera, McAlister, & Rice (2002).
[66] Dooley, Patil, & Lineberger (2000), Misko (2000), Thompson, Orr, Brooks, & Thompson (2000), and Thompson, Thompson, & Orr (2002).
[67] Kelsey, Lindner, & Dooley (2002).
[68] Parnell (1996), p. 19.
[69] Kerka (1997).

situations, having an expert or peer model understanding and dealing with the situation proved a helpful way to guide their own attempts[70]. Further studies with students of electronics[71], hospital workers[72] and coal miners[73] provided similar results.

Research has shown vocational education focuses exclusively on the learner and their active construction of knowledge. Due to this, Stevenson suggests vocational education should be a learning process rather than a teaching one[74]. The teacher only organizes tasks in order to allow learners to develop their own knowledge and understanding. Under cognitive apprenticeship theory, the teacher also acts as an expert tutor, who provides guidance that gradually decreases as the learners' expertise and confidence increases.

Currently a great deal of effort has been put into connecting Vygotsky's Zone of Proximital Development theories with vocational education[75]. By doing so, it is determined that facilitators can encourage learners to reach beyond their current development levels and strive for higher knowledge and understanding. This can be achieved by facilitating learning one step ahead of the learners' experiences, and allowing learners control over their subsequent choices[76].

2.4 Initiatives and Programs

In the EU, each country is responsible for its own training and education, but collaborative efforts between Member States are valuable sources of research and development in traditional learning as well as vocational. Since the 1992 EU recognition that learning should be a collaborative effort, many projects and initiatives have supported vocational needs that continue today. Many of these projects are technology-based. The following section summarizes some of these efforts.

The Vocade Project[77] is a European vocational distance learning and training knowledge initiative in the European Union. The Vocade survey and analysis is supported through the

[70] Farmer, et al. (1992).
[71] Rahn (1996).
[72] Hart-Landesberg, et al. (1992).
[73] Billett (1994).
[74] Stevenson (1994).
[75] Bockarie (2002).
[76] Hodson & Hodson (1998).
[77] Vocade Project (2004). http://www.fernuni-hagen.de

Leonardo Programme[78]. The Leonardo Programme supports national vocational training strategies and funds many projects that foster improvements in quality and innovation for vocational education. In 2002, the Leonardo program approved 279 projects from 30 participating countries for a total of 89.7 million EURO for themes such as elearning and the use of ICT for life-long learning[79]. Vocade is composed of six goals that include the survey of; institutional provisions, enrolment statistics, market volume, certification, course provision, and transportability of qualifications. Three centers handle surveying the Distance Education International, Ltd (DEI) in Ireland, Zentrales Institut für Fernstudienforschung der Fernuniversität-Gesamthochschule (ZIFF) in Hagen, Germany, and the Laboratorio di pedagogia sperimentale (LPS) in Rome.

The final reports from the Vocade Project were last compiled in January of 1997. These include case studies of distance training including elearning in the EU, national profiles from 15 European countries, and target group discussions such as distance educational possibilities for prison sectors or the disabled. In addition, an array of analytical papers on topics from theoretical analysis of European distance education, to evaluation, teaching, qualification transferability and documentation are included.

The European Centre for the Development of Vocational Training (CEDFOP)[80] supports the development of vocational education and training with academic activities. CEDEFOP supports European life-long learning efforts by providing information and analysis on vocational education and training processes, regulations, research efforts and practices. They also provide an open forum for interested parties to exchange ideas and debate critical themes. For 2003-2006, CEDEFOP has developed medium-term priority guideline activities. These include; improving access to learning, mobility, and social inclusion, enabling and valuing learning, and supporting networks and partnerships in an enlarged EU. CEDEFOP additionally has various products and services available including The European Training Village (ETV), corporate web site, publications, journals, visiting study programs, conferences, and library/documentation resources.

The European Forum of Technical and Vocational Education and Training (EfVET) is the leading network for vocational practitioners in Europe. It is comprised of institutions from

[78] Leonardo (2004). www.europa.eu.int/comm/education/programmes/leonardo/leonardo
[79] EUROPEA (2004). http://www.europa.eu.int/
[80] CEDEFOP (2004). http://www.cedefop.eu.int/

the public and private sectors as well as universities and colleges, departments of firms, national groups, and individuals. This Forum was developed with the support of the European Community and the European Institute of Education and Social Policy. Their mission statement is to ensure the innovative development and enrichment of quality vocational education needs European wide. With the introduction of the EU's memorandum on life-long learning, EfVET prioritized six key actions.

Under key action 2, "New Basic Skills for All", EfVET announced its commitment to the EU Elearning Initiative for those citizens, young and old, who lacked adequate elearning knowledge in today's society. This goal is supported by facilitating access to technical options, informing citizens about benefits to elearning and technology, arranging learning opportunities for digital-based knowledge skills, organizing financial support for those elearning possibilities, and ensuring training for those learners is conveniently based close to target populations. Sub-objectives included encouraging employers to allow employees work-day time for elearning efforts, modernizing technological systems, and programs for low-achieving learners. Clearly, objectives made by all related parties together form a strong foundation of commitment in the area of vocational education and electronic learning.

3 Education and Electronic Learning

Throughout the history of education, electronic learning in any form is fairly recent[81]. The idea of distance learning, one of the earliest, less traditional styles of education delivery, can be determined to have laid the first foundational bricks for the vast array of electronic learning methods we have today[82]. By allowing teachers and students to learn and facilitate in different geographical locations[83], distance learning caters to those with less traditional learner requirements, and at the same time delivers education relevant for the needs of the people. It also allows for the potential of learning opportunities with high standards, high accessibility and lower costs[84]. It is no wonder then, that distance learning has had strong ties with educational systems, and particularly vocational education and training systems around the globe since its onset, and those ties continue with today's elearning opportunities as well.

Although distance learning is said to have begun in Europe in the mid 1800's with correspondence courses teaching shorthand[85], soon after vocational organizations began to see the opportunities correspondence courses could give to their workforce. In 1890, a safety course was delivered to miners, railway and iron workers in the US, creating comfortable learning that ensured more skilled and safe employees[86]. It has also been reported that across the Atlantic even as early as the 1920's, Germany had approximately 1/4th of its university technical graduates certified through distance education[87].

During the later 1900's, an exponential amount of innovations, research, developments and technologies arose making distance learning evolve from pen and paper to the technologies we have today. Projects on learning and technology in the US and England[88] provided successful compliments to Intel's 1971 development of email and the 1991 initial implementation of the World Wide Web by Tim Berners-Lee[89]. These evolutional

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[81] Matthews (1999), Sidebar (2001), PBS (2003).
[82] Moore & Kearsley (1996).
[83] John (2001).
[84] Jones (1999).
[85] PBS (2003). In 1837 Sir Isaac Pitman delivered courses through the „Penny Post" in England.
[86] PBS (2003). The Colliery Engineer School of Miners designed this safety course. The school was later developed into the International Correspondence Schools (ICS), and continues to be the largest provider of home study courses in the US to this day.
[87] Curran (1997).
[88] PBS (2003). In 1964 the University of Wisconsin, a forerunner for learning technology innovation in the States, began the Articulated Instructional Media project (AIM) to incorporate communications media into instructional curriculum. Although the project failed to reach its objective goals, findings led the British Government to successfully found the British Open University in 1969.
[89] Lickliden (1978), Berners-Lee (2000).

connections support the interpretation that elearning falls under the umbrella of distance learning, as do correspondence courses through the mail. Distance learning is simply the educational process by which teacher and student are not in the same physical location[90]. Unfortunately despite the long history of distance learning, there is very little sound research surrounding it. What has been available is usually of questionable quality and validity[91]. This may be due to the fact that early forms of distance education such as correspondence courses only played a small role in education efforts on the whole. With the introduction of the Internet, research in areas of elearning has changed significantly[92].

Since the early days of correspondence courses, elearning methods have evolved quite a bit, allowing greater opportunity for innovation as well as research, evaluation and rethinking to take place. Part of this development has come directly from the learners who wish to pursue degrees without sacrificing families or relocating. Continued developments have also come from legislators and the public who are critical of quality and accountability measures[93]. Naturally technological innovations have also supported this elearning timeline. Combined, these factors help push elearning forward as collaborative efforts to improve current means.

In the wake of these extreme advances, an interesting controversy has arisen which lies at the very heart of elearning; what exactly does elearning *mean*?

3.1 What "elearning" Means

An extensive amount of terminology can be found floating around the idea of alternative learning methods and delivery channels. Many times terms like distance learning, electronic learning, online learning, learning with technology and all the tools in between- telegraph to ITS, satellite to CD-ROM, are confused and interchanged. Various scholars have suggested using and adhering to specific terms and definitions may help support reliable comparative literature on elearning and related topics. Nichols[94] suggests common terms also lay the basis for sound elearning theory, as will be further discussed in section 4 *Designing Elearning Environments*. He specifically suggests terms such as online learning, mixed-mode/blended/resource-based learning, eLearning, learning objects, learning management

[90] Holmberg (1978), Keegan (1983), Steiner (1995).
[91] Phipps & Merisotis (1999).
[92] Paloff & Pratt (1999), Simonson, Smaldino, Albright & Zvacek (2003).
[93] Zirkle & Shoemaker (1999).
[94] (2003).

systems (LMS), interactive and pedagogy must be discussed to find common meanings for study. Throughout this paper, the term "elearning" is used. In this section, an attempt is made to smooth the confusion within the context of comparing and defining elearning, outlining current discussion on elearning as a formal term, and organizing various current technological options one has in order to reach elearning. To begin with, a section is developed noting the most important factor of elearning, namely *learning*.

3.1.1 The Learning Factor

Clearly most educational technology has been designed and implemented to teach, and therefore for others to learn. Unfortunately, there has been a long and rocky history of many technology-based educational and training systems that do not come close to such objectives[95]. Many fall short of delivering material in order to soundly support goals and objectives on a technical and pedagogical basis. Many lack clear theoretical foundations on which to design meaningful and necessary knowledge. Despite this, learning acts as- in word and theory, the heart of electronically-based educational programs and systems, and worth discussing separately from its technological delivery. Unfortunately, scholars themselves seem to have difficulty overcoming the inconsistencies of defining learning, much less consistently and successfully combine learning with electronic means of delivery.

Most educational psychology texts have their own definitions of learning. Although most are similar, inconsistent factors within those definitions are significant enough for one to question the variety. Some definitions take a standpoint that learning is completely behavioral[96], completely knowledge-based[97], or both[98]. Some use broad terms for learning such as "relatively permanent"[99]. Others contend that no one really knows what learning is and choose to not offer any definition at all[100]. Regardless, most professionals do agree that there are differences between behavior and cognitive definitions[101].

What can be said is that learning is a change that surfaces over time through improved cognitive capabilities. These capabilities are attributable to personal observation and

[95] Clarke (2003).
[96] Schunk (2000).
[97] Mayer (1987).
[98] Slavin (1994).
[99] Good & Brophy (1995), Ormrod (1995), Woolfold (1995).
[100] Pressley & McCormick (1995).
[101] King, Young, Drivere-Richmond, & Schrader (2001).

interaction by the learner to the realm in which they are subject. This realm is based on specific intertwined situations[102]. The learning situations may be formally contrived, such as a learner working with a CD-ROM learning program, or informally naturalistic, such as learning not to touch a hot stove a second time. Learning therefore is a greatly dynamic process based on the actions taken by the learner in relationship to these situations. This process continues and grows, and changes the learner thereafter on a completely individual basis depending on their own unique circumstances. These ideas are further developed in relationship to designing elearning environments with theory and the learner process in mind in coming sections.

3.1.2 Elearning and Online Learning

That being said, the second factor in technology-based learning is the technology, but again it is important to emphasize the fact that technology should be secondary[103]. Here an argument between two currently popular terms is addressed; elearning and online learning. It is important to be aware that there are differences between the two before further discussion can continue. According to LearnFrame[104], there are specific differences between the two terms, although they are quite often falsely interchanged. Online learning is only one part of technology-based learning, and most popularly takes the form of web-based learning. That is to say, it is learning while part of an online environment connected to the course facilitator and/or additional learners through the web, that may consistently use WWW resources as a part of the course content. Of course, other online environments may connect learners and facilitators via Internet, intranet or extranet.

What defines online learning is the fact that it is *online*. Elearning on the other hand is also part of technology-based learning, but does not have to be online. Online learning then can be a significant part of elearning. Elearning is at its very foundation the delivery of content via all electronic media, and covers a wide set of applications and processes. This is not to be confused with technology-based learning *tools* such as retina mouse systems, or touch screens. Elearning is the realm of dynamic delivery and reception of learning content between situation and learner, as previously discussed.

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[102] Brown, Collins, & Duguid (1989), CTGV (1990, 1993), Lave & Wenger (1991), Young (1993). Greeno, et al. (1998).
[103] Maddux (1994).
[104] www.learnframe.com

There are literally hundreds of different definitions for the word *elearning* today, and the numbers keep rising. Perhaps the first step in defining is developing what elearning is. According to most, elearning involves learning at a distance where the learner and teacher are at two separate geographical locations, perhaps at different times, and communicate and interact both with the electronic system as well as with each other. Even in this simple way, professionals seem to have slightly different intricate meanings. A list of the most common components of elearning definitions, taken from an informal survey of the WWW in the fall of 2003, resulted in the following:

Elearning is...

- The convergence of the Internet and learning, or Internet-enabled learning
- The use of network technologies to create, foster, deliver, and facilitate learning, anytime, anywhere
- The delivery of individualized, comprehensive, dynamic learning content in real time, aiding the development of communities of knowledge, linking learners, and practitioners with experts
- A phenomenon delivering accountability, accessibility, and opportunity to allow people and organizations to keep up with the rapid changes that define the Internet world
- A force that gives people and organizations the competitive edge to allow them to keep ahead of the rapidly changing global economy

Clearly, with use of words such as "phenomenon" and "force", defining elearning is as colossal a work as it seems, and perhaps just as broad as defining learning. Despite the differences professionals have in defining elearning, there are some similarities that surface. Phrases such as "technology", "learning", "accountability", "individualized" and "facilitation" prove that although statements on elearning are not exactly the same, ideas behind it are similar. These topics will be discussed further in coming sections.

eFit Austria defines elearning as "Learning, teaching, research for a networked knowledge-based society"[105]. WIFI Wien defines it as "Lernen überall und jederzeit"[106]. Wentling, et

[105] CEDEFOP (2003).

al.[107] did an extensive study of various terms surrounding elearning dating back to 1994 to help configure their own definition of elearning as "... the acquisition and use of knowledge distributed and facilitated primarily by electronic means. This form of learning currently depends on networks and computers but will likely evolve into systems consisting of a variety of channels (e.g. wireless, satellite) and technologies (e.g. cellular phones, PDA's) as they are developed and adopted." The Arbeitskammer Wien simply says, "...elearning, das Lernen über Computer und Internet."[108] Birgit Godehardt, et al., in her book Vernetztes Arbeiten und Lernen[109] prefers instead the term "teleteaching" and explains only that "there must be a distance between teacher and learner and dialogue should be information and computer technology developed."

Finally, the letters of the word *elearning* itself have been creatively moulded and reconstructed enough to deserve due credit. In literature, at conferences, and on the WWW, numerous people have innovatively tried to re-write elearning to portray its usefulness and true meaning. Styles such as, *E-Learning*, *eLearning*, *"e"learning*, and *elearning* have attempted to show the evolution from the initial importance of the electronic variable, to the now more pedagogical basis of learning. Others go a step further and question the "e" as even standing for electronic at all. Elliot Maise[110] for example offered that perhaps the "e" stood for *experience*, *extended* or *expanded.*

As before mentioned, most people would agree that the pedagogy behind the technology is the real heart of elearning success. At a conference in Atlanta on July 15, 2000, Maise even went so far as to say that the "e" in elearning will soon be gone all together- as all learning methods will in some way incorporate electronics regardless. Others contend that it is the "e" itself that leaves some learners unmotivated to attempt such programs[111]. To this, I'd like to offer my own suggestions: perhaps *LeARNING*, or simply *learning* will be more appropriate in the future as elearning methods evolve in a pedagogically positive manner. After all, clearly "electronics" will still be a growing part of our lives.

3.2 Technologies of Elearning

[106] (2004).
[107] (2000), Gotschall (2000), Hall (1997), Karon (2000), Porter (1997), Schreiber & Berg (1998), Urdan & Weggen (2000), Willis (1994), Zahm (2000).
[108] (2002).
[109] (1999).
[110] (2001).
[111] Josef (2003).

The abundance of unique definitions could very well steam from the unique needs and circumstances in which elearning is implemented for organizations and professionals. It is perhaps then of no surprise to learn that elearning covers a wide set of delivery methods, tools, and technologies. With as many technological innovations that there are, there are just as many challenges[112]. This section attempts to introduce a non-critical overview of some factors of elearning.

3.2.1 Methods of Delivery

According to Learning Circuits[113], elearning includes the "delivery of content via Internet, intranet/extranet (LAN/WAN), audio- and videotape, satellite broadcast, interactive TV, and CD-ROM." Other tools can include Personal Digital Assistants (PDA), m-learning (mobile) and Virtual Private Networks (VPN). Other methods of delivery depend on the various categories of elearning that are chosen for specific learning purposes. Delivery methods can then also include phone technology, the Internet (which would constitute online learning), TV, radio, video, audio and even cinema. Elearning environments, the National Information Technology Council of Malaysia goes on[114], are delivered by a combination of "hardware, software and personnel; a multi-faceted learning programme that utilizes distance learning interactive cable TV, and the Internet to connect learning environments to homes, places of work and the community at large".

3.2.2 Implementation Options

The method of delivery is of course not the only choice surrounding elearning. There are also many implementation options that must be decided in accordance with those delivery systems. With the many new innovations and uses of elearning systems, there are of course an abundance of names. Most of these specify the combination of communication technologies, delivery and implementation options. Such examples include; telelearning, computer-based training (CBT), computer-based learning (CBL), web-based training and learning (WBT, WBL), technology-based training and learning (TBT, TBL), network based training and

[112] Murphy (1995).
[113] (2004).
[114] www.nitc.org/my

learning (NBT, NBL), computer supported learning (CSL), or computer assisted learning (CAL).

Despite these discrepancies, most of the foundational implementation options fall into a handful of categories. These include:

- On-demand elearning- jukeboxes of content that are available as needed- mostly through CD-ROM databases that can be referenced at any time depending on the reoccurring needs of learners. The dynamics of on-demand elearning environments is dependant on the learners' self-paced interaction with specified content.
- Live On Line elearning- multiple learners at multiple sites at the same time interact not only with the content of the course, but also with the facilitator and even additional professionals.
- Learning Objects- small chunks of learning by objectives organized in a comprehensible way to work as a realistic educational goal for the learner to access as they wish. Learning objects are small, reusable digital or non-digital learning material that supports the educational objective to be met.
- On-line Coaching- access to subject matter expertise whether synchronous or asynchronous. This acts not as a database, but rather a personal tutoring system that may also be combined with a database for most requested information.
- Knowledge Bases- database of learning content in a searchable environment that allows learners to access material on a completely self-regulatory basis. Learners create experiences on their own accord, and develop as far as they wish.
- Multi-Site Learning- accesses various necessary sites for one goal, making the content in these learning environments usually consist of a combination of PDF reference material as well as text and web site addresses to achieve learning objectives.
- Elearning Communities- collaborative learning groups that allow access to real and asynchronous time interaction, reference materials, chats, question and answer forums, and other cooperative activities for a similar cause.

- Simulation-Based Learning- virtual learning environments that attempt to put the learner in reality-based programs to allow them to experience life situations in as real an environment as possible.
- Best Practices Knowledge Management Learning- learning from experts that are available in real or asynchronous time as reference and personal tutors for the learning material wished for. These experts do not lead the learning process, but fill in knowledge gaps where learners see fit.
- Blended Models- traditional classes with technology content can take the form of technology use in the classroom, or elearning technology- in whatever form, that is accessible outside the classroom altogether. This can be a database, tutor, community, in real or asynchronous time.

3.2.3 Communication Technologies

In addition to the methods of elearning delivery, and the options on implementing elearning content, there are also many communication technologies that can be integrated depending on the previous choices. Elearning communities may use newsgroups that are moderated by those that organize, delete or update relevant material. These newsgroups may also offer information via email or occasional expert tutoring sessions. On-demand or chuck implemented learning may use video or audio CD or cassette as a communication method. This would naturally allow learners to continue access at their own speed and over a period of time as the knowledge was needed. Other learner groups using chunked information can access audio or emailed objectives over cell phones or PDA's. Blended models of elearning may choose to use listservs that send information via email from the facilitator to the whole group of learners at once. In addition, the blended model could also use both synchronous communication discussion at a set time and day, and a chat room for learners to communicate with another without facilitator interaction. Regardless, it is important to think carefully about the communication technology to be used. Some environments call for certain communication methods or learning may be impeded[115]. A computer-mediated threaded discussion may not, for example, be able to effectively portray intimacy, voice and spontaneity[116].

[115] Lieblein (2000).
[116] Schifter (1999).

Email for one has enjoyed perhaps the longest elearning communication technology histories. Networked systems of learning via question-answer problem solving have been around since elearning began. These systems allowed, for example, a mathematical problem to be sent to the learner group, answered and sent back to the teacher. CSILE[117], Earthlab[118], and Computer-Mediated Communication[119] (CMC) are a few examples. Romiszowski and Chang[120] did note their CMC experiments experienced increased participation for extended periods of time in contrast to CAI. They additionally noted the improved quality and quantity of foreign student contributions, yet most email question-answer systems simply do not show such reliable improvements.

There are many options one has in designing and implementing elearning. Choosing the best combination depends on many factors. Naturally, the learner population is a significant one. Age, gender, geographical location, language and culture all must be taken into consideration when choosing proper elearning technologies. In addition, cost of materials, resources, and faculty must also be considered.

In many countries like Austria, testing centers provide opportunities for potential program implementers to try out elearning platforms before they buy[121]. This allows providers to more accurately ensure that their forms of communication and delivery match the learner populations as best as possible.

3.3 Phases of Educational Technology

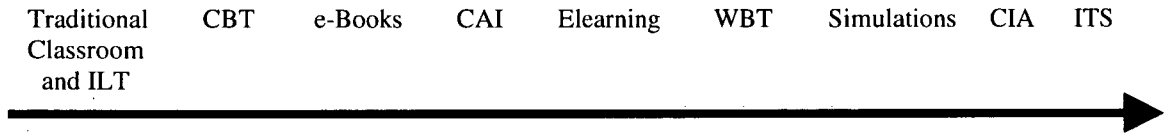

Figure 2: Elearning Timeline

[117] Bereiter & Scardamalia (1992).
[118] Newman (1992), Vossen & Hofmann (1992).
[119] Romiszowski & Chang (1992).
[120] (1992).
[121] Josef (2003).

Educational technology is the technology available for educational purposes[122]. Over the years there has been a great many questions as to whether or not we are really using the correct type of technology to achieve educational goals through technological means. Due to an incredible amount of technological options coupled by limited empirical research on proper use, designers, implementers and facilitators are challenged by elearning before they have even begun. Technological education has seen many popular phases that have brought about various methodologies. Without valid research, many appropriate methods may have been abandoned while other, less helpful methods may continue to evolve.

The following pages describe the various types of educational technologies implemented over the years that in part make up these phases. Particular attention has been given to the explanation, delivery/distribution, development tools and challenges associated.

ILT: Before 1983, learners were limited to various forms of Instructor Led Training (ILT). Although many believe ILT methods have been around for hundreds of years, once modern technology methods came into play, ILT developed from correspondence courses to audio or video classes. Although new, these classes delivered mostly stilted, lecture-learning, and were limited by their technological boundaries.

CBT: From 1984 to 1993, with the introduction of Windows 3.1, Macintosh, CD-ROM's, Power Point programs, laserdiscs and even floppies, a new form of Computer Based Training (CBT) was established[123]. In most cases, a large central computer delivered information to a system of connected terminals and was considered an "off-line" system. This resulted in limited bandwidth restraints and a media-rich environment for self-study. CBT is delivered using runtime software particular to the authoring system or programming language used to create it[124]. On occasion, license fees must be paid to use this software, which is sometimes platform-specific. In CBT, learner theory and technological innovation helped create the foundations for more consistently visually appealing, motivating, anytime/anywhere learner environments. These claimed to deliver cost and learning time savings. CBT was developed with specialized authoring tools combining interaction, navigation, presentation and student management systems as built-in options or templates.

[122] Bouwhuis (1996).
[123] Clarke (2002).
[124] Shepard (2003).

Nonetheless, a lack of instructor interaction and dynamic presentation in CBT created a slower, less engaging, less individualistic learner experience. In addition, modifications and updates meant expensive redesign efforts and new programs. Authoring these systems did not satisfy all needs. Highly specialized simulations or intelligent tutoring devices with a separate language.

CBT drill-and-practice programs today are driven by the ever increasing need for remedial teaching, and usually looked down upon from the scientific world. Although these programs aim at learner understanding, they usually do not test for realistic understanding, which in turn decreases learner motivation. As the CBT survival rate decreases, despite attractive designs and interaction, more "challenging" systems such as ITS are developed in their place.

E-Books: After CBT, convenience overshadowed efforts for more educational improvements, and a surge of e-Books as complete learning materials manifested over the Internet. A few attempts to counter this text-book structure were made. Network-based interactivity and coaching support for e-Books were developed, so that learners could finally interact with each other in real time, called simply "e-books with mentoring"[125].

CAI: Computer Aided Instruction systems followed but faced various challenges, most of which stemmed from the great amount of personnel necessary to conduct such processes. Now, computer aided instruction is beginning to once again flourish, as most home and office PC's also contain CD-ROM's. In addition to technological challenges, these systems had and still have difficulty catering to the individual learner[126]. This is clearly due to the fact that they are made once and then distributed many times after without consistent re-modifications for the learners. Carbonell[127] said challenges with CAI could not be helped without the aid of artificial intelligence programs (AI).

Modern Elearning: Despite these rapid changes, the first real wave of what we call modern elearning came between 1994 and 1999. Here, email, web browsers, HTML, media players, low fidelity streamed audio and video and simple JAVA changed the face of educational technology for the future. Basic mentoring via email, internet CBT with text and simple graphics and web-based learning emerged. At this time greater efforts were made to combine

[125] Clarke (2002).
[126] Bouwhuis (1996).
[127] (1970).

technical as well as pedagogical innovation, and clarifying and defining the realm of elearning as discussed previously became a conversation piece in its own right. Nonetheless, these efforts now allow learners and facilitators unlimited options for topics, objectives and delivery for a variety of learner groups with individual needs and wants that continue to evolve today.

WBT: There has been much controversy surrounding the differences between CBT and WBT. The characteristic heart of web based training is that it is distributed online over the internet or the WWW. Being "on-line" allows WBT courses to be delivered anytime, anywhere in the world. This makes WBT easy to maintain, accessible to anyone online, and allows collaboration between large groups of users. WBT is delivered free of charge (aside from course-specific fees) using a broadly compatible, cross-platform, user-friendly browser[128]. After a WBT course is developed, it is generically available- updates are automatic and inexpensive. WBT can incorporate interaction with other humans, tutors, experts and additional learners, allowing more appropriate use of email, discussion forums and chat rooms for all.

Unfortunately, WBT does have its limitations. Bandwidth limitations that make animation, sound and video consistent may fall from grace. Authoring tools do not come with built-in CBT, so a simple multiple choice question must be self built, although making templates can save reuse time. Understanding of various languages such as JavaScript, HTML or Java is helpful.

Simulations and Computer Aided Intelligence: Flight simulations, which since their implementation have made up for 50% of total training time, are a simulation-based learning success story. Although the flight simulator basically only trains skills, it operates almost exactly like the real machine. Despite the lack of student modeling or tutoring, the training pilot and simulator act and react in response to each other as equal partners, much like video game environments. These types of systems have very intensive interaction dialogues that verge on the addicting- a phenomenon supported by an array of game theory.

In addition, micro-worlds, exploratory simulation programs that portray various specific processes difficult to interact with on a normal basis, also fall under this category. Many

[128] Shepard (2003).

micro-world simulations are popular, such as the well-known dissectible frog[129]. Others include Newtonian kinematics and chemical titration, or optic media programs.

ITS: Intelligent Tutoring Systems. Self[130] argued that an interactive learning program should "contain knowledge of how to teach, knowledge of what is being taught, and knowledge of who is being taught". Combining CAI with AI did just that- ITS. ITS systems consist of four basic modules. The first is expert knowledge on what to teach; the second is a student module on whom to teach; third is a tutoring module on how to teach, and fourth is a user interface/communication module[131]. A basic foundation of ITS is that individualized tutoring can only be initiated when the learner's cognitive mistakes are diagnosed[132]. That is to say, the learner is compared to an expert system- an almost impossible task in itself[133], and judged by their lack of knowledge rather than a more learner-centered pedagogical model of their knowledge basis and growth.

There has been empirical research to show that this is not the most appropriate model for facilitating knowledge[134]. The GUIDON and GUIDON 2[135] programs, based on the MYCIN(ES) system is an ITS environment for medial diagnosis knowledge. Due to the fact that the MYCIN(ES) explanations for its rules were so complicated for learners, the project was proven insufficient[136]. Later the GUIDON 2 implemented a more user-friendly tutoring model.

3.4 Discussion on Elearning

There are many benefits to elearning, which seem to be growing in number as innovative technologies and thoughtful theories are matched with learner needs. Despite this, some agree that there are definitely still lingering challenges. Some of these problem issues come from the past, and some are beginning to surface now. Yet, contending with the challenges should not be in vain. As the table below conveys, most of the barriers elearning faces deal with planning, designing, evaluating, and implementing these environments and how they will be

[129] Virtual Frog (2004). http://www-itg.lbl.gov/ITG.hm.pg.docs/dissect/dissect.html
[130] (1974).
[131] Bouwhuis (1996).
[132] Mandl & Hron (1992).
[133] Challenges also arise in this system due to the fact that the learner's performance or response may be misinterpreted, and thus misrepresented, by the system, giving misleading results.
[134] McArthur et al. (1988), Roschelle (1990).
[135] Clancey (1987).
[136] Frasson (1992).

administered. The challenges arise when these efforts are not undertaken carefully- with the elearners as top priority as they should be. When this is correctly accomplished few challenges remain. Clearly then, this table would be more one-sided, and benefits would greatly outweigh the challenges, as recently seen in more and more case studies and research literature. A spiral process of careful planning, evaluation, testing, editing, and re-evaluation can ensure many benefits with few challenging difficulties for all.

Benefits	***Challenges***
Anytime, anywhere - Real-time information transfer world-wide Successful learner achievement Collaborative learning environments Supports life-long learning - career-learners, retired persons populations, etc. Flexible for various learner groups - parents,full-time workers, etc. Positive environments for diverse populations - non-native speakers, people with disabilities, etc. Greater opportunity for worldwide professional input Supports individual learner styles - Multiple Intelligences - Learners can work self-paced Rich (multimedia) learning experiences possible - Audio, video, animation, interactivity, text, etc. - Contain high motivational elements	Institutional challenges -poor planning - no realistic learner market - to time to plan, impliment or assess - no support from administration, etc. - no funding for tech, training, and classes - no facilitator training - no re-evaluations of programs or facilitators Learner challenges - lack of learner theory basis - limited learner experience with environment - lack of sence of community - no learner support (technology, etc.) - environment does not match learner Design challenges - too complicated for learner population - lacks relevancy - unmotivating - technology does not match learner goals - no evaluation and re-adjustment

Figure 3: Benefits and Challenges to Elearning

3.4.1 Challenges to Elearning

In a *Der Standard* interview, TU-Professor Lohninger stated, „... Ein immer und überall einsetzbares Allheilmittel ist E-Learning nicht."[137] There are certainly issues surrounding elearning endeavors that support such a view, as some less wise implementers believe that simply using elearning will heal all learning wounds and move institutions miraculously into the educational future. Challenges to elearning come in many forms from many different angles. Zirkle[138] condenses challenges simply into two categories; those for the learners, and those for the institutions that offer the programs. This is expanded slightly in the above table to include design as a third significant element.

[137] Fashing (2001).
[138] (2001).

Institutional barriers that hinder elearning are usually founded in an initial lack of thought and planning on the part of the administration overseeing the elearning project. Without such proper planning, challenges can include extremely high costs for teacher training to use programs and facilitate them correctly, program design by outside sources and other technologies necessary for implementation[139]. Costs can also play a role when institutions purchase elearning that does not match their learners or needs, or is not properly updated as new technology innovations surface[140]. Although these two scenarios cause fewer costs in the beginning, future costs in order to finally match user needs to programs (once it is clear previously bough generic programs won't support learner objectives), or update systems with new technologies will skyrocket. Second, a lack of proper computers, video, audio and other necessary equipment also cause frustration when trying to smoothly implement elearning. Although the technology is often thought of before the elearner, many times the incorrect technology is chosen for political or financial reasons. That, coupled with overlooking a proper technical support staff[141] is usually considered significant blunders in planning elearning programs.

Scheduling is also an overlooked factor[142]. Many times administrators believe it must be easier to facilitate an elearning course than a traditional course. Due to this, they may choose to make staff members facilitate more than one course at a time. This creates great difficultly for the faculty that actually need more time to correctly facilitate elearning environments- especially if their experience is novice. Similarly, some administrators believe traditional teachers can make a smooth transition to teaching in elearning environments without any problem. This is not the case. Just as teachers in a traditional classroom need proper training to be able to use new technological tools or even new text series in the classroom, they need the availability of proper resources[143] in order to facilitate elearning correctly also. Administrative challenges can also include a lack of overall staff support. Some traditional teachers may not be willing to transfer their courses online. When administrators force them to do so, the implementation of these courses, and the learners experience both result in less than positive experiences[144]. On the other hand, some institutions that offer elearning do so

[139] Murphy & Terry (1998), Miller & Miller (2000) site program costs as a barrier for agricultural programs.
[140] Mihalic (2003).
[141] Garland (1993), Yap (1996).
[142] Ragothaman & Hoadley (1997), Murphy & Terry (1998), Miller & Miller (2000), Zirkle (2002).
[143] Ko & Rossen (2001).
[144] Dillon & Walsh (1992).

for financial rather than pedagogical reasons. When administrators give off the impression to their staff that these decisions are not "owned" by the whole institutional community, faculty (coming from a pedagogical priority background) that must facilitate these courses may be less enthusiastic to do so.

Issues concerning owning the elearning idea are very significant and affect various levels of interested parties. Administrators must be willing to support their faculty and give them the funding, resources, and time they need to be successful facilitators. Facilitators must be willing to spend the extra effort and rethink their pedagogical theories in order to give elearners all the support they need to succeed. Both administrators and faculty must own elearning ideals and be ready to encourage learners to try these environments with their full support and tutorship. They must promote their programs on the basis of heightened learner experiences and knowledge levels in order to attract learners- hanging a sign on the campus door for elearning is not enough to secure elearners.

Pedagogical challenges have everything to do with issues surrounding the elearner. These challenges begin when elearning does not cater to the learner, but rather to what programs were the least expensive for the institution to purchase. Many times these programs deal with generic "soft skills", and have little basis in learner theory. What results is elearners interacting in environments that do not match their pedagogical objectives or personal characteristics. Additional challenges can include lack of appropriate elearner motivation and self-regulation, as mentioned above. From an instructor facilitating standpoint, lack of contact and feedback from the teacher and other learners[145] may make elearners feel alone[146] in the environment. Students may also have a difficult time deciphering written reactions of remote course members. This lack of interaction can cause problems when there is a dissenting opinion that cannot be supported with non-verbal cues, and is misperceived as a verbal attack. This affects most students' sense of community and hinders motivation levels allowing them to continue successfully. Similarly, lack of student support and additional services[147] such as technological help staff can become frustrating for elearners. In a traditional classroom, tools may consist of pencil and paper. When the pencil breaks traditional learners know what their options are to continue in the learning environment

[145] Swan & Jackman (1996), Miller & Webster (1997), Dooley, Patil, & Lineberger (2000), Murphrey & Dooley (2000), Flowers (2001).
[146] Galusha (1998), Flowers (2001), Zirkle (2002).
[147] Birnbaum (2001).

without problem. When an elearner has a technical difficulty, for example their video stream of an expert does not work properly, they need professional technical assistance promptly. When this is unavailable, a great deal of learning may be missed, and learner trust in the delivery method- key to interaction and motivation, may have dissolved.

Many students simply do not have any experience with such environments when they begin their first elearning course. Hornacek[148] has reported that in America 80% of learners who have registered and paid for elearning courses never finished the class. Euler[149] has suggested a reason for this high percentage could stem from decreased motivation due to lack of experience with elearning technologies. Because of this, learners begin to interact with programs before they are completely equipped to deal with such methods, and thus carry factors of failure before they begin. As will be further discussed in section 4.2 *The Elearner*, certain learner characteristics blend more successfully in elearning environments than others. That does not mean that only certain learners will be successful with such delivery. Understanding what makes some elearners potentially more successful than others, and how to support ones own elearner characteristics in these environments, can help ensure positive experiences regardless. Without an initial pre-course on how all types can learn and communicate successfully in such environments, many students give up and decide these environments are simply too complicated[150].

Finally, there are many difficulties in the design of the elearning interface that can negatively affect learner motivation and outcome. Elements of strategic design based on empirical research are further detailed in section 4 *Designing Elearning Environments*. Such challenges can include a lack of overall assessment through the design process to ensure that user populations successfully match their elearning environments. Also, technology tools may result in diverse results over various computers with different bandwidths. Although much has been done to ensure all learners receive similar content regardless of bandwidth, this has the potential to create completely different experiences for each learner. Interfaces that are too complicated or have "noisy" colors, irrelevant graphics, animations and frames, and difficult navigation also lead to frustrating challenges for elearners. These factors singularly and together discourage users and create unmotivated learning.

[148] (2000), p.70.
[149] (2000), p. 7.
[150] Galusha (1998), Hillsheim (1998).

3.4.2 Benefits to Elearning

There are naturally benefits to elearning as well. Many studies show there are no differences in learner achievement between elearning and traditional methods of education[151]. This means that if these environments are designed and implemented correctly, their benefits only increase. For one, elearners can be located anywhere. This means that learners from around the globe can collaborate in a course and bring meaningful insights supported by their diverse cultural and educational backgrounds. Of course, distance learners could also be located just about anywhere. The difference is that distance learners communicated one-to-one with their master teachers, and knew little if anything about their colleagues. Thus, were completely dependant on only their instructors' knowledge, beliefs and experiences. Elearners on the other hand can truly learn together in open cooperative discussions where facilitators help support the communication- like a good party host, and allow learners to learn together from everyone's knowledge base. Also, elearners are no longer time-bound as they are in traditional classes[152]. Many programs allow learners to pace their own programs with only activities or special tasks at specific times. This allows learners with diverse responsibilities such as jobs and families to be successful members of these environments, too.

Elearning environments can help support the individual learner in many ways. In a traditional classroom setting, learners are often expected to soak up significant material in a lecture-type teacher to class setting. Mastery is established in many instances by the teacher asking students to regurgitate information on paper during the final exam. Students are marked on a completely individual basis on how good their memory skills are. Those students who fall into one particular intelligence type category are the only ones who prevail. Students of other intelligence types, as will be further discussed in section 4.2.2 *Multiple Intelligences*, are left to try to adapt.

In properly designed and implemented elearning environments, all learners are taken into consideration in terms of content, delivery and teacher facilitation. Elearners benefiting from the spoken word have audio options. Those enjoying graphics of content and tasks have visual elements. Learners who like a sense of community with others have opportunities to chat with colleagues in online "café houses". Learners who like to work independently can chose to post email concerns and questions to all course-mates, or only to the facilitator- as

[151] Meyer (2002).
[152] Zirkle (2002).

they wish. In this way, the elearning environment has the potential to cater to many diverse learners and personality types. This allows more diverse learning environments which support rich learning experiences not otherwise possible in most traditional settings. In addition, most elearning settings allow the learner to have control over how much personal information they offer to others. This has proven very successful in the learning success of more intrinsic learners. Particularly, foreign students seem to benefit in elearning environments, where they can chose to communicate at a level that is comfortable to them. Naturally, there are other learners that feel more comfortable with high levels of personal interaction. For these, many environments offer links to elearner photos, email addresses, and web sites if they wish.

Clearly the technology in elearning environments can be strong motivational elements. Many elearning programs that especially utilize telecommunications technologies are said to have almost the same contact and interaction with other learners and facilitators as traditional classroom environments[153]. Clearly, using the Internet and other quick computer technologies also gives the ability to transfer necessary information instantaneously[154]. When colleagues consist of diverse members from around the globe, timely transfer can be appreciated. The current multimedia elements available can greatly encourage motivation, which in turn supports life-long learning. When used correctly, audio, video clips, animated characters, color, and even special affects can all make learning easier and more understandable. Even interface design elements such as the use of frames, links, menus and other navigational tools can be helpful. These factors not only make learning material more comprehensible and interesting, but also support faster interactivity to a wealth of relevant resources and additional material.

[153] Galusha (1998).
[154] Sloman (2002).

4 Designing Elearning Environments

Designing elearning environments is much like designing a building. Whether the elearning is multimedia based or PDF linear text based, careful planning is key. Like building design, every step of the process, from sketching a blueprint to choosing correct materials and over-proofing details, is necessary. In terms of elearning, foundations to that building begin with a sound basis of learner theory and content. Built on that, empirical studies from the literature help support decisions pertaining to layout, color, and line-length of text. Throughout the entire process, from pre-design to post-implementation, evaluations help ensure that users, like building inhabitants, are receiving the most comfortable, pleasing and reliable environment possible.

This section delves into the many essential elements of elearning design. Here, topics such as learner theory, motivation, interface design, authenticity and multimedia are covered. These discussions have been chosen in order to more effectively design elearning environments on both valid research and reliable theory. Section 5 *Evaluating Elearning* continues this discussion with specific information on effective assessments and how they are conducted.

As previously discussed in section 3 *Education and Electronic Learning*, the evolution of elearning throughout the years has brought with it both benefits and challenges. Likewise, decisions concerning design also create an array of possible benefits and challenges. It is essential that designers understand the various diverse factors that comprise interface design in order to choose wisely. Coordinating these factors together in effective and motivating ways helps ensure positive learning experiences and outcomes. Currently, there is a growing amount of empirical research and foundational learner theory that can help affect elearning environments.

Specifying content learning goals and blueprinting elearning environments constitute the first stage in proper design. Current study suggests elearning environments benefit from exact initial planning and specifications for the learner[155]. This ensures that goals and objectives for the learner are clear and consistent. Only when this is accomplished, can accurate knowledge and program analysis be made throughout the design process. This being said, the learner is of utmost importance. They must be recognized as such at every point of the design, and

[155] Vivet (1996).

likewise be given priority over technological components. To accomplish this, research supports the fact that more must be done to ensure the design of the elearning environment is soundly based on learner theory[156]. Learning systems must first acknowledge learners' specific goals and objectives, and how interactions with the elearning environment will support these goals. Secondly, the ergonomics of the system must be considered. A helpful first step in this process is sketching the potential layout of the environment, including links, connected screens, and other multimedia elements. This allows designers to more accurately plan user communication and interaction processes, and make possible alterations before implementation, when changes may be too late. Thirdly, a sound evaluation process must be carefully planned and revisited throughout the design and implementation process from pre-sketching to post-implementation. This ensures that system and learning assessment can be meaningfully collected. As the elearning environment is planned, designed, revisited, reconstructed and further designed, continuous trials must be made in order to take into consideration potential user comments and expert advice. This type of revisited assessment is otherwise known as the "spiral process"[157].

4.1 Learner Theories

In 1981, Perraton mentioned that "distance education has managed very well without any theory"[158]. Less can be said for elearning. Thousands of elearning programs have bannered new recipes for increased learner performance, with less than successful results[159]. Many times efforts to design elearning are based on the universal ADDIE model (Analyze, Design, Develop, Implement, Evaluate)[160]. This has its drawbacks. Evaluation, as traditionally placed, comes at the end of the acronym. As discussed above, more appropriate perhaps would be to distribute evaluations throughout- "AEDEDEIE". Additionally, although this model may have worked for traditional educational activities, the lack of a pedagogical element significantly damages elearning design naturally based on learners. Resources in research and literature may play a part in these hindrances, as many in the past have not placed proper priority on the importance of pedagogy.

[156] Winans, et al. (1988), Clancey (1992).
[157] Boehm (1988).
[158] p. 13.
[159] Mayes (1995).
[160] Abas (2003).

The majority of literature on elearning today is based upon case-study descriptions with low transferability potential. Many of these efforts are technological, rather than pedagogically based, the latter of which would lend more to being grounded in theory. As a result, many technology-based approaches are wrongly determining fledgling attempts at related educational theory, instead of the other way around[161]. One author illustrated that the literature around a subject such as elearning can be likened to a "tree of knowledge"[162]. The branches of that tree are the practice-based research, adorned with all the fruit-like bells and whistles of multimedia, animation and sound. The needed theoretical principles are the roots which, although not as aesthetically pleasing as the branches and fruits, are necessary for the health and growth of the tree. Elearning needs not only proper technology, but also relevant roots in pedagogy and psychology. According to Nichols[163], it is "unlikely that eLearning practice will continue to evolve unless the theoretical underpinnings of eLearning are explored and debated, providing a wider platform and a common philosophy of eLearning development." Keegan[164] also noted that theory could be a "touch-stone against which decisions- political, financial, educational, social- when they have to be taken, can be taken with confidence."

Research shows that connecting computer-based learning programs directly with learner theory, individual, and social cognition results in higher levels of user motivation and performance[165]. For this reason, many theories have since been applied to computer learning environments in order to connect the already established benefits of learner processes to electronic delivery methods. There have also been recent attempts to connect pedagogies directly to elearning worth mention here. These include already well established distance learning theories by scholars such as Moore and Kearsley, Lockwood, Holmberg, Peters, Rumble, and Rowntree, and Mason.

- Constructivist Model recognizes that the learner is an active participant in the learning and knowledge acquisition process[166]. This is based on ideas from Dewey, Piaget and Vygotsky. Proponents of this model believe learners acquire knowledge through an interaction between themselves and the environment- not necessarily directly by

[161] Jackson & Anagnostopoulou (2003).
[162] Nichols (2003).
[163] (2003).
[164] (1983).
[165] Xu, et al. (2003).
[166] Bruner (1960), Wonacott (2000).

teaching. This means that proper activities should include a variety of media and tasks that can support various cognitive learner styles[167]. This also leads to the idea that learners and humans on the whole wish to make sense out of the environment around them[168]- a central foundation to life-long learning, as discussed in section 2.1 *Elearning and Life-Long Learning*. The main function of the teacher then is to guide and consult when necessary, instead of point and lecture. This theory has been more and more widely used in elearning environments, and has moved less successful instructivist models of distance education into active learner processes. The constructivist theory in elearning is supported by learning objects that deliver problem-based objectives. Learners are encouraged to explore and discover their own learning through these activities. Key components infer that; instruction is related to the experiences and willingness of the learner, that material is constructed in a fashion that is user-friendly and easily understood and retained by the learner, and that material is designed to encourage life-long learning beyond the curricula presented. For these reasons, constructivist-based elearning is mostly used for higher educational goals, as learners must be particularly responsibly for their own learning[169]. This theory has been closely related to others of its kind such as Piaget's Genetic Epistemology[170] model, or Vygotsky's Social Development theory.

- Situated Learning[171] is also embedded in constructivism. It contends that learning occurs as a result of interacting and processing specific variables within a context and culture. This is supported by social interaction and collaboration and based upon the idea that knowledge must be presented in realistic settings. This process leaves the responsibility of learning to the learner rather than the teacher or facilitator. Problem-based learning is one part of situated learning, and so naturally used widely in work-place learning environments. This theory compliments online learning environments in which for example, just-in-time content is delivered, or searching for knowledge within a problem situation is necessary, such as in many medical school objectives.
- Social Cognition Theory was first introduced by Vygotsky. He suggested that in order to understand a learners' capacity to learn, one must take into consideration the learners "zone of proximital development" (ZPD). This is defined as the distance between "real development level"- determined by individual problem solving

[167] Wonacott (2000).
[168] Gottlieb (2000).
[169] Perkins (1991).
[170] Piaget (1954).
[171] Lave & Wenger (1990).

activities, and the "potential development level", that compares current learner development to their own individual learner potential. In relation to social cognition is Activity Centered Design, also built upon Vygotsky's ideas. This is based on the fact that priority is not set on the teacher or the learner, but rather the actual design of the learning environment from which to determine learner ZPD. This directly supports learner ability through the development to carry out socially formulated, goal-directed actions[172].

- Cognitive Flexibility Theory[173] supports learning in what Spiro has called "ill-structured domains"[174], or the complex nature of connections between learner concepts. Spiro contends that in order for learners to comprehend and retain information, they must use this constructivist-based theory to revisit similar material more than once, in different contexts for different purposes. Due to the fact that concepts have different meanings when presented and conjured in various contexts, meaning to the learner is not unequivocal. In this respect, a variety of learning contexts are necessary. Only then can full understanding of material be achieved. By interweaving knowledge nodes in various constructs, content is likewise more strongly interwoven in the minds of learners. This can be achieved by using large numbers of case studies that must be compared and contrasted similarly to gain full understanding.
- Cognitive Apprenticeship theory is also closely tied to Vygotsky[175]. This refers to learning programs that mirror traditional apprenticing practices, with a focus on defining, communicating and reflecting upon observations in order to independently pace and control learner strategies. When tied to elearning environments, Cognitive Apprentice Theory can be designed into structures by identifying task processes and making them clear to users, offering tasks in real-life-like contexts so relevance is clear to the user, and diversifying situations and activities in order to articulate important goals and objectives learners may need later on[176].
- Behaviorism[177] literature stems from Skinner's works among others, and suggests independent learning structures. Skinner proposed a method of learning to overcome the challenges of the traditional classroom, called programmed learning. Steps within this method included deciding on a goal, determining a pace of learning, setting

[172] Gifford & Enyedy (1999).
[173] Lehman (2000).
[174] Spiro, et al. (1992).
[175] Collins, et al. (1989).
[176] Gottlieb (2000).
[177] Skinner (1954).

efficient feedbacks, and control by the machine. Programmed learning includes information presented in small chunks, with resulting reinforcements. Learners must master previous content before moving on in these learning environments. Testing assessments can aid in the communication of these needs. If learners do not succeed in mastering specified content, they must return to former content nodes and master that content first. Behaviorist theories support more linear-based knowledge delivery, such as in the traditional classroom. Chunks of information are presented in a structured fashion and stretched along a specified time period, which concludes with the main learning objectives. This structure is quite opposite from constructivist views that favor less structure, and more knowledge from learner experimentation and discovery on their own cognitive time schedule. There has been some research that states programmed learning takes less time than traditional learning structures, which is positively perceived by learner groups[178]. It has also been suggested that these forms of learning may better suit basic knowledge skills. Other related works include Keller's Personalized System of Instruction, which is based on the idea that learning requires students' mastery of certain material before moving on. Another is Knowles' Learning Contracts where students identify their own learning requirements and goals. Related, Gagnè also introduced the "conditions for effective learning" that connected cognitive processing to instruction[179]. He determined specifically that different types of learning require different types of instruction.

- Anchored Instruction[180] originated with John Bransford at the Cognition and Technology Group at Vanderbilt. It is based on a problem solving principal related directly to technology supporting learning. Its foundation lies in that the learning and teaching are "anchored" in specific situations that can take the form of case studies or problem scenarios. In addition, the learner is supported and encouraged to explore the curriculum at will within the context of the anchored situation.
- Conditions of Learning Theory[181] was developed by Gagne. These conditions supported the idea of four different levels of learning that required four different, well-defined methods of instruction. Methods included verbal information, intellectual skills, cognitive strategies and motor skills and attitudes. These conditions laid a foundation not only on how to design elearning environments, but also on choosing

[178] Abbey (2000).
[179] Wiberg (1995).
[180] Bransford, et al. (1990).
[181] Gagne (1992).

appropriate media. Key principles of this theory included; different instruction is necessary for different learner outcomes, and events that occur during the learning process impact what is learned.

- Engagement Theory[182] is most specifically related to technology-based learning environments. It suggests that technology use may more easily facilitate the learning processes, even though it may not be necessary. This model by Kearsley and Shneiderman states that learners meaningfully participate by interacting in a realistic way with program activities. They suggest that these learning activities are project-based, occur in collaborative groups, and have a meaningful and realistic focus. Many of Salmon's "e-tivities" are based on engagement theory[183].
- Laurillard[184] has also devised a model of instruction for technology-supported learning environments. Laurillard emphasizes communication and collaboration between learners and facilitators, and is mostly for the use of interactive learning. Laurillard's model is composed of several stages of knowledge, experiences and communication. Here, she separates formal descriptions and personal experiences and uses reflective activities to develop knowledge. This practice is based on the idea that someone with a formal, more public knowledge may find it challenging to link it to personal direct experiences, and vice versa. Communication techniques can help bind various knowledge chunks and experiences together in one learning experience. The Laurillard model facilitates learners by supporting them through 12 activities. These activities are dependant upon facilitator/learner participation and communication. Ties between knowledge, experience, theory and behavior are constructed through a flow of articulation, feedback, reflection, re-articulation and adaption.

4.2 The Elearner

Naturally, the learner that is using the elearning- or *elearner*, is a vital part of the elearning process. For many reasons outside the multiple intelligence categories, not every learner is a good elearner. There has been a great deal written about the various characteristics an elearner must have in order to be most successful in such an environment. Of course, new insights in learner theory and advancements in technology and design make learning for

[182] Kearsley & Shneiderman (1998).
[183] Salmon (2002).
[184] Laurillard (1993).

diverse populations easier. Nonetheless, elearners must have certain heightened characteristics to get the most from their elearning experience.

For example, elearning learners require a sincere desire to learn in an independently motivated way. Many of the tasks and activities are not directly supervised by a facilitator or instructor. Many also do not require that learners engage during certain days or times. This means that elearners need to *want* to learn- no one will make them learn. Elearners need to have regular contact with instructors, thoughtfully and carefully read and interact with all information provided, study and revisit previous materials and objectives, and use learned material in real-world situations to their personal necessity level. Also, elearners must many times commit to their own elearning plan. Course objectives are not always structured by the facilitator. Elearners need to choose when to engage in the elearning activities and how much effort they should commit to learning the material. They must consistently maintain self-discipline and avoid procrastinating tasks in order to "keep up" with class objectives.

Secondly, they must be able to communicate effectively with facilitators, professionals, support staff and other learners and fulfill course assignments in a timely manner in order to reap full benefits of elearning programs. This not only means being a motivated and self-directed learner, but also an excellent communicator. In the traditional classroom, many nuances can assist how an idea comes across to colleagues and instructors. Questions and comments can be supported by various forms of body language and voice tones. In an elearning environment, there are certainly technologies such as video or audio phone that can help bring fluctuations in voice and body language across to recipients. For the most part through, chat streams and email are still the most popular form of communication. This means that the ideas and thoughts of elearners come directly through the written word. For the normal learner, matching exactly every personal communication nuance into words is very difficult. Elearners must not only be comfortable in thinking carefully about their written correspondence, but be confident that their ideas are coming across to others in a meaningful and relevant way.

Of course, there is a wide variety of different elearning environments to choose from. Many may be more relevant for a certain type of elearner. Elearning environments can combine elements from a variety of technologies and formats to cater to learners with specific needs and comfort levels. For those not willing to chance comments and questions exclusively

through chats and emails, some environments include video streams to communicate with others. Others include an array of materials that supplement the regular elearning environment for diverse multiple intelligences. These can include elearning with additional post correspondence, telephone conversations with colleagues and facilitators, and video cassette case studies. It is of utmost importance that elearners understand their environment options and are able to find one that fits their needs and comfort levels.

4.2.1 Empirical Research

Empirical research is one way to decide if certain elearning environments are more relevant learning tools than others for diverse learners. Different methods of elearning delivery such as Internet, instructional video cassettes, and even correspondence have been carefully studied in the past decade[185]. Many agree that none seem to have any direct bearing on student performance results, as determined over the past 20 years[186], and also reiterated through more current studies[187]. This supports the need for elearners to find environments that attract their personal needs as a basis for decision. In the vocational education sector particularly, these studies have not been extensively undertaken, yet there have been a few significant contributions. Research results such as satisfactory student assessments of vocational education distance learning classes[188], equal or better student performance results[189], and student positive perceptions of knowledge-transfer in online courses versus traditional campus courses[190] have been made. With innovations in technology and more priority on theory, these environments are becoming increasingly positive in many sectors of learning and training.

There have been several statements since the late 1980's suggesting that hypermedia elements create beneficial outcomes for elearners[191]. A number of empirical studies have unfolded significantly positive learning achievement in hypermedia-based environments compared to text-based materials. There has also been more recent empirical study on the individual

[185] Simonson, et al. (2003).
[186] Clark (1983, 1984), Verduin & Clark (1991).
[187] Cheng, Lehman & Armstrong (1991), Fallah & Ubell (2000), Johnson, Argon, Shaik & Palma-Rivas (2000), Gagne & Shepherd (2001), Johnson (2002), Rovai (2002).
[188] Misko (2000).
[189] Swan & Jackman (2000), Tucker (2000).
[190] Willis & Joyner (2000), Petty & Brewer (2002).
[191] Ford & Chen (2000).

differences between learning and hypermedia user navigation in particular[192]. Ford and Chen's[193] study on the topic resulted in a range of results based on age, gender, prior experiences with hypermedia, learning behaviour, and learner outcomes. These results were based in part on a categorization system of cognitive elearner styles- or the strategy by which individual learners' process information. These cognitive styles can include field-dependent and field-independent learners. A field-independent elearner is analytic, and prefers learning environments where they have control over the structure of their own learning. In comparison, a field-dependent elearner prefers more globally-processed information, in an environment that is structured and analysed for them.

The results from Ford and Chen's study have interesting implications on multimedia design for diverse learners. First of all, field-independent elearners had significantly greater levels of prior experience with computers. This lead to those learners viewing greater amounts of screen pages, spending less time with the program and less time finishing activity tasks. These students also looked back at previously visited pages less often, and made fewer requests for help. Females were more motivated than males to spend time with programs for extrinsic reasons. They also made more requests for assistance, and completed more goals within programs. No significant differences were found between learning outcomes and field dependence differences, although the authors did note this was unique compared to other such studies that contended field-independent learners outperform their field-dependent peers.

Even though many students have shown that cognitive factors such as learning, performance, and achievement in elearning classes are comparable to those observed in traditional classes, perceptions and satisfaction levels of instructors and students of elearning education have not shown the same consistency[194]. Factors such as accessibility to materials, other students, instructors, control of time and cost can influence individual perceptions of elearning. Carr[195] found that undergraduates enrolled in an introductory psychology course performed better in elearning courses, but were generally less happy with them. Students in the web-based course consistently scored an average of five percentage points higher on the final exam than did those in the lecture course, but they consistently reported less satisfaction than the students in the lecture course. The study reveled that the exam results were slightly higher in the

[192] Ford & Chen (2000).
[193] (2000).
[194] Rivera, et al. (2002).
[195] (2000).

traditional class, and lower in the blended class. Student satisfaction on the other hand was highest in the traditional class, and second in blended learning situations.

4.2.2 Multiple Intelligences

It has been previously established that an important factor then is the individual as an elearner, and how they as a single entity- not a collaborative class group, are affected and effect the elearning program and their knowledge[196]. One challenge to that is even conventional educational technology has been limited in how much it can effectively reach all learners in a traditional classroom[197]. This challenge has come to affect new multimedia learning environments as well. Gardner created the theory of multiple intelligences in order to support this idea, which can be integrated both into the traditional and multimedia elearning environment. These thoughts have affected multimedia-based elearning environments as well. With many current environments designed with a foundation in multimedia, combining learner intelligences with multimedia elements creates many new possibilities for learner comprehension and retainment. In this way, multimedia allows learners to use as many senses as possible for full comprehension. Eight intelligence categories make up Gardner's Multiple Intelligence Theory (although others have since been added, such as "religious/spiritual"), but it is noted that clearly one individual would not solely be described in one intelligence. The following summaries of the eight categories are exemplified by elearning-based design suggestions.

- Visual/Spatial includes those learners who think in terms of cognitive "pictures". These elearners capture knowledge pictures and store them in their mind as visual representations of thoughts or concepts. Due to this, these learners respond most successfully to visually-based learning material such as graphics, visual effects, Power Points, videos, charts, maps, graphic organizers, and design, draw and modification tools.
- Verbal/Linguistic learners have exceptional speaking and listening skills, and as such learn most successfully when given opportunities to listen or reiterate stories, take detailed notes, read and interpret, memorize facts, analyse case studies, communicate through typed correspondence, and answer written quizzes or surveys.

[196] Händschke (2003).
[197] Manouselis & Sampson (2002).

- Logical/Mathematical types have strong senses of reason and logic. These learners process and connect cognitive information in the form of numbers and patterns. They benefit from elearning environments that use spreadsheets and calculations, conduct and analyze experiments, use expert assistance for solutions, organize and classify information, and develop theories and conclusions based on fact.
- Bodily/Kinaesthetic intelligences are usually very good at controlling their body movements and handling physical objects. They best process information through interacting with physical space around them. In an elearning environment, the physical space is virtual, so these learners will benefit from interactions with that virtual environment. This means activities such as hands-on manipulations, videos and simulations where the user has the choice of outcomes, game-like activities, videoconferencing, and blended-learning solutions are best.
- Musical/Rhythmical learners naturally think in terms of sound, rhythm and pattern. This makes them particularly sensitive to what other users may consider "background noise" in an elearning environment. Because of this, certain activities may be best for these types. Composing songs or raps to summarize information, associating tones with stages of a process, using sound effects to accentuate key points in a presentation, or using background music to enhance mood are a few effective suggestions.
- Interpersonal Intelligences include those learners who are very good at relating to and interpreting the thoughts and feelings of others. They usually enjoy cooperative and collaborative learning settings, and excel with activities that have role-playing, discussion groups, case study analysis for motivation, conflict, feelings or intention, or verbal-skill based agreement.
- Intrapersonal learner types can precisely understand and express inner feelings. They are particularly good at processing information and reflecting on strengths, weaknesses, establishing goals and understanding their relationships with others. They may excel with activities that allow voicing opinions and feelings, role-playing, discussions, and dissemination about how a problem was solved.
- Naturalists have increased sensitivity to the world around them including animals. They process information best by exploration and respond to elearning activities that visit additional web sites, implement virtual field trips and tours, and have blended learning combining live field trips with virtually communicated experiences.

Until recently, computer-based learning environments were subject to the predominant use of Power Point slides and PDF resource texts. Meacham suggests that various available features should be used in elearning environments in order to touch upon all multiple intelligences[198]. These options can include

- Display presentations and Power Points
- Whiteboards or other drawing and charting programs
- Chat-room communications
- Voice-playbacks
- Real-time video
- Document mark-up tools such as highlighters and text and draw tools
- Surveys and quizzes
- Downloads and relevant reference materials
- Links and connections to internet and intranet resources
- Symbols to express emotion or signify concern (emoticons)

4.2.3 Soft Skills and Elearning Content

Naturally, the learning content delivered to the elearner is a significant factor in the learning process. Soft skills for example, are becoming a particular topic of conversation in elearning circles. Soft skills are the practice and mastery of such topics as effective communication, creativity, listening, flexibility, negotiation, conflict management, teamwork, problem solving, and other such open-ended practices. Research has suggested that workers and learners with a mastery of such soft skills perform beyond general expectations[199].

For the most part these skills are learned and practiced from birth onward with the support of face-to-face mentors from parents to teachers to supervisors in the workplace. Now, with the growing use of elearning delivery methods for education and training, soft skills are entering the virtual learning place as well. Regardless, controversy surrounds the implementation of such topics through technology. What was once a strictly human-to-human learning process is now becoming a computer-to-elearner process, but whether it is an effective delivery method remains a concern.

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[198] Meacham (2003).
[199] Goleman (1995).

According to Godfrey Parkin, president of MindRise in Washington D.C., some soft skills lend more to elearning than others[200]. These include marketing, strategy, administration and managerial skills. In these areas, learning objectives can present and apply concepts, offer examples and feedback, and introduce learning chunks and theories. Needless to say, challenging factors can still arise. Mirroring face-to-face mentoring through elearning delivery creates communication, collaboration and design challenges. Parkin believes the best solution is to blend methods of elearning and traditional mentoring to create the most successful soft skills learning platform. Even pseudo face-to-face mentoring can be executed online, through collaborative learner groups faced with problem-solving scenarios. Combining elearning soft skills with traditional classroom learning, cooperative email and chat room experiences, online video and audio opportunities with professionals and other colleagues all make soft skill learning more authentic and accessible.

From a research point of view, very few empirical studies have been undertaken in areas of soft skills. According to the American Society of Training and Development (ASTD), more than "67% of the training directors interviewed do not measure the effectiveness" of their soft skills programs at all[201]. The growth therefore of elearning-based delivery has traditionally been driven by less scientific grounds; flexibility of use, demand for soft skills, extended reach of elearning delivery, and future potential are some of the most significant. Naturally, such growth leads to some of the challenges of elearning, as discussed in section 3.4 *Discussion on Elearning*. Research by Bernthal, et al.[202] has shown that soft skills do develop more effectively in tested groups over time. Although 73% of organization members rated their elearning soft skills as "neutral" or "not at all" effective, over the next 5 years, their ratings were much more positive. This may be due to more exact soft skills elearning objectives for the specific learner group, or increased elearner confidence and comfort with such topics.

To counter these less than consistently positive results, various suggestions have surfaced to support the effective delivery of elearning-based soft skills. These factors include; knowing the elearner population, understanding their goals, objectives and expectations, having a clear development plan for the learner content, implementing regular evaluations of the system with relevant user groups, and choosing pertinent technologies and delivery methods that support

[200] Barbian (2002).
[201] Clothier (2003).
[202] (2003).

learner content. Most literature research has suggested a blended approach to soft skills topics is necessary. Others have additionally claimed thinking "outside the box" can increase motivation and learner instigation. Clothier notes for example, developing soft skills programs with motivational theory from TV, the cinema and video games may support learner interest and interactivity levels[203]. These factors may significantly increase the positive potential of elearning for soft skills development.

4.3 Attractive Motivational Factors

At some level, elearning or any learning material must be motivating to be attractive to the user. Attractive elearning may come in the form of ease of use, time saving potential, financial or professional gain, interesting layout and design, complimentary colors, eye-catching characters, enlightening new learning concepts, text written in an interesting style, content providing information that is relevant to the user, or programs incorporating innovative technology or activities. In addition, elearning that mirrors learner goals, or elearning built on learner theory foundations significant to the user- whether those foundations are conscious to the learner or not, can also be attractive.

All of these elements can ignite a level of attraction from the user toward the elearning programs. This attraction motivates the user depending on their perception level toward particular elements to continue activities with that program. In this way, evaluating motivational factors can provide a credible way to support the isolation of the concept of elearning attractiveness.

After learner goals are secured, and an appropriate foundational theory is determined, motivational factors must be taken into consideration. Motivated participation in learning efforts of any kind, and of course elearning, is a key component to success[204]. Even with the very best learning content, design, and facilitators, without participating learners, elearning does not have a chance to properly begin. Horton has noted that elearning courses have a drop-out rate of approximately 85% world wide[205]. Because of this, keeping learners sufficiently interested, engaged, and motivated to continue is an essential element[206]. Horton

[203] (2003).
[204] Dick & Carey (1996), Clements & Sarama (2003).
[205] (2000).
[206] Abas (2003).

and others go on to note that elearning requires motivational elements to be successful as well[207].

Based in part on Horton's thoughts, Abas has designed an organizational wheel of essential elements of motivational success, as reprinted below[208]. These elements should be used as guidelines for web-based learning environment design. Many may also be included in other forms of elearning. From the innermost sections, this wheel builds upon Horton's four recommended areas of motivation which are Communication, Content and Activities, Community and Reinforcement. Moving outward in any one of these four areas are suggestions for effective design elements. One example is the area of "Reinforcement", to "Prompt Feedback". Continuing to the final ring of the motivational wheel gives further examples of how prompt feedbacks can be implemented. These include "Assignments, tests, questions, comments and suggestions." and also "Auto marking."

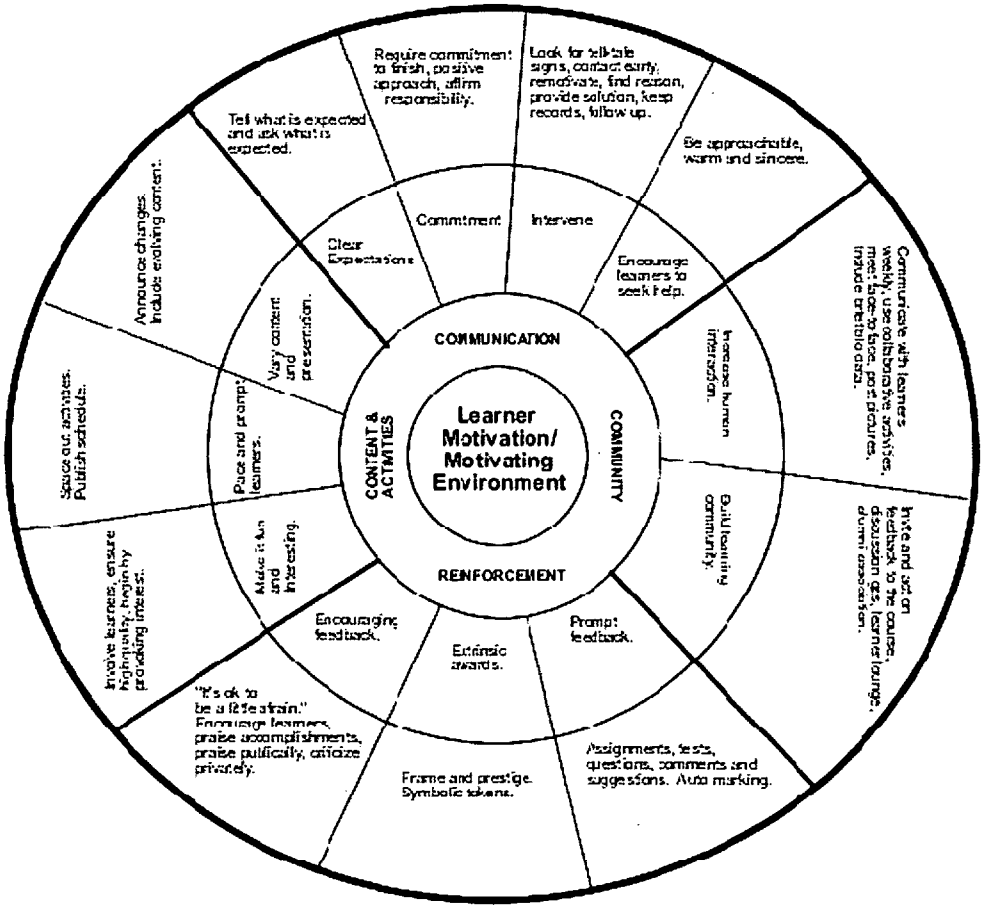

Figure 4: Abas' Motivation Wheel

4.3.1 Motivational Theory

[207] (2000), Powers & Guan (2000).
[208] Abas (2003), p. 402.

Although Abas gives us a helpful pallet for motivation elements, it is difficult to construct a reliable *theoretical* basis for motivating learners. In the past, motivation was said to be based solely on primitive needs and wants[209]. More recently, three particular theories have been formed around motivation that can assist in the design and implementation of effective elearning environments[210]. These include attribution theory, expectancy-value theory and goal theory.

Attribution theory relates to how the learner themselves explain their own successes and failures. These can be determined by controllable or stable internal and external factors. A learner that states that the reason they did poorly on an exam is due to the fact that they did not study leads to internal attribution. That is to say, the situation was not stable, but the learner had control. In lieu of this understanding, elearning environments need to encourage learners to understand their success is based on controllable and unstable efforts on their part to succeed. When learners realize they can change their own success rates, motivation will in turn increase[211].

Expectancy-value theory basically states that a learner will be motivated by what they believe they can expect to achieve. If a learner wishes to have a good grade, they will be more motivated to succeed in the learning environment. Clearly, this theory is based heavily on what the students' own perception is of success. If good grades are not an important factor of success for the student, they will not be motivated to the extent the student in the first example was.

Goal theory supports the idea that if a learner organizes their own personal goals, they will be more motivated to achieve those goals than if another person organizes the goals for them. Personal performance goals are designed around what the student already knows, compared to what the student wishes to achieve. If the learner wishes to achieve a better grade in a subject than they did last semester, they will be more apt to strive for that achievement due to the fact that it is personally chosen by they themselves. These goals can be long (distal) or short (proximal) term. According to Driscoll[212], "Performance goals foster the implicit belief that

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[209] Weiner (1990).
[210] Bandura (1997).
[211] Hodges (2004).
[212] (2000), p. 309.

intelligence is fixed, while learning goals are associated with the belief that intelligence is malleable and can be developed." Due to this, short term goals are more motivating, although actually working toward the goal is necessary after setting a goal.

Although all of these motivational theories are unique, they do all contain the element of learner self-efficacy. The learner, in other words, always has control of their success through level of motivation. In addition, all three of these theories have both internal and external rewards. Receiving a better worker salary after accomplishing performance goals in goal theory, taking pride in knowing personal time and efforts paid off for a positive mark through expectancy-value theory, or realizing "I did well in the class due to the fact that I participated consistently" are all potential reward motivators.

4.3.2 Authenticity

Authenticity has to do with the real-life transferability of the elearning content. Many scholars have attempted to define authenticity and authentic characters of elearning environments[213]. Basically, there are 10 elements that support authenticity as given by the literature:

- Real-life relevancy
- Open-ended, need learners to complete tasks and activities
- Elongated, learners can investigate and re-investigate over a period of time
- Provide opportunity for learners to examine a task from different perspectives and use a variety of resources
- Collaboration opportunities
- Opportunities for the learner to reflect
- Activities can be applied to various settings outside the environment goals
- Activities and assessment of tasks is cleanly integrated
- Create finished tasks as compared to building blocks to other activities
- Allow for diverse outcomes

Incorporating authentic elements supports not only that users will be more motivated to learn, but also that this real-world motivation may encourage life-long learning commitments.

[213] Herrington, et al. (2003).

4.3.3 Interaction and Timing

Interaction refers to how learners deal with and navigate through the elearning environment. Due to its significance, interaction is an important part of design, and can affect the level of motivation a user has. If environments are convenient to interact with, users will be more willing to continue. If programs are frustrating and overly complicated, users will have difficulty interacting within their learning environments, and lose motivation. Many designers think interaction is trivial compared to other elements, and leave its evaluation until post-implementation[214]. This results in un-necessary glitches in reliable elearning evaluation, as lack of motivation from interactivity levels can affect other perceptions as well. For that reason, it is important designers ensure users feel comfortable and confident interacting within the learning environment as early in the design process as possible.

Interaction should not just be contemplated in the design process, but evaluated in implementation as well. Preece, Rogers, and Sharp[215] note the "ten minute rule". Here, if users take more than 10 minutes learning how to use a system (if it is not entirely too complicated), then interactions needs to be altered. Elements of interaction have been discussed in the area of vocational education and technology-based learning environments. Research has contended that adult learners in these settings are driven by life-long learning needs, and thus take interaction-motivated active learning positions instead of more traditional, passive ones[216]. These findings reiterate the vital importance of proper interactivity.

Theoretically, Piaget has suggested that interactivity is essential from a constructivist point of view, as the manipulation of learning objects and the real world develops mental cognition. Likewise Vygotsky also notes interaction is important. Cooperation and collaboration between social peers with differing levels of ability can help aid the intellectual development of others. This can also be supported in the learners' interaction with computer-based learning objects[217].

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[214] Bouwhuis (1996).
[215] (2002).
[216] Fung & Yeung (2000).
[217] Vivacqua, et al. (2003).

Along these same lines, efforts have been specifically made to develop human-like conversation elements in elearning environments. Many language programs and other educational materials include interactive conversations for learning. With the improvement of successful multimedia agents such as audio, video, and even animation, color and download time, meaningful elearning interactivity such as this is growing. The level of interactivity a user is able to have with computer-generated characters has been said to support collaborative learning efforts much like cooperative peer groups[218]. Characters have the potential ability to show emotion, tutor, guide, facilitate and support. In addition, direct interaction with computer-generated characters supports gaming[219] in learning environments. Users are motivated to interact with comic-like characters, as further discussed in 4.5.3.1 *Text and Graphics*, and also 4.5.7 *Animations and Cartoon Drawings*. The multiple-choice format of most interactive elearning conversations instills a power of self-determination and thus motivation- all of which are key elements to successful elearning environments and also life-long learning efforts.

When designing interactivity, a few priority elements are mentioned in the literature. One of the most common elements in elearning environments is the use of metaphors[220]. Metaphors help users interact and navigate through potentially complicated environments through commonly connected objects. Due to the fact that metaphors, like those commonly used in everyday language, are such an integral part of our lives, designing interfaces around metaphors makes interaction more comfortable for the user[221]. Icon links designed as books or doors make it clear that users can travel to another node for additional or new information and experiences. Of course, some metaphors have had less than understandable design. Throwing a diskette icon into the desk top trash can in the Macintosh interface in order to eject it seemed naturally peculiar. The use of a particularly American mailbox and red flag to indicate one has received an email was, for most non-American users, also questionable.

Other systems offer more realistic options. Deciding on which metaphor to use depends on a number of questions. These include understanding how the system will work, what elements may be challenging for users, and which metaphorical ideas will compliment the system and assist users accordingly[222]. By incorporating metaphors, not only is interactivity positively

[218] Klaila (2001).
[219] Gaming is further discussed in section 4.3.5 *Gaming Integration*.
[220] Ebersol (1997).
[221] Erickson (1990), in Laurel (1990).
[222] Erickson (1990), in Laurel (1990).

affected, but also ease of use- this in turn supports user motivation as well. In addition, as previously mentioned, choice and control are also important elements of interactivity design and motivation. When individual learners are able to choose the learning nodule to be undertaken, they will have higher levels of interest which creates more success and efficiency in learning[223].

Despite its importance, interactivity is also one of the greatest challenges to elearning design. Although there have been many successful case studies elaborating on interactivity[224], reliable models based on *pedagogical* foundations are difficult to come by[225]. One particular factor in interactivity is time. Research on response times has been well-established[226]. Tong and others have contended that speed and time are top design priorities[227]. Users require less than a one-second time window when moving from one screen to another for most "effective" use. Regardless, not much has been empirically written on time windows between screens and learner outcome. If teaching is, as one considers, a way for learners to save time in knowledge attainment, it is interesting to note little research has directly tackled the theme.

4.3.4 Creativity

Creativity can also be a consistent motivator in elearning classes[228]. Due to the broad and rapid growth of the Internet, creativity has begun to play an extensive role in competitiveness. Companies must likewise then keep up pace with creative and changing environments, and so seek equally creative employers. It is becoming more and more apparent to educational institutions that creativity is a growing need and commodity, and this has also affected the design of elearning environments. It is important now for learners to learn and think to creatively solve problems, as opposed to learning through conventional lecture methods that do not support real-world need. With that in mind, educational settings founded on constructivist theories that support creative environments and activities are important and necessary structures for elearning as well. Computer systems have the ability to support

[223] Xu, et al. (2003).
[224] Futtersack & Labat (1992), Major (1993).
[225] Teutsch (1993).
[226] Tong (2001) also lists the work of Dalal, et al. (2000), and Fernando, et al. (2000), to name a few.
[227] (2001).
[228] Vivacqua, et al. (2003) also see Clements & Samara (2003) for an extensive list of positive empirical research on technology-based learning systems and creativity, p. 8.

creativity through knowledge gathering, integration and idea generation, and also by providing functionality with clarity and meaningfulness[229].

Shneiderman has developed eight guidelines for the support of creativity in elearning design, many of which have close relationships to pedagogical theory[230]. These make up the GENEX framework, and may be undertaken by individual learners as well as collaborative groups. One belief surrounding GENEX is that new knowledge is built on previous knowledge, which is supported by constructivist theory. Secondly, in accordance with Piagetian thinking, meaningful tools can help support creativity in learners and interaction with real world experiences can result in the development of intelligence. Vygotsky's words are echoed in the third and fourth foundational belief which recognize that learning is a social effort as well as one that must be disseminated.

One guideline for creativity suggests learner options for browsing digital libraries and other web and CD-based resources. This allows learners to broaden and more quickly collect pertinent information on an individual basis. Another recommends exploring solutions where learners can interact with "what-if" tools and simulation models. Activities designed in this way encourage users to control their own decisions as well as create multiple scenarios and outcomes. These actions broaden the learners' cognitive horizons and allow them to safely simulate and understand complex relationships. A third recognizes the importance of the learners' option of reviewing and replaying previous nodes in order to analyze and reassess activities. Other guidelines include visualizing data, free associations, and disseminating results.

4.3.5 Gaming Integration

Gaming is an interesting topic of discussion in elearning activity, and one that I believe, as do many scholars, should be discussed in relation to elearning environment design. Scholars agree that play can be an important factor in learning[231]. Computer games specifically lead the way to combining play and learning through fun[232]. This makes them excellent models for successful motivational elements and interface design in learning activities. Amory[233]

[229] Greene (2002).
[230] Shneiderman (2000).
[231] Amory (2001).
[232] Crawford (1990), in Laurel (1990).
[233] (2001).

relates there has been evidence both adventure and simulation games are appropriate tools in education. Naturally, the artificial intelligence based flight simulator "game" has become one of the most successful training and recreational programs over the last 20 years. A growing question in technology-based learning circles is how to combine learning experiences with the motivation levels attained by gaming users. Designers of such systems have pinpointed, in many respects, extraordinary methods of enticing people to learn and continue to learn. These levels of continuous motivation are key elements in life-long learning.

As Gee[234] suggests, "... computer and video games are going to become the predominate form of popular culture interaction in our society". Realizing this fate, it is essential for learning environment designers to uncover the recipes of success games seem to create. Many of these gaming methods are based on learner theory similar to that being discussed in traditional and elearning settings. For the most part, games are a way users can interact on a constructivist level with microworld learning environments. In a microworld, learners become an active part of an environment, constructing knowledge as they go, which stimulates interest and supports motivation. Despite this, very little has been written concerning developing a strictly game-founded learner theory[235].

One reason for gaming integration is that games give users an opportunity to interact in an environment they would never have been able to before. They are encouraged to have new experiences in new places as "new" people or characters. In many gaming environments, users can also interact with life-like and non-reality characters and objects, such as cartoons and animations. Experiences such as these not only promote creativity, but also encourage user thoughtfulness and intelligence.

There are various ways to integrate successful gaming techniques into motivational interface design. Crawford[236] suggests placing greater value on graphics and sound and emphasizing interaction. Gee goes on to suggest a list of elements that gamers integrate into successful programs in order to encourage extended and motivated use. Naturally, integrating these principles into related elearning environments could create similar responses. These principles include empowering learners through co-design, customization, identity and

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[234] (2004).
[235] Quinn (1994) did describe game development from a variety of theoretically-based angles, and Amory, et al. (1999) additionally designed the Game Object Model (GOM) for design, play/development and educational theory.
[236] (1990), in Laurel (1990).

manipulation; involving learners in pleasantly frustrating problem-solving activities; and an overall support of learner knowledge through diverse actions and experiences. Two game-based factors are of particular significance in this research. These include the use of simulation questions, and artificial intelligence agencies.

4.3.5.1 Interactive Simulation Activities

Creating gaming situations in elearning design can also be accomplished through the integration of interactive simulation activities between the user and the elearning program. There has been recent research suggesting that interactive simulations can be effective learning tools[237], but not just due to simulation attributes, but also specific design factors. Interactive simulations are those that present brief scenarios, highlight small learning themes, or chunks of information, outline real-world scenarios, and ask learners to make decisions with the intention to support learner knowledge. Such simulations are then very beneficial when the information to be learned is verbally-based as opposed to non-verbal such as sport performance. Taken from an extensive literature review according to Thalheimer[238], there are five basic learning factors utilized in effective interactive simulations; aligning contexts, retrieval practice, feedback, repetition, and spacing.

Aligning contexts refers to learning and performance. This can be achieved by designing realistic decisions aligned with realistic settings for the learner. Psychologists have found that such alignments support the memory and retrieval of necessary information later in similar contexts, as opposed to attempting to retrieve and use information in a different situation[239]. By doing so, learners are more likely to remember and reuse information from these simulations later on the job. By using aligned contexts, Thalheimer[240] concurs learners are said to improve their performance by 10-55%.

Retrieval practice encourages learners to remember and retrieve information to make decisions. This prompting can be supported by interactive simulation questions in elearning

[237] VanSickle (1986), Bell & Waag (1998), Klein & Fleck (1990), Jentsch & Bowers (1998), in Thalheimer (2004).
[238] (2003).
[239] Smith, Glenborg & Bjork (1978) on children in and outside classrooms, Godden & Baddeley (1975) on scubadiving students, Bower, Monteiro & Gilligan (1978) on moods, Eich (1980) on under the influence, Herz (1997) on peppermint smells, Grant, Bredahl, Clay, Ferrie, Groves, McDorman 6 Dark (1998)on noise levels, Smith (1985) on Mozart and Jazz, in Thalheimer (2003).
[240] (2003).

design. These types of learning exercises help learners heighten retrieval abilities for real-world situations later on. Although many suggest retrieval practice does not increase learning, they do acknowledge it prevents forgetting- even without proper feedback[241]. Adding elements of retrieval practice is said by Thalheimer[242] to improve learner performance by 30-100%.

Eliciting realistic feedback throughout interactive simulation scenarios is also determined by Thalheimer[243] to improve learner performance 10-25%. This is supported by many research studies[244]. Such feedback allows learners to better understand and correct their decisions. In addition, feedback that explains the correct answer and reasons for that answer, as opposed to simply stating whether an answer is right or wrong has also shown advantages[245]. Moreover, feedback on incorrect answers supported learning improvements far more than feedback given to correct answer responses[246]. The timing of this feedback has also driven significant research results. Immediate feedback as opposed to delayed feedback increased later retrieval rates by 97% in a study by Phye and Andre[247].

Repetition also plays a significant role in successful interactive simulation question design. Planning scenarios that cover similar learning themes can improve learning outcomes by 30-110%[248]. There has been extensive research on the effectiveness of repetition in many fields. These include Morse-code telegraphers, typists, computer game players, target tracking, reading, list retention, music, television and advertising, and note taking[249]. In addition, spacing within repetitions also has significance in interactive simulation questions. Spacing has been the topic of more than 300 research studies over the last century, and continues to be an important factor in learning improvement.

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[241] Allen, Mahler & Estes (1969), Runquist (1983, 1986), Izawa (1992), Rose (1992), in Thalheimer (2003).
[242] (2003).
[243] (2003).
[244] Karraker (1967), Kulhavy & Anderson (1975), Surber & Anderson (1975), Kulhavy, Yekovich & Dyer (1976), Sturges (1978), Clariana, Ross & Morrison (1991), Webb, Stock & McCarthy (1992), in Thalheimer (2003).
[245] Phye (1991), Phye & Sanders (1994), in Thalheimer (2003).
[246] Guthrie (1971), Surber & Anderson (1975), in Thalheimer (2003).
[247] (1989), in Thalheimer (2003).
[248] Thalheimer (2003).
[249] Bryan & Harter (1897), Fendrich, Healy & Bourne (1991), Shebilske, Goettl, Corrington & Day (1999), Wulf & Schmidt (1997), Rothkopf (1968), Barnett & Seefeldt (1989), Bromage & Mayer (1986), Krug, Davis & Glober (1990), Waugh (1962), Roediger & Challis (1992), Madigan (1969), Gardiner, Kaminska, Dixon & Java (1996), Rethans, Swasy, Marks (1986), Singh, Mishra, Bendapudi & Linville (1994), Kiewra (1989), in Thalheimer (2003).

4.3.5.2 Artificial Intelligence Agencies

Artificial intelligences reach wider than our traditional archaic picture of man-like robots conversing to our children or vacuuming our carpets. Now, basically every successful computer game is proof that AI can exist without reaching human level. AI can be incorporated into video games by suggestions and referrals, office programs with help support and assistance, or be integrated as voice recognition systems for advanced usability. Naturally, AI has the potential to be highly complicated, or relatively simplistic, depending on the needs and constraints of the intended integration. Due to the interactivity of such agents, AI aids in the potential users have for a more immersed experience with the program. One of the greatest challenges now is initializing AI agents into programs that possess non-stilted, non-scripted, human-like behaviors and still engage users. Regardless, there has been growing interest around AI elements of all levels of complexity. These ideas can help continue to support more life-like and effective agents in the future.

According to the CMU project "OZ" from 1995-2002, to ensure AI agents are supporting the program experience in an effective way, they must at minimum:

- Have believable social behavior
- Deliver reactions to experiences
- Affect or support affecting users
- Be clearly speaking or listening to other agents or the user

A great deal has also been published around the benefits of AI. Magerko, et al.[250] for example implemented a study to determine whether or not AI character agents really facilitate and support games where the AI agents' incorporation was key to the success or failure of the user's interaction with the program. Although the character agents in their project contained complex physiology and environmental sensing, their results showed carefully designed AI characters that were specifically developed for use within particular environments were indeed facilitators of the program storyline and gaming factor. This supports the fact that such agents can be valuable and effective gaming and learning guides. Even at more simplistic levels, incorporating AI-based characters that possess a sense of mood, opinion, and *character* lend to the overall dimension of reality within an interactive program.

[250] (2004).

4.4 Interface Design

Horton has contended that there are no boring computer learning systems, just boring designers[251]. Interface design refers to how the elearning environment looks, is "laid out", and how interactions take place through pre-determined connections. Psychophysics is a branch of psychology that is concerned with such relationships of search and identify to interact, supporting its importance. A great deal has been written about effective interface design both from case study and suggestion standpoints, and also empirically. Interface design can include menu design structure[252], how user orientation is organized and referenced[253], colors, buttons, links, frames and other such architectural details.

Horton has suggested various ways to keep interface (and pedagogical) interfaces interesting and successful. These include; appealing design, short synopsis and scenarios, quick and easy initial questions to be answered (promoting interactivity and motivation), learner portfolios to re-examine throughout and after the course end, interesting text, quality programming without technical error, game-play, meaningful learning, various presentation methods, recognition of learner achievement, friendly class competitions tracking learner objectives, course syllabi, facilitator feedback and opportunities for learners to participation in various communities such as chat rooms.

4.4.1 Shneiderman Guidelines

Ben Shneiderman has made great contributions to interface design. In his book, Designing the User Interface: Strategies for Effective Human-Computer Interaction[254], he explains his suggestions for developing successful interfaces. These suggestions can be taken in the successful design of elearning environments as well. His suggestions include:

- Be consistent in actions, terminology, colors, layout, fonts, menus and prompts
- Enable shortcuts for frequent users
- Consistently offer informative feedback

[251] (2000), p. 425.
[252] Lai & Waugh (1995).
[253] Shneiderman (1998).
[254] Shneiderman (1987), in Norman (1988).

- Design sequences with a beginning, middle and end
- Include error prevention and handling methods that are clear and easily understood
- Allow users to reverse actions at their will
- Support user control
- Reduce short-term memory load by using pull down screens, menus and the like

By incorporating Shneiderman's ideas, as well as including suggestions by others such as Horton, effective and motivating interfaces can be designed.

4.4.2 Usability

Usability pertains to how convenient the elearning environment is, how the interface is used, and how learners are affected through those environments. The ISO 9241[255] characteristics of usability include efficient, effective and satisfying. Quesenbery[256] has expanded the ISO definition to include the inter-relationship of effective, efficient, engaging, error tolerant, and easy to learn. Effectiveness refers to how completely and accurately learners can attain objectives within the environment. Efficiency deals with the speed and accuracy of that achievement. Engaging has replaced satisfying in Quesenbery's view in order highlight the "dynamic interaction"[257] between learner and environment. It deals with the level of user comfort and pleasing nature of the environment. Error tolerance means the system attempts to prevent user error as much as possible. Ease of learning ability recognizes that users can easily build on their previous knowledge and continue learning through the system.

There are various ways these dimensions of usability have been referred to in study. Most scholars and professionals agree that less is more, and interfaces with fewer elements, colors and options are easier to use[258]. This is due to the fact that with fewer elements on the screen, they are easier for the eye to find, and thus the user to interact with as they wish. Since 1994, there have been many results published concerning usability studies. Nielsen[259] has comprised a summary list of these literature-based results. In his compilation, he noted that users most often do not read text material, but instead scan the screen for necessary information. He also noted that the author's personality had a great deal to do with the

[255] www.iso.org
[256] (2003).
[257] (2003), p. 83.
[258] Preece (2002).
[259] (1997).

successful design and implementation of the environment, and certain personality types lead to more attractive environments.

Additionally it was suggested that users are usually impatient concerning complicated or "cool" features, and do not want to be slowed down by author promotion and the like. Factors such as search capabilities, ease of downloads, and ease of overall use were very important. Moving animations of any kind, frames, and wild backgrounds were greatly disliked. In addition, image maps were tolerated if they were designed with small sections and load quickly.

4.5 Elements of Hypermedia

Most recent platforms have the ability to incorporate many interesting and motivating elements into elearning environments. Multimedia, a combination of at least two of the following components; text, graphics, sound, animation, and video[260], is a popular way to deliver content and motivate learners. There is a growing amount of empirical research in the area of multimedia supporting this view[261]. Hypermedia, a similar combination of organized nodes of information connected by links, also has foundations in empirical study. These works recognize that such systems instill positive attitudes from users, that multi-modes of hypermedia (sound, visuals, text) support diverse learner groups, that hypermedia designed systems have just as high learner achievement rates as traditional environments, and are even more so effective with remedial and learning-disability groups[262].

This does not mean that simply using the resources ensures design and learner success. Knupfer and Clark[263] warn that "technology offers 'bells and whistles' that seem to have great potential but often take the lead and interfere with instructional design. Indeed, if misapplied, the software enhancements could actually befuddle the learning process". Too many operation options, poorly lain buttons and links, and un-necessary pop-up's and animations can inhibit users and potential learning[264]. More recent study contends that although

[260] Gretes & Green (1994).
[261] Lehman (2000).
[262] Ayersman (1996).
[263] (1996).
[264] Preece, et al. (2002).

hypermedia research seems positive on the whole, study into the affects of specific components of hypermedia (audio, animation, etc.) is currently in a weaker state[265].

One challenge may be that despite traditional instructional systems, design and constructivism has helped support hypermedia-based learner environments. Regardless, there is still no set hypermedia theory. In addition, other more technological grounds may affect valid hypermedia research. Incorporating hypermedia-based files when learners have slow access to the Internet in web-based learning certainly does not create reliable research environments, nor supports interactivity, time-effectiveness, or user motivation[266].

4.5.1 Models for Hypermedia and Motivation

Despite some research gaps, many agree that motivation factors play a significant role in overshadowing the current lack of hypermedia theory[267]. Hidi and Harackiewicz[268] have determined that multimedia-based, life-long learning environments have greatly assisted in motivating the "academically unmotivated". Given the necessity and benefits of life-long learning, coupled with the potential challenges of the "unmotivated", determining the true effectiveness of hypermedia elements is vital. This needs to be grounded in learner theory, as has been previously established all such environments should, but motivational factors need to play a significant role in this theory[269]. There are several motivational models that can support multimedia elements in the design of hypermedia worth mentioning here. Namely, these include the Time Continuum Model, ARCS Model, Hede's Integrated Effects, and an Instructional Design approach.

Although there are no recipes to absolutely ensure motivation success, Hodges[270] does refer to two particular models that he had determined best support motivation integration; the Time Continuum Model, and the ARCS Model. The Time Continuum Model is based on Wlodkowski's thoughts on organization[271]. It contends that there are three vital periods in any learning process, namely the beginning, middle (during the learning process) and end. Each of these periods is comprised of two factors (attitudes and needs) that support six

[265] Koroghlanian & Klein (2004).
[266] Abas (2003).
[267] Astleitner & Wiesner (2004).
[268] (2000).
[269] Jonassen & Land (2000).
[270] (2004).
[271] Wlodkowski (1985).

specific questions that can help support learner motivation while in that learning period. Instruction must support all three of these motivational learning phases. If one phase is lacking, motivation can be lost.

In the beginning first phase, for example, successful learning may be ensured by guaranteeing quality facilitation that encourages learners to try. Developing various methods to cater to different learning styles and intelligences can support this effort. Additionally, identifiable activities and opportunities to collaborate with colleagues can also support proper facilitation. Including evidence for the learner that their attempts were recognized is also important. These attempts are further developed by constant feedback concerning the learner process. Constant feedback allows learners to realize their feelings are being heard. Activities that reflect learner ideas and outcomes likewise support feedback efforts. Making the initial learning experience with a new topic stress-free, safe and interesting helps support successful learner attempts. Encouraging learner self-motivation throughout the process develops autonomy. Proper facilitators must stress the amount of effort necessary for learner success and highlight quality work and how it will be assessed. Evaluations should be based on personal performance measures and reinforced accordingly. This provides clear guidelines learners can follow in order to achieve high standards comfortably and knowledgeably.

The ARCS Model by Keller[272] is a three-part method for weaving motivational elements into learning materials. This model, that works with the expectancy-value idea stating learners are motivated when they feel they can be successful, is summarized by its four categories of motivation; Attention, Relevance, Confidence and Satisfaction (ARCS). By incorporating these four elements, learners will be better able to achieve their highest levels of motivation.

Attention motivation can be achieved by incorporating novel, interesting or surprising events into curricula. This in turn can increase learner information-seeking efforts and a motivation to ask questions or search for answers is thus ignited. This attention can be maintained by changing the elements within the curricula delivery. *Relevance* is addressed in order to increase motivation as well. Using learner-meaningful language and examples support this. Explaining goals and how they can be used in the learner's future can also address relevancy. Allowing learners to succeed promotes learner *confidence*. Presenting challenging yet undertakable goals encourages learners to exert effort to continue to attempt new goals.

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[272] (1987).

Providing feedback and support and assistance for the learner to assess their success rates also promotes learner confidence. Lastly, *satisfaction* can be achieved by providing feedback and support that sustains current learner behaviors. Facilitator consistency in terms of standards, reinforcement and consequences also develops successful learner satisfaction.

In his Integrated Model of Multimedia Effects, Hede[273] determined several categories of interwoven elements can help support motivation. First are those elements that have to do with the instructional material. These materials are transferred by visual or auditory input. Multimedia can affect these modalities through various degrees of learner control over design features, links, personal-goals, and interactivity choices. The second category deals with information processing. This is based on the attention level of the learner and memory. Elements such as time of interactivity, multiple learner intelligences, and engagement must be considered. Finally, the last category group is made up of four elements; intelligence, reflection, long-term storage, and learning. Intelligence should be influenced by diverse multimedia tools. Reflections help support the assessment of comprehension. Long-term storage refers both to receiving and storing information and also working knowledge. Lastly, learning is determined by understanding material delivered through multimedia elements, and effectively applying what was learned.

Lastly, Malone and Lepper[274] created a motivational model consisting of four important factors; challenges, curiosity, elements of control, and fantasy. Activities are made to be challenging by using Vygotsky's ZPD. Objectives are continuously kept at an optimal level of difficulty that in turn keeps users interested and comfortable. Elements of curiosity can be achieved by using audio and visual information. This entices the user to assume their present knowledge is incomplete, and they then strive to find out more. Motivation can also be supported by allowing learners a sense of control in their environments. If there are personal choices to be made, users are more apt to feel self-motivated to continue on their own accord. Lastly, fantasy or make-believe components are intrinsically motivating for learners, and keep interaction levels high. This can be accomplished by adding situations, characters and environments that are not similarly attainable in real-life.

4.5.2 Guidelines for Hypermedia Design

[273] (2002).
[274] (1987).

There are a significant handful of suggestions consistently presented in the literature that form reliable guidelines for interface design, which can additionally support hypermedia interface design. Simplicity, consistency, clarity, balance, harmony and unity, screen grid layout, line length, screen density, font selection and leading, icons, buttons and menus, and color comprise the majority[275].

Simplicity and consistency are relatively self-explanatory. They refer to keeping environments easy to use and navigate, and consistent enough that each node and link within that environment is equally user-friendly. Consistency can be achieved through screen grid layout by making sure all button links are on the same side of each screen. Tognazzini[276] does warn that consistency does not always mean "never changing anything". Many systems are greatly affected by new technological innovations and techniques. This means that first editions of programs may not enjoy the updated elements available to later editions. What may be more important, Tognazzini reiterates, are two guidelines for consistency. First, keeping true consistency or choosing new or altered positions for elements should be based on the users' consistent interpretation throughout the system- not on physical placement. Second, if alterations consistency do need to be made due to user interpretation or updated technologies, make alterations clear and obvious. Hiding such changes may make users wary of subsurface differences as well, hindering motivation, and interactivity.

Elements of clarity are related to these two ideas. Clarity, like simplicity, means keeping instructions, tasks, activities, and audio/text sheared down to the bear essentials, without any un-necessary material. Clarity also refers to the language being used in the environment. Writing short sentences with active rather than passive voice, personal pronoun use, informal language and inclusive words (those terms that include all genders, ages, and races, etc.) are all part of ensuring clarity. Likewise, harmony and unity are effective ways to design with consistency. Harmony can be achieved by similar fonts and colors throughout the environment. Unity through the consistency of networked screens.

Balance in an elearning environment can be designed by carefully placed objects and color-weight values (light and dark tones) on the screen. It has been suggested that during the 20th century typographic layers discovered asymmetric layouts of printed material proved greater

[275] Schwier & Misanchuk (1993), Lynch & Horton (1997).
[276] (1990), in Laurel (1990).

"vitality and inherent visual interest"[277] by the reader. It must be noted though that the "balance" of asymmetric layouts takes great effort to properly and effectively design. Balance can also result in the placement of words and pictures, which will be further discussed below in section 4.5.3.1 *Text and Graphics*. Additionally, line length, text font and leading, and screen density will be addressed in the same section. Icons, buttons, and menus are part of the interface and interactivity design. In addition to the previous discussion on interfacing, it is of utmost importance that buttons and menus look like they can be interacted with[278]. The use of icons has many advantages including 100% recall rates[279], but also has the disadvantage of being difficult to design and potentially "gaudy"[280]. Color is additionally further explained in section 4.5.3.3 *Use of Color*.

4.5.3 Visualization

Human memory consists of two divisions; short- and long-term. Both types "chunk" information, but short-term memory is limited to being able to store fewer chunks, while long-term memory has a limitless storage capacity. Likewise, the human brain has a limitless capacity for storing recognized pictures, and is thus directly routed to long-term memory, given that the pictures are meaningful. That being said, the computer is an excellent environment for the use of images to enhance learning, and has been documented in the literature as such[281]. Yet despite this realization, this was not always the case. A past 1984 survey found that there was a very low use of graphics and pictures in technology-based education software[282]. This may have been due to many reasons such as scholars and designers not realizing the importance of graphics, technologies not being able to properly transfer pictures, or copyright and other legal barriers. Now, especially with the increased use of multimedia, the importance and use of visualizations to support elearning is growing. Yet scholars do warn that unnecessary graphics can interfere with the learning process, and so should be used with care[283].

[277] Mullet & Sano (1995), p. 103.
[278] Shneiderman (1998).
[279] Branden (1996), Horton (1994).
[280] Horton (1994), p. 15.
[281] Horton (1994), Anglin, et al. (1996), Braden (1996), Koroghlanian & Klein (2004).
[282] Alesandrini (1984).
[283] Anglin, et al. (1996).

Levie and Lentz[284] recognized four effective functions of graphics. These included those visuals that attract attention to certain elements on the screen, affective pictures that are simply enjoyable and affect user emotions, cognitive related graphics that support understanding, and compensatory visuals that help "fill in gaps" where comprehension may be difficult. Using pictures related to texts next to a story is an example of compensatory visuals. In addition to these functions, Misanchuk, Schwier and Boling[285] point out a list of issues that need to be addressed when deciding to use visuals. Visuals, as they determined, need to be of utmost relevance to the objectives of the environment. They should be realistic (although photograph picture research does not show verification of this statement), simple, large enough for 1/4th of the screen, but not larger, and take cultural nuances into consideration.

4.5.3.1 Text and Graphics

That is not to say that pictures should stand alone. The human brain is composed of two hemispheres- the right hemisphere which is stimulated by illustrations and visuals, and the left hemisphere which reacts to more logical, pattern-based information. Elearning design should then cater to both hemispheres, so a meaningful stimulation of the two is achieved. This idea has been reiterated in comic-theory[286]. Balancing various elements of text and graphics (drawings, in the case of this research project) can support underlying meanings, feelings and set tones for entire environments. Text and graphics can even be combined to form picture-like words and word-like pictures in order to encourage certain reader perceptions.

Text options can include font, size, case, length, writing style, and even color and pattern. Human nature encourages readers to personalize these options, and put different meaning into words where there was none before. Reading "here is some normal, everyday text" in the same font, style, size, color and case as this dissertation can give readers a very different understanding as reading the hard, short, unfriendly (and rather frightening)"**TEXT**". Choosing text options that most reflect the tone of the environment can then play an important role in the learner's experiences. Likewise the style and color of the graphics, as further discussed in section 4.5.7 *Animations and Cartoon Drawings*, may also hold their own meanings for the reader. Many comic masters have ensured their popularity by finding the

[284] (1982).
[285] (1996)
[286] McCloud (1993).

perfect text/graphic match to support their characters for reader audiences. Other masters are renowned for experimenting with various diverse levels of text and graphic use- high flowing language style with complimentary colors, but sharp, hard drawn lines, or short, blunt sentences, strong, bold lines yet with soft tones and patterns. The decision is based on author style and audience preference.

A great deal of research has evolved surrounding the question of text and graphics[287], and text alone. Research concerning the length of each text line seems to be contradictory, and range between 35-75 characters- a rather significant discrepancy[288]. Some studies have shown that longer lines were more effective[289], others state guidelines that text is "read more efficiently when presented in a dense manner"[290], and still others suggest worrying about line length is completely moot[291]. Text can also refer to screen density, or the amount of text on each screen. Research in this area has been very contradictory[292], and has mostly attracted scholars prior to 1990 when monitors were unable to reach current technological advancements. More recent research was carried out by Spool[293]. His initial findings were that users perceived screens with too much white as complicated, unclear, and un-motivating. These interesting findings led him to conduct additional studies comprising of five different white-space effects, only to result in similar outcomes.

Research on text font and alignment has also been conducted. There are basically three types of text relationships one can use in screen design; concordant, conflicting, and contrasting[294]. A concord relationship means text is consistently in one font, weight (bold, italic, plain), and size. Conflicting is a combination of similar styles, such as same font, same weight, differing sizes. Contrasting refers to the use of completely different text styles on one screen. Williams[295] contends that a pleasant combination of more than one difference (conflicting, or *carefully* selected contrasting) is effective.

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[287] Williams, et al. (1995).
[288] Schwier & Misanchuk (1993).
[289] Kolers, et al. (1981), Grabinger (1993).
[290] Hopper & Hannafin (1986), p.26.
[291] Misanchuk, et al. (1996).
[292] Schwier & Misanchuk (1993), Ross, et al. (1994).
[293] Festa (1998).
[294] Williams (1994).
[295] (1994).

Studies have shown users lean toward 14 to16-point font, which contradicts similar studies on paper materials that prefer 12-point font[296]. Others suggest 12 to14-point if the text is Times New Roman, or 14-point with Bookman. They additionally note plain style rather than bold, italic, or other such details should be used. Headings on the other hand should be 18 to 36 point, Sans-Serif or Serif font, and also plain style[297]. Although, choice of font may directly relate to the effectiveness of the screen organization. Additionally, contrary to some popular belief, jagged right-margins (as in this dissertation) are presumed easier to read than traditional block sentence format[298]. Williams[299] does suggest that there is no one recipe for text alignment. What is of top priority is how the alignment is designed in relation to other elements of the page (a question of contrast, as will be further discussed below). This helps achieve greater unity and organization to the overall design.

The style that the written material is composed is also worth noting. Three studies by Morkes and Nielsen[300] lead to results that suggested users prefer written material that presents the most important information first, and then details- known as journalistic writing. These studies also contended headings before information was appreciated, as well as simple and informal writing styles. More specifically, Kilian[301] has pointed out text needs to be passive, in concrete language, use simple sentence structure, avoid clichés, use strong verbs (use "make use of" rather than "use"), consider dialect variations of users, and be precise. Shneiderman[302] goes on to list a few specific suggestions for composing good error messages that should not discourage users. Here, he notes; error messages should be polite and offer ideas on how users can continue in the correct direction; avoid discouraging words such as 'bad', 'fatal' and the like; avoid long elements of all-capital letters, put users in control of audio warnings; make error messages clear and understandable; and short error messages should contain additional options for more detailed explanation.

Due to the fact that a computer screen is not meant specifically for text-based material, a balanced combination of visual and text should be included. Williams, Lock, Crisp and

[296] Chen, et al. (1996).
[297] Misanchuk, et al. (1996).
[298] Schwier & Misanchuk (1993).
[299] (1994).
[300] (1997).
[301] (1999).
[302] (1998), in Preece, et al. (2002).

Longstaffe[303] have organized a list of points from 153 research projects surveying the effects of text and graphics combined. These points include;

- Pictures relevant to the text will assist in learning
- Pictures not referred to in the text will not enhance learning the text
- Pictures will not support learning the text if they are not explained
- Pictures can help learner understanding and remembering
- Pictures can substitute for words as non-verbal information
- Learners may not make full use of complex illustrations
- Pictures may assist learners with poor verbal skills more than those without

The element of contrast is perhaps one of the most important factors in design, and should also be briefly discussed here. Contrast encourages user motivation to look at and interact with the screen and also supports the organization of that screen. Contrast deals with not only color, but also various diverse elements such as type, size, line thickness, shape, and space[304]. If all elements of a screen look too much alike, they begin to blend into one another. Green links on a light green background, or headings and explanations in the same font and size are examples of poor contrast. This blending makes it difficult to easily identify specific interractable parts of the screen. For that reason, elements should be contrasted to a degree respective of its ease of use.

4.5.3.2 Representational Placement

A great deal of research has also been conducted surrounding representational pictures and placement of visuals[305]. Representational pictures share a direct resemblance to the information presented, and are the most common visuals in elearning environments. Of course, effort on the part of the learner is also key. When learners spend greater amounts of time and effort in a learning environment with complex pictures, achievement is positive. When learners have less time to spend in these environments, simpler drawings are more effective.

[303] (1995).
[304] Williams (1994).
[305] Williams, et al. (1995).

Additionally the placement of these visuals is important. Visuals should be placed near to the text that they support[306], and never be on the "next page". This suggestion is supported by Contiguity Theory which states that multimedia instruction is more successful when graphics are placed in close proximity (not as a separate link) to text[307]. Baggett[308] specifically determined that knowledge retention in multimedia-based learning environments is better retained when animation graphics are shown at the same time, or within seven seconds of verbal or text material.

This combination of information is what Scott MacCloud calls "received information" (pictures need no explanation), and "perceived information" (text must be read, decoded, and analyzed) in cartoon design. The combination of each element is a vital necessity to the other[309]. Some visuals on the other hand require long download times and must be accessed through a link. When this occurs link-buttons should be used that are located near the related text, and clearly marked. To keep most visuals on the same page however, limiting the size to 1/4th the screen is an adequate guideline.

More specifically, there has been additional study suggesting that visuals be placed at the upper, left-hand corner of the screen[310]. The reason for this being that the human eye automatically scans left to right, and any visuals would naturally catch the attention of the user first. Other studies have shown users spend more time analyzing images and texts when the image is placed on the right side or below the text[311]. Likewise when visuals are placed above, users commonly glanced over the image and did not refer back to it as they did when the image was placed otherwise.

4.5.3.3 Use of Color

Despite the potential array of design possibilities available today, the use of overall color in elearning environments is said to be used sparingly[312]. This may be due to the current relatively novice era of color and interface design. An additional reason is the difficulty of

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[306] Bernard (1990).
[307] Mayer & Gallini (1990), Mayer & Anderson (1991, 1992), in Sanger (2001).
[308] (1984), in Sanger (2001).
[309] (1993).
[310] Russell & Redhead (1991).
[311] Bristol University, in Williams, et al. (1995).
[312] Preece, et al. (2002).

perfecting color interactions within certain environments. As Salomon[313] explains, colors are additionally affected by the shape, size, location and placement within the environments that they are used. This means all such factors must be carefully taken into account to correctly formulate color decisions in context rather than singularly. In addition, even now colors in interface design are greatly affected by the many diverse displays on which they are viewed. On one screen with high-resolution pixel display a color may seem bright and strong. On another with low-resolution display, the color may seem relatively drab.

Similarly, the outside environment may affect the screen colors. Halogen compared to natural light can result in noticeable differences between colors. To support simplicity, colors should be used conservatively, and second to black, white and grey tones. Reasons surrounding this have been attributed to user color deficiencies, color discrepancies due to aging, and monitor differences[314]. On a learner-level, many scholars have come to the conclusion that color may "inhibit performance and confuse the user"[315], or make "reading text and interpreting small objects slower, less accurate, and more painful"[316].

On the other hand, color has been said to communicate much more effectively than black and white. Green[317] has reported visuals in presentations designed with color increase motivation, participation, and willingness to read related text by 80%. His studies also show color visuals enhance learning and retention by more than 75%. Various research has contended color is the most effective way to reduce screen display search time from users[318]. Additional conclusions have discovered that five or six distinct colors in an environment are recommended[319]. Yet, it has been suggested color should only be added later on an affective, structural, or cognitive basis[320].

Used effectively, color can motivate learners or support emotional responses. Light blue, for example, has been associated in our society with health, education, and serenity. Green tones have been associated with hospitals, as they seem to lower stress levels. Structurally, colors can assist in connecting meanings. Help icons can be consistently structured on each screen

[313] (1990), in Laurel (1990).
[314] Schaeffer & Bateman (1996).
[315] Shneiderman (1998), p. 265.
[316] Horton (1994), p. 164.
[317] (1984).
[318] Nowell, et al. (2002).
[319] Nowell, et al. (2002).
[320] Schaeffer & Bateman (1996).

by the same color. Menus or text for already-visited button links can be a different color. This makes it easier for the user to identify and remember various elements of the environment and how they have been, are, or could be interacted with.

Cognitively, color helps in remembering information and retrieval, as in the use of red for help links, and green for next page connections. This simplifies information for the user, and makes categorizing different elements of the environment easier. Priority information, for example, could be designed in bright green, while secondary information is written in black. Pett and Wilson[321] have further noted that color should only be used to add reality to a visual, to highlight a part of a visual or screen element, to focus attention, and to help categorize related elements. They suggest that when using color, designers should be consistent, use red and violet tones to attract attention, use commonly accepted color meanings such as red-halt/green- go, and consider cultural differences when using color for such commonly used meanings. In many Asian cultures for example, red is a color of luck and success, and not one of caution.

4.5.4 Linear Text

The research noted in the previous section 4.5.3.1 *Text and Graphics* can be further used when designing other text learning materials. Texts can be electronically composed on PDF files just as well as text in more hypermedia based environments. Both sorts may contain graphics, but up until now most PDF files are restricted from other forms of multimedia elements such as sound or video. The fundamental difference between the two is based in part on the technologies involved in their composition. Due to the fact that both can be electronically constructed, they may both be considered forms of elearning.

Commonly there are two types of texts discussed; linear and hypertext. Linear texts include most traditional forms of reading materials such as books, articles, and reports. In linear text, there is a specific beginning, middle and end. There are usually numbered pages within a linear text that include similarly sized units of information in paragraphs and pages. The structure of the text material is permanently fixed[322]. That is to say, there are no user options to alter the process or structure of material given. Although users may flip to a specific chapter or to the end of a linear text novel, they will have seriously missed the content or

[321] (1996).
[322] Levy (1997).

reasoning behind the conclusion of the story without following its traditional structure. Users of linear text materials are guided by this structure to read through the material from start to finish to effectively gain information. As Birkerts notes, "it is the reader, not the [linear text] that moves forward."[323]

Linear text is also usually designed for one individual at a time, making such compositions lend to more private and personal experiences. They are not enticed by outside factors such as can be done by some multimedia elements. These linear texts are also read at the particular pace of the reader, depending in part on their sustained attention spans with such materials. These attention spans, as Birkerts[324] emphasizes, are directly related to reader engagement and motivation. Related is the idea that linear text requires a delayed engagement. Readers must first be motivated enough to begin and continue to read before they are fully enveloped into the world the text invites them into. Without such reader motivation, linear texts are unable to effectively deliver full learning objectives. Effective writing of linear texts may be supported by fundamental qualities of cohesion and coherence[325]. Without these qualities, linear texts fall short of clarity and ease of knowledge delivery, and thus may partly discourage reader motivation and engagement.

As previously mentioned, with new technologies, linear texts can be composed and used on the computer. PDF files for example contain mostly linear text materials. This is in opposition to hypertext which is found traditionally on web sites. Clearly, there are benefits and challenges to both linear and hypertext learning materials and delivery, but more research in these areas are needed to fully understand the potentials of both, as well as the technological implications involved[326].

4.5.5 Hypertext

In comparison to linear text-based information, hypertext offers an alternative way to read text. Using hypertext, information is organized in a network of multiple related sections, all linked with each other. Users then have the opportunity to browse through sections of the text that fit their need or interest. By jumping from one section of the text to another, as opposed to reading in a traditional linear fashion, users are able to choose their own individual path

[323] (1994), p 122, in Levy (1997).
[324] (1994), in Levy (1997).
[325] Halliday & Hasan (1976), Connor (1984), in Levy (1997).
[326] Levy (1997).

through the material. By using hypertext in elearning environments, users are given sole control over their navigation through the learning content, and are then able to construct their own knowledge. Thus, hypertext supports constructivist learner theory, as discussed in section 4.1 *Learner Theories*.

Clearly, hypertext gives the user a great deal of flexibility when working through reading material. Hypertext uses the concept of associative retrieval paths to support learner knowledge formation. This is similar to the way the human memory naturally retrieves information. This similarity between hypertext and human memory may be responsible for the general appeal hypertext has to researchers and developers. As a result, some contend hypertext may improve a user's ability to find and use information more effectively[327]. Whether or not this flexibility is actually good or useful to the reader through, has been a topic of controversy[328]. Fittingly, Landow[329] explains, "because hypertext has the power to change the way we understand and experience texts, it offers radical promises and challenges to students, teachers, and theorists of literature".

Despite the wide variety of hypertexts developed in the last years, it is not always entirely clear whether or not there are strong advantages to such methods. Research has usually come short of showing any significant advantages compared to linear text methods. No widely used standards or definitive rules yet exist on how to most effectively develop hypertext. However, due to the fact that hypertext includes various domains such as user-interface design, psychology, education, and information retrieval, learner theory connected to these domains can be applied in order to help support effective development.

Much research in hypertext has focused on computer-based and interface issues rather than the cognitive domain. In summary, some major areas of hypertext research include: development of underlying representations of information and connections[330], methods of connecting, structuring and retrieving the information[331], designing hypertexts for supporting argumentation[332], studying information seeking in hypertexts[333], and the role of rhetoric and writing in hypertexts[334].

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[327] Martin (1990), Nelson (1967).
[328] Foltz (1996).
[329] (1989), p. 174.
[330] Botafogo & Shneiderman (1991), Furuta & Stotts (1989).
[331] Croft & Turtle (1989), Crouch, Crouch & Andreas (1989).
[332] Conklin & Begeman (1989), Fischer, McCall & Morch (1989).

Unfortunately, a great deal of research has resulted in inconsistent results. For example, in the past, low resolution computer screens tended to affect reading times when comparing linear texts to hypertexts. This made paper-based linear texts quicker to read than hypertexts on the computer. Now, with high resolution computer screens, research has consistently showed no discrimination between paper-based linear and hypertext reading durations[335]. Second, research around the question of including a navigational map in hypertext for ease of use has also been inconsistent. Due to the fact that linear text generally includes a table of contents "map", including a similar overview in hypertext materials proved in some research cases effective[336], and some not[337]. Nielsen[338] in particular performed a meta-analysis study of 92 benchmark measures taken from usability issues to test hypertext. From his analysis, he concluded that there are actually very few studies than have shown real impact for hypertext systems. He likewise contended this lack of significant effects may be due to individual differences among users, tasks and texts. These studies have shown that although there has been research around hypertext, few solid results exist providing strong evidence on hypertext effectiveness.

Various books and articles have been published explaining general guidelines for effective hypertext development[339]. However, most of these guidelines focus on abstract, common sense rules and not on theory. Nevertheless, theory-based approaches to hypertext design do exist. One approach has been to use user-interface guidelines to determine how hypertext interfaces should be designed[340]. Another is to use "formative design evaluation"[341], where development and alterations are based on psychological guidelines. Thirdly, developing hypertexts using information retrieval theory may assist in the structure of information. Such methods include; probabilistic models of retrieval[342], hierarchical clustering[343], and petri nets[344], which support effectively connecting information nodes. On a cognitive-based level,

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[333] Marchionini & Shneiderman (1987), Weyer (1982).
[334] Bolter (1991), Britton & Glynn (1989).
[335] Gould & Grischkowsky (1984), Gould, Alfaro, Fonn, Haupt, Minuto & Salaun (1987).
[336] Monk, Walsh & Dix (1988).
[337] Hammond & Allinson (1989).
[338] (1989).
[339] Nielsen (1990), Martin (1990).
[340] Hardman & Sharrat (1989), Shneiderman(1987).
[341] Egan, Remde, Gomez, Landauer, Eberhardt & Lochbaum (1989), Landauer, Egan, Remde, Lesk, Lochbaum & Ketchum (1992).
[342] Croft & Turtle (1989).
[343] Crouch, Crouch & Andreas (1989).
[344] Furuta & Stotts (1989).

Cognitive Flexibility Theory[345] represents textual information from various perspectives, permitting the user to learn and use the information flexibly.

Lastly, the topic of comprehension is significant when discussing hypertext as opposed to linear text. In linear text, the reader maintains a consistent coherence throughout the material. Here, words and concepts are built upon previous ones in order to structure and guide user knowledge in a linear fashion. In general, users must make few inferences or knowledge bridges when using linear text, as information is given from start to finish, resulting in the overall comprehension of a particular concept. On the other hand, hypertext allows the user to navigate and construct knowledge through the material at their own will. Without properly thought-through connections between nodes, hypertext has the potential to leave readers with gaps between concepts they may or may not correctly fill through their own cognition. To ensure that the most effective connections can be made with hypertext as can be accomplished with linear text, various guidelines should be adhered to. These include providing learning content in small "chunks" of information concepts, carefully planning links between nodes and node content, providing feedback or summaries that allow users to check their knowledge, and allowing users more than one way to fully access all content nodes.

4.5.6 Audio

One of the greatest benefits to including audio within multimedia elearning design is that it allows commentary and assistance without disrupting the screen in comparison to help links or pop-up's. In addition, audio in terms of music and sound effects can meaningfully support learning environments and contribute to the learners overall experience. Especially in microworld simulations and interactive environments, the use of audio can be an effective support element when used with care. Ambron[346] suggests sound and images should be composed first in an environment, with text secondary. She does warn though that its use can be bothersome if ill-designed. Clearly then, the use of audio has its guidelines. The repetition of the same dissonant *clang* each time errors by the user are made, or an unrealistic background train noise in a simulated office environment do little to support learning experiences.

[345] Spiro & Jehng (1990).
[346] (1990).

Unfortunately, research in the area of audio use in elearning is small, and usually conflicting[347]. Many suggest audio is only used because the technology is there to use it, or it plainly attracts attention[348]. Other studies suggest guidelines when deciding on whether audio should be in place of, support, or mirror text-based information, but even this research show little discrepancy between test group comparisons[349]. In some cases, the use or dismissal of audio functions seems to have no significance at all.

In a study by Beccue, Whitley and Vila[350], the use of instructional audio tools resulted in no significant differences in performance, attitudes toward the CBT environment, differences between males and females, or age groups. Although it has been suggested that the use of professional voices that match learning environments must be considered, they again noted little research in types of voices or gender of voices has been made. Beccue, et al. additionally wrote audio may be more effectively used when complimented by relevant graphics and visuals. That being said, it is important here to note that diverse learning styles are stimulated by different learning elements. Some learners may certainly benefit from audio tools, and multimedia tool combinations, while others may not.

4.5.7 Animations and Cartoon Drawings

Animations and cartoon drawings can be effective motivational elements in elearning environments. Many scholars contend[351] that one of the greatest problems with authentic-based elearning environments is the time and effort it takes for learners to completely submerge themselves into a learning environment that could never truly mirror a real situation. Perhaps this is not necessary. As Harrington, Oliver and Reeves[352] point out, movie audiences see films such as Star Wars and The Matrix and have no problem submerging themselves into the proper mood. The integration of animation, cartoons and related special effects seems to demand that onlookers conform to a new environment- and they do willingly. In the same respect, such art can encourage users to interact with elearning environments without question as well.

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[347] Beccue, et al. (2001).
[348] Beccue, et al. (2001).
[349] Barron & Kysilka (1993), Koroghlanian & Klein (2004).
[350] (2001).
[351] Petraglia (1998), and Kantor, et al. (2000), in Harrington, et al. (2003).
[352] (2003).

Although the traditional idea of animations and cartoons comes from Sunday morning programs and comic books, multimedia animation can encompass a number of interface elements as well. Transfers between screens, panning in and out from objects, pull-down menus and pop-ups are all examples of interface animations. Animated characters can take on life-like actions and also show feelings, moods, interests, confusions, and sensibilities. Animations and cartoons can bring new meaning to life-like characters, or life-like characteristics to inanimate objects. For these reasons, animations and cartoons have become the center of both praise and criticism in learning circles over the years. An entire volume of the *Journal of Educational Sociology* was devoted to the educational uses of comics in 1944. Sidonie Gruenberg of the Child Study Association stated, "There is hardly a subject that does not lend itself to presentation through this medium"[353].

Despite these current realizations, animations and cartoons were not always given such positive welcome. In the past, many scholars thought that combining such elements with educational materials was so "...educationally unsound that their use would lead to mental stagnation."[354] Now, many more believe that comics and animations are positive and effective ways to support learning. They are understood and appreciated in many cultures, lands, societal levels, age groups and across gender and racial differences. This makes such elements attractive to the majority, and thus easily recognizable learning tools.

Certainly no one can argue the effectiveness such art has on children. Large companies such as Disney have clearly mastered the technique, and likewise adopted specific principal guidelines for effective animation[355]. These range from integrating time-pause effects for anticipation, to sound for direction and motion. Others have recently jumped on the growing comic/education market trend. Many of these so-called "edu-tainment"[356] companies design English as a second language programs, or other literary services- a natural combination for text and graphic-based interfaces. These firms realize that comics and animations ignite motivation and thus a desire to learn, depict real-life characteristics to encourage user interaction and effort, and support various learning styles as well[357].

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[353] Gruenberg (1944), p 213.
[354] Ellman (1979) and MacGregor (1996), in Davis (1997).
[355] Mountford, in Laurel (1990).
[356] Schmitt (2004).
[357] Davis (1997).

Theory around the use of animation and cartoons in learning is founded on Paivio's Dual Coding Theory[358]. Similar to previous discussion in section 4.5.3 *Visualization*, Paivio's theory understands that learners store either verbal and visual mental representations in long term storage. Due to the fact that visualizations can be recognized and stored both visually and verbally (thus "dual coded"), they are more likely to be stored more securely than text which is recognized only verbally. This realization has been adapted to computer animations to support their effectiveness on learning[359].

Research has also offered insights to the use of animation and cartooning. Experiments in the early 1940's focusing on increased motivational levels of learners when using comic book materials was very positive[360]. Similar study on the advantages of these mediums on visualization[361], their permanency in relation to re-visitation[362], their use as effective stepping-stools to other more difficult tasks[363], and their popularity[364] have all been discussed. Believability is important for learners both to interact with a character and also to learn with their assistance. The correct appearance of that character then becomes essential[365]. Like interface design, simplicity is a key element, and there is research showing users prefer simply drawn characters over intricately drawn ones[366]. Additional study has shown cartoon-like characters are better than real people acting as artificial characters[367]. Apple Computers' use of low-movement cartoon drawings compared to live character video resulted in interesting insights. Two versions of "Phil" were tested; one was a professional actor from chest up dressed smartly with a bow tie. The other was a simple, black and white line drawing of a pleasant mans' face- also smartly attired with a black tie. Results showed users preferred the line drawing, and claimed the real actor seemed "dumb".

Perhaps one of the most referenced professionals in comics and text/character relationships is Scott McCloud[368]. He has determined cartoon drawings have various advantages. People identify cartoons with themselves, whereas photos and realistic drawings are "other people". McCloud explains that when two people converse, they see the detail of the face from the

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[358] Sanger (2001).
[359] Mayer & Gallini (1990), Mayer & Anderson (1991, 1992), in Sanger (2001).
[360] Hutchinson (1945).
[361] Versaci (2001).
[362] Williams (1995).
[363] Versaci (2001).
[364] Morrison, et al. (2002).
[365] Preece (2002).
[366] Scaife & Rogers (2001).
[367] Laurel (1993), in Preece (2002).
[368] (1993).

person to whom they are speaking with. In comparison, they visualize their own face as simply placed shapes- much like a cartoon face. By using simply drawn cartoon-like characters then, learners (or comic readers) become more involved with characters they see much in the same way as they visualize themselves. This involvement promotes interaction, identification and motivation. To support this view, other professionals agree that it is of great importance to incorporate elements of social interaction into elearning environments. This is especially true if those environments deliver soft skills content such as communication methods and training[369].

Similarly, a mixture of realistic elements (such as a background) blended with cartoon elements (such as a character) allows learners to "enter" sensually stimulating environments as cartoon characters as well. Depending on how a cartoon is drawn and colored may also add value and meaning for the learner. Line differentiation can signify mood, personality and feeling of a drawn character. Comparing popular cartoons such as Donald Duck (drawn with whimsical, positive, child-friendly curves and up-swings) to Dick Tracy (drawn with bold, negative, straight lines and sharp angles) illustrates this idea. Cartoon color respectively adds life and motion to a drawing, and objectifies the drawn characters physical form more than black and white is able to.

Used correctly, these arts can be effective learning tools. Animations and cartoon elements must engage the users to interact more. In contrast to a movie, which is watched, comics allow users to read into the picture, be affected by it, and in turn draw from their own experiences in order to relate. This creates a unique type of conversation between user and drawing. Such art should contrast/compliment the text that goes with it. In this way, users must analyze, and not simply be told in a caption, what the graphic is revealing. Users must read into the picture as well as the text to attain the highest level of comprehension from the screen. To successfully integrate an animated or drawn object into an environment, Baecker and Small[370] suggest a few guideline questions are answered. Is the animated object better positioned from a particular viewpoint? What light and shading effects are best with the object? Is the impact of the object positive to the rest of the screen? These questions help decide elements of aesthetic value put on the animated object, as well as supporting clarity, usability, consistency, and motivation.

[369] Northrup (2001).
[370] (1990), in Laurel (1990).

4.6 Seductive Augmentation

Section 4 of this paper has put great emphasis on research supporting the various factors that make up elearning multimedia and text-based design. It has been previously mentioned that integrating simply every and all elements does not necessarily determine successful elearning environments. For that reason, this section on seductive augmentation is a necessary addition. Seductive augmentation surfaces when the multimedia-based elements throughout an elearning environment do not support the learner or learning objectives. These elements can include unnecessary words, graphics, photos, videos, colors, and sounds. As determined in section 4.1 *Learner Theories* and 4.2 *The Elearner*, what is of utmost importance in elearning design is the learners themselves, and after the environment and all that it is composed of. Unnecessary components littered throughout an elearning environment may seem interesting and innovative, but "seduce" the learner away from their learning priorities, and hinder learning altogether.

With the onset of more and more interesting technology-based items within the last years, research began to recommend using colors, text options, sounds, videos and the like to heighten elearner motivation and interest levels[371]. Since then, more recent research has determined too much of these elements may take attention away from learner material and objectives[372].

Thalheimer[373] compared 24 research articles containing seductive element study. In his comparison, he found that 16 stated adding interesting items hurt learning outcomes, 7 resulted in neutral outcomes where the learning was neither harmed nor supported, and one study that determined interesting items actually supported positive outcomes. From these studies, seductive augmentation effects surfaced when; seductive details were added to expository texts, photos were added to expository text, photos and printed details were added to expository texts, visuals or printed/narrated seductive details were added to multimedia narrated animations, or music was added to multimedia narrated animations and computer-based instruction. No seductive augmentation effect was found when printed seductive details were added to narrated biography text, or context-appropriate sounds were added to multimedia narrated animation and computer-based instruction. Although these studies were

[371] Levie & Lentz (1982), Gagne, Briggs, Wagner (1988), Carney & Levin (2002), in Thalheimer (2004).
[372] Garner, Gillingham & White (1989), Moreno & Mayer (2000), in Thalheimer (2004).
[373] (2004).

slightly marred with various weaknesses (short learning sessions, various studies, similar materials, etc.), more specific suggestions can be extrapolated. These include only adding elements that directly assist learner understanding of the content, not overloading learners with visual and auditory information, and creating only job-related interesting elements that help create realistic exercises. In conclusion, sensitivity to those elements of seductive augmentation that can negatively affect the effectiveness of an otherwise solid elearning environment is of utmost importance to design.

5 Evaluating Elearning

The exponential rate of elearning makes it imperative that valid and reliable research likewise develop. Often, elearning is subject to traditional learning evaluations, that do not match the multi-faceted nature of elearning delivery, content, environments or potential. In the past, the context for determining learner success was founded on the purpose of the education, and the population for whom it was provided. Initially, curriculum was finite and was expected to serve the learner for life. An example of this is medieval apprenticeship programs that, after a certain number of years, gave the apprentice all the knowledge necessary for an extended career- far from supporting life-long learning. In this respect, the criteria for quality was limited and could be assessed with two basic questions[374]; was the instructor a context expert? could learners demonstrate through some type of examination, a mastery of the information provided to them by the teacher?

Due to this history of education and training, it has become somewhat challenging to assess today's educational quality. Especially when new technologies are involved, as in the case of elearning. Due to this, there are now many more intricate variables that help support learner success. Elearning and other forms of modern methods have since greatly broadened our perceptions of education, theory and learner potential. Likewise, evaluating elearning education has also been rethought to ensure the most effective evaluations system possible.

Elearning education has only been offered to the general public since the last 25 years. Given this, current efforts to evaluate elearning are likewise novice. One of the most compounding current challenges in elearning is to establish a commonly practiced methodology for evaluation[375]. Specifically, the addition of technology means evaluations should not be treated the same as in traditional learning settings[376]. Evaluations should help ensure that technology stays as an educational vehicle and tool- second to the learner and their outcomes. Elearning thus requires unique thought in design, technical specifications, and course implementation. Due to this, measures need to be taken to uniquely evaluate such effectiveness[377]. Measurements such as quality assurance systems that reflect learning effectiveness based on the technology *delivering* the knowledge are necessary[378]. Such

[374] Pond (2002).
[375] CAP (2004).
[376] Rovai (2000).
[377] Monolescu & Schifter (2000).
[378] Reid (2001).

evaluations on the effective delivery of learning information chunks are the basis of the research in this paper, and further developed in section 6 *The Research Project.*

Technological factors play such a significant (yet secondary) role in elearning. Due to this, proper evaluation built on foundations previously discussed in section 4 *Designing Elearning Environments* may all be key components. Exactly which of these components need to be evaluated depends on the research question posed. That being said, proper evaluation is not facile. Evaluation takes careful thought and planning. Evaluation frameworks must be organized at the beginning of the elearning concept, and carried out *throughout* the design and implementation process- not simply left until the end. Initial evaluations such as informal observations and conversations with professionals can help determine a general direction for the research to be conducted. Through the development process, evaluations should help ensure environments are truly built and implemented with learner population, theory, and learner intelligence in mind. Continuing evaluations help determine if users are comfortably and effectively working with systems, and goals and objectives can be achieved. Evaluations help designers, experts, and learners communicate about the learning environment collaboratively to discuss positive design elements as well as those worth rethinking and re-editing. All of these components help ensure final evaluations are reliable sources of research information.

The validity of elearning evaluations is difficult to determine. Traditionally, validity refers to a physical- or valid, outcome. As elearning effectiveness in any aspect is dependant to a strong degree on the theoretical basis on which it was constructed, what may be more significant is the *credibility* of such research outcomes. To support the credibility of elearning evaluation, more than the collection of data from one source is necessary. This means that along with designers, great effort must be taken to weigh and interweave comments, concerns and suggestions from reliable literature reviews, experts in related fields, and users. These collaborative efforts are repeatedly undertaken during the planning and blueprint stage, prototype stage. As a result, the collection and analytical comparison of various data may uncover similar outcomes that support credibility in the research. Examples of these various data collection options are further explained in this section beginning with section 5.3 *Evaluation and Data Collection.*

With these issues in mind, all elearning evaluations must begin with these important questions:

- What is my research aim?
- Who is my research population?
- What is my research question?
- What am I evaluating?
- How will I evaluate this?

5.1 Evaluation Challenges

Understanding the many challenges that affect proper assessment is essential in developing successful evaluation frameworks. Along with those factors mentioned above, current research, the impact of technology, and the diverse priorities of various interested parties present challenges for elearning evaluation. Traditional definitions of educational quality assurance such as attendance, contact hours, testing, school accreditation, credentials of instructors, and other factors are now uniquely affected by elearning. In an asynchronous elearning class, for example, there may be little relationship between the amount of time a learner is logged on and their quality of learning. That a prestigious university now has an elearning certification does not mean it can provide the exact same education as traditional methods. These ideals and the people that support them create an un-unified group trying to pull elearning- and thus its effective evaluation, in too many directions at once. Understanding some of these larger challenges to elearning evaluation may make attempts at devising systems for specific populations more successful.

5.1.1 Research

Unfortunately, empirical validity and evaluation for elearning activities is seriously lacking. For the most part, literature is composed of enthusiastic case studies of short-winded attempts at elearning implementation. Despite their innovative contributions to elearning progress, solid research on the effects of learner outcomes or interactibility seem weak- yet new such case studies keep surfacing at an impressive rate. Bouwhuis, et al. among others has voiced their concern that educational technology may proceed forward so quickly, without proper

research, that poor elearning will "penetrate society"[379]. Reigeluth also exemplifies this in his works by mentioning 15 different educational system design measures- not one of them concerned with evaluation[380].

Fortunately, this is not the case for the field of elearning as a whole. There are many researchers that are producing valid data, particularly on interactive learning environments, and interface design components. Despite this, the most successful computer-based instructional system, the flight simulator, produces very little literature to date. More and more though, professors and consortiums are demanding empirical data to close this gap. In the coming years elearning may very well more directly establish its own stream of learner theory and assessment framework.

5.1.1.1 Evaluation Toolkits

That is not to say there have not been notable efforts to move towards commonly used elearning evaluations. Many organizations have defined "evaluation toolkits" to help support sound and effective evaluations. These toolkits provide a foundation on which to conduct research based on similar factors. The toolkits are structured around a specific model or theory and include examples in order to help users choose correctly. Instead of acting as evaluation recipe books, toolkits can be used as guides to assist in making informed decisions that support the research being done[381]. Such toolkits include:

- LTDI Evaluation Cookbook[382]- supports lecturers in evaluating effectiveness of learning technologies for specific objectives.
- Evaluating Learning Technology Guide[383]- highlights social and political values of evaluations and persuasive arguments, and helps support validity and reliability. Supports staff in ensuring courses mirror learning outcomes.
- Online Evaluation Toolkit[384]- step-by-step design of evaluations in three sections (planner, adviser and presenter). Contains resources and model evaluations that may be adapted to the users' specific contexts.

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[379] (1996).
[380] (1993), in Bouwhiuis, et al. (1996).
[381] Oliver & Conole (2002), in CAP (2004).
[382] http://www.icbl.hw.ac.uk/ltdi/cookbook/contents/htm
[383] http://www.elt.ac.uk/ELT%20documents/materials/evalguide.pdf
[384] http://www.ltss.bris.ac.uk/jcalt/

5.1.2 Technology

The integration of many differing technological breakthroughs has also made elearning evaluation and quality success difficult to decipher. Many times designers, implementers and users are caught up in too many technologies that are difficult to successfully integrate together for the sake of the learning objective. Environments containing specific program texts, which are additionally developed through web-based or multimedia design components don't always share complimentary platforms. New updates of various programs, bandwidth, and age of the computer must all seamlessly combine to deliver the necessary content ensuring the most effective learning environments. Without this, it is virtually impossible to reliably evaluate such fluctuating systems and the learners that are subject to them.

Many scholars are asking necessary questions concerning technology that reach beyond mere compatibility. Fahy[385] recognizes the importance of "technology's fitness for use". That is, whether the technology is directly or indirectly related to the learning outcomes. Tuckey[386] discusses the possibility that some technologies are more appropriate for visual-based activities and others are better for discourse. Harasim[387] notes that there could be a "best media match" for specific learning goals, and Barbules and Callister[388] present the question, "Which technologies have educational potential for which students, for which subject matters, and for which purposes?". These topics have the potential of further developing sound and meaningful elearning environments that, when properly implemented through such research, could greatly affect the reliability of evaluation.

5.1.3 Priorities

The elearning community is comprised of various diverse members including users, institutions, designers, scholars, and also the public, governments, businesses, and societies. Naturally, all attempt to communicate their own priorities for elearning. Depending on their diverse situations, these priorities can be very different. These differences make it challenging for the elearning community as a whole to conceive design methods and theories

[385] (2000).
[386] (1993).
[387] (1996)
[388] (2000), in Meyer (2002).

that are consistent across the board. With a lack of such consistency, developing effective evaluation methods for environments and learners is a great challenge.

Pond for example has contended an indicator of quality today should be interaction, not attendance[389]. Unfortunately, not all implementers agree. For some, priorities are based on ancient methods of learner quality assurance that do not mirror current theory or implementation. Many elearning systems still simply tally the time a learner has spent with a concept or lesson. What is actually "assessed" is a check box stating the learner went through an activity for a certain period of time, without knowledge of what they learned. For some institutions, these tally marks are the sole means of elearning funding, and so suffice for "learner evaluation". Clearly, methods such as these from institutions of less-than-educational priority keep authentic evaluation attempts from positively moving forward as they should.

5.2 Standards and Evaluatory Consortiums

According to Pond[390], we must agree upon a set of "universal" attributes or standards on which to base elearning quality success if we are to move forward in a positive manner. He offers that standards for elearning be based on quality traditional educational pieces such as credentialing, learner growth, and continuity between purpose and practice in order to more smoothly transition from traditional learning to modern elearning in an organized, planned manner. There is a vital need for collaboration between these groups that support open, ongoing evaluation discussion forums for more consistent quality assurance in technology, and learner areas. As of yet, these efforts in private and governmental sectors are being conceived and encouraged, but at a rate far below that of sprouting and flourishing elearning developments.

Standards can help support such elearning efforts on various levels. ISO 9241[391] for example, is an international consortium for standards on interaction design. Europe in particular has shown significant leadership in understanding technological dimensions and standards for elearning[392]. It is clear they have begun to realize the benefits of creating and adhering to

[389] Pond (2002).
[390] (2002).
[391] www.iso.org
[392] Smith (2001).

specific evaluation methods. One such effort includes the smooth transition of information and technological advances as new modifications and innovations crop up.

At the EUCEN Conference 2002 in Vienna, various standard tools were noted. These help support diverse guidelines in the areas of learning, technology, and total quality. Computer standards from the International Standards Organization[393] (ISO), International Electrotechnical Commission[394] (IEC), and French and European Standards[395] (NF) were presented. Web standards are also published and include the World Wide Web Consortium[396] (W3C), the Dublin Core Metadata Initiative[397] (DCMI), and the Tele-education New Brunswick[398].

Technological standards can be met through the Institute for Electrical and Electronics Engineers[399] (IEEE), the Aviation Industry Computer Based Training Committee[400] (AICC), Shareable Course Object Reference Model[401] (SCORM), Alliance of Remote Instructional Authoring and Distribution Networks for Europe[402] (ARIADNE), Promoting Multimedia Access to Education and Training in European Society[403] (PROMETEUS), Learning Resource Interchange[404] (LRN 3.0), or the Instructional Management System Global Learning Consortium[405] (IMS).

Total quality and standards can be viewed at the British Association for Open Learning[406] (BAOL), Quality Standards for Evaluating Multimedia and Online Training[407], Distance Learning Guidelines[408], International Society for Technology in Education[409], Training Programs for Trainers Involved in ODL[410], Open and Distance Learning Quality Council[411]

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[393] http://www.iso.ch
[394] http://www.iec.ch
[395] http://www.afnor.fr
[396] http://www.w3org/QA/
[397] http://dublincore.org/documents
[398] http://teleeductaion.nb.ca
[399] http://standards.ieee.org
[400] http://aicc.org
[401] http://www.adlenet.org
[402] http://ariadne.unil.ch
[403] http://www.prometeus.org
[404] http://www.microsoft.com/eLearn
[405] http://www.imsproject.org
[406] http://www.baol.co.uk/qmguide.htm
[407] http://www.mcgraw-hill.com
[408] http://www.qaa.ac.uk/public/dlg/guidelin.htm
[409] http://www.iste.org/standards/index.html
[410] http://www5.vdab.be/vdab/europe/ditra/profile/intro.htm
[411] http://www.odlqc.org.uk/

(ODLQC), Centre for Educational Technology Interoperability Standards[412] (CETIS), and the EASI-ISAE Consortium[413].

For others, the concern behind this idea is the possible lack of continuity. If an elearning user uses outside quality guidelines from one of the above organizations, no matter how professional, to assess their own elearning endeavors, will all organizational quality statements match user needs? or would there be gaps and overlaps that would need to be worked through at any rate in order for the user group to mold organizational guidelines to their own use? If that is so, should the guidelines designated by these groups be truly used as the backbone of a user's elearning evaluation plan?

Some professionals in the field of elearning believe quality standards for specific areas should be designated by specific organizations such as these, and are additionally content that no more time or effort must be put into collaborating on a specific set of their own elearning evaluation guidelines. Others agree that organizational committees, and thus specific quality success standards, should be designated by theme, content or user needs, such as standards specifically for engineers using elearning. Others contend elearning standards should directly reflect the pedagogical theory used. The best possible scenario might be a combination of these ideas, whereas collaborate user groups use organizational standards to support individualized evaluatory plans, and don't depend only on organization statements as law for all.

5.3 Evaluation and Data Collection

As previously discussed, evaluating elearning environments is an important part of achieving learning objectives positively. Correctly collecting the data from these evaluations is equally key. Interpretation of that data can offer vital information as to the level of effectiveness and proper design of the elearning environment. To do so, organizing one's evaluation around a set framework, and collecting data by pre-designed means helps ensure research is meaningful and valid.

[412] http://www.cetis.ac.uk/
[413] http://mediamatch.ac.uk/

Identifying priority factors are necessary to build evaluation and data collection around. Clearly, the learner should be at the heart of these priorities, although relevant data collection involves the interpretation of a variety of interwoven issues[414]. In addition to the learner, many interested parties should be involved in the design process, and as such, in the evaluation process. The use of various data collection techniques allows evaluation to take place on many levels and from many angles. This supports multi-faceted and more reliable research. Also, pilot tests with prototypes should be implemented to understand real-world use. All of the information from these efforts should be recorded by note taking, video or audio cassette for convenient reference. Once even the first data collection has been made, interpretation of that information should begin. This ensures that necessary changes in the environment are made early on, and will not continue to negatively affect the learning process.

According to Reed and McNergney[415], the integration of authenticity is a key component in the effective evaluation of elearning environments. Technology and learner objectives that are integrated through life-like simulations that enhance user understanding for real-world experiences are positive elements that should be given particular priority. This idea supports the need for constructivist-based evaluations. Before designing such authentic environments, definitions of the learner population, the instructor and their responsibilities, and possible technical limitations should be formed. Once this is established, content, required technology, instructional tools, learning assessments and teacher support can be determined. Built on this framework, effective authentic evaluations can be determined. Depending on priority frameworks are many components to effective evaluations, as previously mentioned. In the following section, further effort is made to delve more specifically into two useful evaluation frameworks; the Four Factor System and DECIDE. In addition, the necessity of organized feedbacks is also discussed. These can take the form of questionnaires, expert interviews, and observations. These two areas- frameworks and evaluation methods, are vital parts in effective elearning evaluation.

5.3.1 Frameworks

Frameworks help construct guidelines for planning evaluations and asking relevant questions along the way. There are many different evaluation frameworks suggested in the literature.

[414] Preece, et al. (2002).
[415] (2000).

They may be informal, such as the "quick and dirty"[416] evaluations given to confirm experts agree with designers, or can be more complicated. Heuristics is a checklist method of early evaluation[417]. These ten listed items assist uncovering potential challenge areas not usually recognized. Another early evaluation method is known as rapid prototyping. This involves observing real users interacting with rough prototype environments in order to determine challenge areas. Steed[418] refers to the importance of having a "sense of audience"[419] when developing multimedia environments. This gives an understanding for who will be viewing the final product, as well as how they will interact and engage in the embedded activities. To help accomplish this sense, he explains a multi-step plan for evaluation that parallels the design process itself. This process begins with peer evaluation followed by adjustments, small population group field testing, followed by adjustments, and then target population group testing followed by final adjustments. By implementing such an evaluation plan, and receiving meaningful feedback in the process, much time and effort can be saved in proper design.

Chan, Chow and Jia[420] have designed a 4-factor system for effectively evaluating elearning environments. The first factor of this system is the course, which includes the learning environment, the learning process, supporting and technologies. Through implementation, the second factor deals with the effectiveness of the learning and encompasses resource repository (including glossaries, links and animation), progress assessment (learner portfolios or reflections), knowledge, and management. Feedback takes the sequence into the third area which includes evaluation methods such as questionnaires, databases, and web log files. With the analysis of these results, the fourth factor, evaluation results, can be determined through student perceptions, performance and learning styles. Lastly, the implications of this process can be determined.

DECIDE is another effective form of evaluation framework[421]. Here, evaluators must follow pre-determined steps in order to most effectively evaluate. These steps include: **D**etermine overall goals, **E**xplore specific questions to be addressed, **C**hoose an evaluation method to

[416] Preece, et al. (2002), p.341.
[417] Nielsen (1997).
[418] (2002).
[419] p. 238.
[420] (2003).
[421] Preece, et al. (2002).

answer questions, **I**dentify practical concerns such as population groups, **D**ecide on dealing with ethical issues, and **E**valuate and analyze the data collected.

First, goals are determined by making sure evaluators are conscious of learner needs. Factors such as ensuring that the interface is consistent throughout the program, and that the metaphor is clear are also conducted. The role of technological influences is here determined as well. Secondly, specific questions must be thought through. By pulling general questions into more specific ones, vital detailed information may surface. Third, the evaluation method must be agreed on in order to continue planning feedbacks and data collection. At this point, specific practical issues must be taken into consideration, such as funding for the project, end users, time and effort commitments, and resources. Ethical issues are important factors in positive design as well. Many are suggested by organizations such as the Association for Computing Machinery (ACM)[422], and provide guidelines such as privacy policies for health and legal records. Finally, valid and reliable evaluation methods must be determined. Validity secures that the evaluation has effectively measured the information it was implied for. Reliability ensures that the same research would result in similar data given a similar scenario. The importance of both factors creates data results that may be used for future research and development.

5.3.2 Evaluation Methods

Feedback from various interested parties is an essential part of data collection. By interpreting the information contained in feedbacks, designers can better understand the comments, praises and concerns of those people related to the elearning environment. Reliable feedback can come in many forms. Deciding on which evaluation method or combination thereof can depend on various factors such as population number, geographical location, intricacy, time and effort. In this section, the importance of the user's integration into the evaluation process is explained. Second, an overview of common evaluation methods is presented. These include questionnaires, interviews, observations, and testing. Of course, there are also additional forms of evaluation that can support effective design. Keeping journal diaries of the design process provides a written history of thoughts and actions. This can help designers retrace their steps when complicated challenges arise, or validation of certain components is necessary.

[422] www.acm.org

5.3.2.1 User Involvement

Due to the great importance of the user as a basis for theoretical, individual intelligence, and interface design, this additional section has been included. The user is a vital factor in effective evaluation. User comments and behaviors greatly affect changes and developments throughout the testing and re-design process. In addition, including the user in the evaluation process early on ensures they will understand specific components and limitations to the final system later[423]. It is important that end users are not illegitimately disappointed in the final prototype by too-high expectations. If they have seen the system from its beginnings, and begin to understand its boundaries, they will understand not only how the end product works, but also its capabilities. From this, users will be more likely to accept final prototypes neutrally.

In addition, by incorporating users throughout the design and evaluation process, they will have more time to become accustomed to the system. This allows them to spend more time and effort on useful and relevant comment, and less on forging through unknown navigation. In addition, as users are part of the process from the beginning, they will have a sense of ownership to the product. This will encourage them to interact with the final prototype in a motivated way, inducing fair and helpful commentary.

Gould and Lewis[424] presented three principles for designing effective computer systems. These included focusing early on the user, measuring empirically, and iterative design. By focusing on the learner/user early on, designers can understand the cognitive, behavioral, anthropomorphic, and attitude characteristics of users, and match them accordingly to system design choices. Early collection of empirical research ensures reactions and preferences of users are noted, analyzed, and taken into consideration for coming prototype design. Iterative design, like the spiral process of evaluation, ensures challenges within the system are made, tested, assessed and reconfigured on a continuous basis to parallel learner needs. According to Bruce Tognazzini[425],

> *"Iterative design, with its repeating cycle of design and testing, is the only validated methodology in existence that will consistently produce successful results. If you don't have user-testing as an integral part of*

[423] Preece, et al. (2002).
[424] (1985), in Preece, et al. (2002).
[425] Preece, et al. (2002), p. 319.

your design process you are going to throw buckets of money down the drain."

5.3.2.2 Questionnaires

Questionnaires are useful resources to better understand the effectiveness of learning programs[426]. Because questionnaires are common, most believe they are easy to implement and fill out. Questionnaires can request simple feedback answers such as circling yes or no, or happy and sad faces suggesting perceptions. Other more time consuming questionnaires can request longer comments and ideas with no multiple choices to choose from. There have been some documented guidelines for writing effective questionnaires[427]. These include suggestions to avoid long or compound sentences, avoid jargon and difficult language, avoid leading questions, and be conscious of biases such as race or gender. Ensuring that questionnaires are as positive and effective as possible can be done through informal colleague or expert interviews.

Questionnaires are usually good choices when information from large groups of people is needed- especially if those people are based geographically far from another. They are commonly used with other data collection methods. Questionnaires are usually designed with basic demographic questions first in order to attain an understanding of the population groups experience and other basic information. This can help assess the range of details within the sample group such as experience with computer learning systems, age, gender, etc. Following these questions, more detailed inquiry into objective-specific issues is made. Results from questionnaires can be measured with Likert Scales- best for opinions, attitudes and perceptions, or semantic differential scales, which offer a range of levels of opinions from which to choose.

Questionnaires do have their drawbacks. Unfortunately, sometimes responses may not be sent back, or not filled out correctly. It has been noted that questionnaires in elearning research should focus on the impacts of teaching and learning, involvement of users and capabilities of the tools being implemented[428].

5.3.2.3 Interviews

[426] Brown, et al. (1996).
[427] Robson (1993), in Preece, et al. (2002).
[428] Chan, et al. (2003).

Interviews are a much more personal alternative for evaluation than post, or email questionnaires. Because they are more personal, interested parties may feel more a working part of the design process, contributing to motivational and creative perceptions later on, as discussed in section 4.3 *Attractive Motivational Factors*. Interviews can be formally structured with questionnaires, unstructured as in a normal conversation, or semi-structured. Choosing which type depends on the stage of the prototype design, and the goals of the interview. If first impressions are wanted, an unstructured conversation may be the best choice. Interviews most often take place face-to-face, yet home, online and telephone interviews have proven effective and convenient for some specific situations. Naturally, many firms conduct extensive telephone interviews to collect significant data from populations too large or too far apart to do otherwise. Preece, et al.[429] notes that when people are interviewed in home and work settings, they may be more comfortable at expressing thoughts. In addition, home and work-based interviews may encourage interviewees to think of concerns and comments they may not otherwise have recollected in an unnatural setting.

Depending on the size of the research population, interviews may be time consuming. To counter that, discussion groups may be organized. This allows many to meet collaboratively and discuss the learning environment openly. Face-to-face or collaborative group interviews can consist of users or experts, as both provide important sources of feedback. Users can give information on their goals, personal styles, perceptions and comfort level with the systems. Experts can suggest specific changes or expansions based on their field of experience. Naturally, feedback from both sources can be very helpful.

5.3.2.4 Heuristics

One way experts can assist in evaluation needs is through heuristic evaluations. Heuristics were first introduced through an empirical study by Nielsen in 1994[430], as a set of principles to guide usability design. Although some of the original heuristics are relatively general by today's standards, they still compose a sound structure for expert (and novice as well) evaluation, and so deserve mention here. Nielsen's guidelines, with descriptions on how these guidelines can be applied to web sites and/or elearning programs include[431]:

[429] (2002).
[430] Preece (2002).
[431] Instone (1997).

- Visibility of system status and appropriate timing and feedback from system
    - make sure links to other screens are clearly marked, include these links on every screen, ensure users know where they are and where they can go next throughout the program or web site
- Simplicity of language and real-world transferability
    - know your user population and their background in order to match words, phrases and concepts to the user, make sure information follows natural and logical order
- Control of the user
    - ensure that the user has control to move through the site screens at will, be cautious when using certain fonts, colors screen widths and browser versions that may not fit the current technology of every user
- Consistency and standards
    - use wording in content and buttons consistently, check titles and headers to ensure they use the same language as the links that are connected to them, use consistency throughout the site (color, font)
- Error prevention
    - ensure the careful design of the site or program so error prevention is not a top priority, when necessary use error messages that are short, clear and give the user information to assist their situation
- Visible objects, actions and options
    - make user actions such as links and buttons clear and understandable, use consistent visible objects that are easy for the user to recognize, ensure paths between screens are clear and users will not get lost
- Shortcut options for advanced users
    - allow frequent users to be able to tailor their programs or sites, allow the use of site "bookmarks" that the user can refer to later, design these options to help the novice and advanced user
- Minimalist design
    - use only relevant information on screens, use progressive levels of detail in content so more general information is presented initially and detailed information later, make sure information is written with the technology in mind- not a brochure scanned for reading on the computer

- Inclusion of help options
    - after ensuring the system is designed with as little need for help options as possible, make sure some necessary help information is available, make sure this information is easy to locate, easy to search, easy to read and understand, lists clear steps the user may need to take, and is not excessively large

By using these guidelines, experts can easily evaluate potential user interaction and feelings.

5.3.2.5 Cognitive and Pluralistic Walkthroughs

Besides heuristics, researchers can also conduct cognitive or pluralistic walkthroughs. Cognitive walkthroughs focus on exploratory learning, and how well a first time user can perform certain tasks without formal training[432]. Cognitive walkthrough evaluations can be performed before final empirical user testing that requires a fully finished program. These walkthroughs can be implemented with system designers, related professionals or expert users. Because they require only a mock-up prototype of the final program, they create inexpensive evaluation methods that help support the detection of critical design flaws before final implementation.

The cognitive walkthrough evaluation method stems from the CE+ theory of exploratory learning[433]. This is an information processing model of human cognition that describes human computer interaction in four steps:

- User has a goal to be accomplished with the system
- User searches the interface to available actions
- User selects the action that seems likely to move toward the goal
- User performs the selected action and evaluates the system's feedback that progress was made toward the goal

In a cognitive walkthrough, the user expert is given a specific usage scenario, with specific goals from the researcher, in order to guide the evaluation of the prototype. This prototype can be drawn on paper or be composed of a set of screens, as in the case of elearning. When

[432] Rieman, Franzke & Redmiles (1995).
[433] Wharton, Rieman, Lewis & Polson (1994).

implementing a cognitive walkthrough, users attempt to achieve their set goals and identified tasks as if they were using the final product. These goals and tasks are carried out by repeating the four steps listed above. Each step in the user's walkthrough with the program is carefully noted and examined. Due to this, users are encouraged to voice their thoughts as they go along. It may be helpful then for the researcher to take detailed notes, tape-record or video tape cognitive walkthroughs to document all subtle and vocal reactions.

There has also been some empirical research that supports the theoretical basis for cognitive walkthroughs[434]. In a study by Franzke[435] on display-based GUI systems, new users first scan the interface for a clear, well-labeled action, select that action, and if further options are given, users repeat this scanning cycle until the goal is achieved. The success of this strategy is dependent upon the proceeding correct action by the user. This study determined:

- Users try label-guided actions first (menus, buttons, etc.) before experimenting with unlabeled objects (tools, moving objects, double clicking)
- A well-labeled action will be especially salient
- If labeling is not provided, allowing few actions in the search makes searching more efficient for the user
- Set effects may prevent users from trying untypical actions
- Users are reluctant to extend searches beyond available menus and controls

These findings suggest that designers must check type of interaction, quality of labeling, number and grouping of alternative choices and overall usability of interaction techniques when evaluating the availability of actions and label matches. All of these functions may be evaluated within cognitive walkthroughs at early stages of program or prototype development.

Pluralistic walkthroughs are very similar to cognitive walkthroughs. The main difference is that pluralistic walkthroughs allow users, designers, and usability experts to work collaboratively and walkthrough a prototype environment step by step. In these evaluations, a usability expert will facilitate the discussion between users. Along the way, the group can discuss issues concerning format and interaction in order to make necessary changes to the

[434] Rieman, Franzke & Redmiles (1995).
[435] (1994).

final prototype. This group setting provides the opportunity for users of various skills and backgrounds to discuss concerns and opinions openly with others.

5.3.2.6 Observations

Implementing organized observations is also a significant evaluation method. Despite the various evaluation methods available, attaining complete and full data to analysis research results is still a difficult task. Many times, small user nuances can put new meaning into previously collected results. These user nuances can include for example, facial expressions signing, glancing around the room, or hand gestures. Other significant data difficult to attain through most evaluation methods may include testing space lighting, physical objects in the testing space, or the general mood of the test group users. Data such as this can have significant meaning in final result analysis. For this reason, observations are a credible and valid evaluation method that can support final data analysis.

For both the designer and the user to truly understand learner perceptions and concerns, actually interacting with the system is necessary. Watching and even listening to these interactions can provide interesting and informative data. Observations are a very effective way to do this. Observations allow designers to watch users interact with the environment in a natural setting. This can be done at any time during the design/evaluation process. Observations can include designers taking photos or videos, extended periods of note-taking as ethnographers, basic notes, and simple questions, and can range from an observers lack of- to full involvement in the user process. Many times, a combination of observation techniques are used; most commonly, photographs and notes, or audio recordings and photos[436].

Quick and dirty observations, for example, may include spending short amounts of time with users and systems and watching from a distance, or working with the users as they interact with the program. Videos provide interesting information that is usually difficult to register otherwise. Smiles, frowns and snickers may all come from important perceptions that are challenging to elaborate. Field studies allow observers to become fully involved, or stay on the sidelines to observe. In this way, various angles of the usability and interactablity of the program may be determined. Whatever the level of involvement, field studies call for the least amount of engagement from the observer as possible. If the observer is too much

[436] Preece, et al. (2002).

involved, and constantly giving directions and support to users, valid research and data collection is impossible. There are various frameworks for effective field observation. Robson[437] has a particularly all-encompassing list of guidelines that include:

- Space- What does the setting look like?
- Actors- Who is the test user group?
- Activities- What is being done?
- Objects- What physical objects are in the room?
- Acts- What is specifically going on?
- Events- Are these activities special in some way?
- Goals- What are the actors trying to do?
- Feelings- What is the general mood?

These guidelines help provide a focus for organizing questions and feedback from field settings.

5.3.2.7 Prototypes and Testing

Testing a prototype of the elearning environment can begin as soon as a rationale is determined for a particular system for a particular population. A prototype can be a paper drawing (low-fidelity prototype) or a rough construct of a program (high-fidelity prototype)[438]. Regardless, prototypes are very effective ways to encourage feedback, thought and collaboration on the usability of a system[439]. It has been strongly recommended to begin all evaluations with low-fidelity prototypes[440]. When designers jump to high-fidelity prototypes first, many inhibit feedback results. These can include; time-consuming efforts to construct systems, reviewers' lack of comment on content, or designers not willing to reconfigure systems once made.

Story-boarding is one way to implement a simple prototype. First, the blueprint flow diagram of a potential interactive environment can be tested. This flow-diagram can include references to color, audio, and links. With the assistance of the designer's short explanations,

[437] (1993), in Preece, et al. (2002).
[438] Preece, et al. (2002).
[439] Schön (1983), in Preece, et al. (2002).
[440] Rettig (1994), in Preece, et al. (2002).

expert interviews or potential users can be observed "interacting" with the environment. From here, enlightening information can be noted and detailed comments and suggestions can pinpoint potential challenges before they are made. Creating sketches and drawings without storyboarding can also suffice as "for example" visualizations to collaborate on[441]. Even low-fidelity prototypes need careful design assessment.

Once metaphors are included, they must also be evaluated. Erickson[442] explains that their usefulness can be evaluated through a set of five questions; Does the metaphor provide more structure to the system?, How much of the metaphor is relevant to the system?, Can the metaphor be easily represented on the screen?, Do users understand the metaphor?, and Can the metaphor be broadened later on?

These questions allow designers to evaluate metaphors long before system design. User test groups can additionally give adequate feedback to these questions in simple interview or questionnaire form, providing excellent information.

Next, pilot studies are small prototype trials implemented before the final test run. This ensures that the prototype is as finished as possible before the final testing. Using an iterative or spiral process, pilot studies can be implemented as many times as possible. User testing evaluations ensure that the product made fits the population it was intended for[443]. Using this method, data is collected concerning how much time users need to complete specific tasks, how many errors were made, what they were, and other significant information.

To implement a user testing experiment, various factors must be organized. First effort must be taken before testing. A hypothesis must be determined that asks a question to be answered by the experiment and data analysis. Then, two prototypes are designed with a specific variable difference, or *condition*. The differences in user reaction to these variables are compared to see the possible affects of changing or emitting that variable. Before observations, a series of tasks should be organized to direct test users. After, specific users should be selected. User testing groups should generally consist of 5 to 12 individuals typical of the end population group[444], although only one or a few are needed for "quick and dirty"

[441] Wagner (1990), in Laurel (1990).
[442] (1990), in Laurel (1990).
[443] Dumas & Redish (1994), in Preece, et al. (2002), and Gomoll (1990), in Laurel (1990).
[444] Dumas & Redish (1999), in Preece, et al. (2002).

evaluations. To implement the two conditions on users, evaluations may have a separate group of similar users for each condition, the same group for both conditions, or specially selected users for each of the conditions.

Next, the realistic testing environment should be determined. The most carefully planned environment will support more reliable research, as natural changes may affect population groups. Issues such as noise level and un-necessary movement around the room should be thought-through for best results. Nonetheless, user testing results should be repeatable with similar results given similar circumstances.

At the observation, users should be introduced to the purpose of the experiment. This is not to say that they should know all the details. By explaining the two condition variables, or the rationale behind sample population group selection, bias may affect results. Additionally, test users should know they are helping voluntarily, and free to quit at any time. Data collection for user testing may consist of video recordings and diary logs. Because of these tools, test users should be aware of what they are and why they're there, so all efforts and thoughts during testing are on the program- not the testing room. Data may also be collected orally. If this is the case, test users must be made aware that thinking out loud is an appreciated part of the test session. After these topics have been introduced, users must know they will not be offered any assistance, but be directed to do specific tasks as naturally as possible. These preparations should end with a question/answer session before actual test observation begins. After observations, it is necessary to explain your hypothesis to group members, answer any remaining questions, discuss unique test user behaviors to gain further information, and ask for overall impressions.

Through a few studies, there has been some consensus on the most effective evaluation methods[445]. Usability testing such as that suggested above seems to uncover more usability challenges than other methods. In addition, usability testing pinpoints more global and unique challenges than other methods, yet uncovers fewer localized challenges than other methods. In addition, usability demands more time and effort than other methods, but has better cost-effective returns. Heuristic evaluations are better than walkthroughs at uncovering usability issues. Also, heuristic evaluations are very powerful when more than one expert is involved. In addition, heuristics uncover more detailed challenges than other methods. Lastly, cognitive

[445] Dumas & Redish (1994).

walkthroughs are less effective than either usability tests or heuristic evaluations at uncovering potential challenges, and so should be noted as such when planning evaluation schemes for learning environments. Jeffries and Desurvire[446] do recommend combining evaluation methods for higher levels of insight. Accordingly they note, "the best evaluation of a user interface comes from applying multiple evaluation techniques. Using multiple experts in heuristic evaluations combined with usability testing for usability can diminish the potential of overlooking both detailed and global challenge areas.

5.4 Analysis and Interpretation

Data collection certainly does not end the research process. Each collection of information throughout spiral design and evaluation needs to be correctly analyzed and interpreted in order to effectively use the results for possible changes in the program. Once data is collected, asking questions in order to find specific differences can be helpful. In the user testing evaluation, recognizing differences in data collected between the two condition variables may prove enlightening. Perhaps significant data will "pop out" after implementation that may not have been proposed before. Organizing this information into data that is qualitative or quantitative is a helpful start.

Qualitative data shows the quality of a situation, and can usually be described in terms of scenarios and story-based interpretation. Qualitative data can be supported through questionnaires, interviews, focus groups, pictures, photos, video, and notes. To uncover qualitative data, patterns within these data collection methods are pinpointed and categorized together in order to convince audiences a particular result is clear. Providing anecdotal examples and quotes can help emphasize analyzed points. Quantitative results are related to quantity, or correlated and regressional methods such as t-tests, analysis of variances and chi-squares. When going through data, tallies of how many times a certain action or activity took place may be recorded for quantitative use. This leads to the organization of these tallies into graphs, tables and charts.

Naturally, a combination of both qualitative and quantitative findings is the most convincing, as it presents results from both perspectives. Synergistically blending qualitative and quantitative data so that both mutually reinforce the other can help support research outcomes.

[446] (1992), in Dumas & Redish (1994).

Interview quotes may be able to support numerical data, and vice versa[447]. What is then conclusively important is the organization and planning of various relevant evaluation methods that can support the most effective analysis of the research data collection.

[447] http://www.sosig.ac.uk/research_tools/

6 The Research Project

This research project was based on the design, implementation and evaluation of two comparable elearning delivered environments- one being linear text based, the other hypermedia based. These elearning environments were designed specifically for pharmacy apprentices, and tested with a population in the Vienna, Austria area. Elearning for apprentice populations has experienced significant relevance in the last few decades, and owes support from local to international organizations. A great deal of funding and reforms have been secured for the further development of relevant elearning technologies for such populations. Therefore, the results of this study further support relevant research for developing effective elearning technologies in the vocational education fields.

From the similar precedent of Berger[448], the relevance of this idea stemmed from conceptualizing an engaging learning platform supported by technology for learners. Similarly, this project followed such goals as EU 2010, and eFit Austria[449] in tapping into new technological innovations to upgrade and support teaching and learning. Along those same lines, missions for such programs as the Vocade Project and the Leonardo Programme[450] further supported grounds for the research project here.

The following section provides an overview of the research and study involved to answer the question; *which elearning delivery and design method is more attractive for Austrian pharmacy apprentices- linear text or hypermedia?* Throughout this section, connections are drawn on referring to information previously gathered in the literature review and their subsequent affects on decisions secured during the project study experiment. These connections made the isolation of the research question, and thus subsequently the elimination of unnecessary details, reliable.

This section begins with the design of the study programs, with an explanation of the hypermedia and linear text programs. After, a section on the evaluation and data collection methods used is presented. Next, research study hypothesis are listed, as were included in the final testing questionnaires. Finally, test measures are explained. This includes the methods

[448] (1987), section 2.1.1 *Austrian Education and Electronic Learning.*
[449] Section 2.1.2 *In Support of Goal 2010.*
[450] Section 2.4 *Initiatives and Programs.*

of study used, the testing population and the results for the initial study, the pilot test and the final user testing group.

6.1 Study Design

The following section provides an overview of the study design of this research. A detailed illustration of the two programs and their formulation, and the evaluation methods implemented for the research testing are included. The programs consisted of one hypermedia based, and one linear text based elearning program. The decision to conduct one program in hypermedia form was based in part on literature by Ford and Chen[451], and Lehman, Ayersman, and Hidi and Harackiewicz[452]. These cited the positive connections between motivational theory and hypermedia programs, as well as discussions throughout the literature review suggesting the usually positive affect multimedia agents have on learner experiences, successes and life-long learning. The hypermedia program offered hypertext and also offered an innovative way to experience traditional learning content for this learner population[453].

The second program was delivered as a linear text program in PDF form. This strictly text based program provided a contrasting equivalent to the hypermedia program, with the same learner content. It also offered a linear structure, as opposed to the a-linear structure of the hypermedia program. Such a program more closely resembled the learning delivery methods common for customer communications in apprenticeship programs in Austria. The linear text program leads the learner through the content, as opposed to the hypermedia program that allowed the learner to lead through the program. A PDF file, as opposed to printed text on paper, was used to ensure use of new technologies and elearning possibilities, as supported through governmental and organizational reform and law.

6.1.1 Design of Elearning Systems

The following section illustrates and explains the details behind the design of both programs-hypermedia and linear text. These two programs are presented separately with additional explanations of elements individual to that program. After, a short explanation is given for

[451] (2000), section 4.2.1 *Empirical Research.*
[452] (2000), (1996), (2000), section 4.5 *Elements of Hypermedia.*
[453] Section 4.5.5 *Hypertext.*

elements that were significant in both programs together. These include life-long learning priorities, user implementation factors, construction of relevant and meaningful content for the customer communication scenarios, creativity, authenticity, the drawn customer characters, standards, and technology delivery methods[454].

6.1.1.1 Hypermedia Program

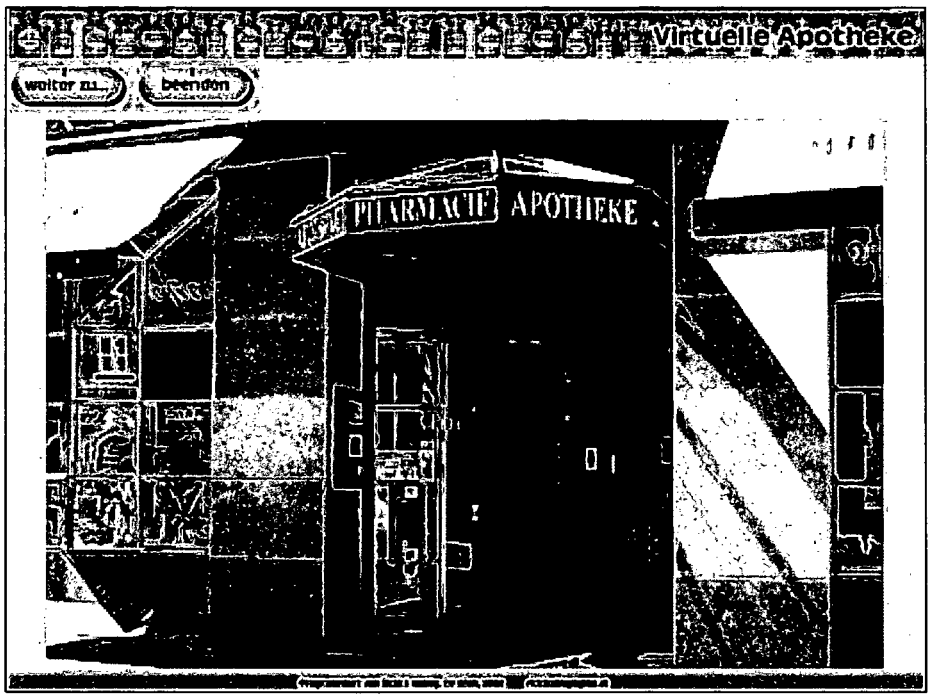

Figure 6a: Hypermedia Elearning Introduction Screen

The hypermedia elearning environment included color, hypertext, graphic drawings, buttons, pull-down menus, pop-up menus, audio and interactive clickable objects and links. Elements of multimedia naturally supported the hypermedia program to a great extent. In this respect, Nichols[455] was taken into great consideration. Effort was made throughout to ensure the program was based on what he calls the roots and branches of the "tree of knowledge"- not just the "bells and whistles" of multimedia applications or the seductive augmentation. An overall metaphor of a pharmacy was chosen in order to mirror the work environment to the elearning environment, and make elearner interaction more comfortable. This idea has been previously discussed by Ebersol[456] and Erickson[457]. This would be accomplished through various means. An initial screen showing a pharmacy door from the street side begins the

[454] Section 6.1.1.3 *Additional Design Priorities.*
[455] (2003), section 4.1 *Learner Theories.*
[456] (1997), section 4.3.3 *Interaction and Timing.*
[457] (1990), in Laurel (1990), section 4.3.3 *Interaction and Timing.*

hypermedia program, as shown above in Figure 6a: *Hypermedia Elearning Introduction Screen.* Soft audio of sidewalk noise would support this feeling[458]. White medicine capsule button links were included to continue the pharmacy metaphor. Users entered the program by moving the cursor over the pharmacy door. This reveals a pop-up box ("Apotheke Tür") and a clickable area that, when interacted with, leads the user directly into the 360° pharmacy panorama, as shown below in Figure 6b: *Scene from the 360° Virtual Pharmacy Panorama.*

Figure 6b: Scene from the 360° Virtual Pharmacy Panorama

Inside the virtual pharmacy, users "turned" to the left or right 360° to view all sides of the pharmacy environment. Within this environment, clickable objects representing the 15 main apprenticeship learning topics (plant represents botany, Austrian flag represents politics, etc.) are accessible, with small pop-up boxes naming each of the topics as cursors moved over each icon. By clicking directly on one of the 15 objects, users would be transferred to further learning materials and activities in that topic area. Alternatively, a button link on the upper left hand side of the screen also provided a navigational short cut. To interact specifically with the Kundengespräche topic learning environment, clicking on "Oma" customer within the 360° virtual pharmacy environment leads to the "Kundengespräche Home Page" as given in Figure 6c below.

[458] Beccue, et al. (2001), in section 4.5.6 *Audio.*

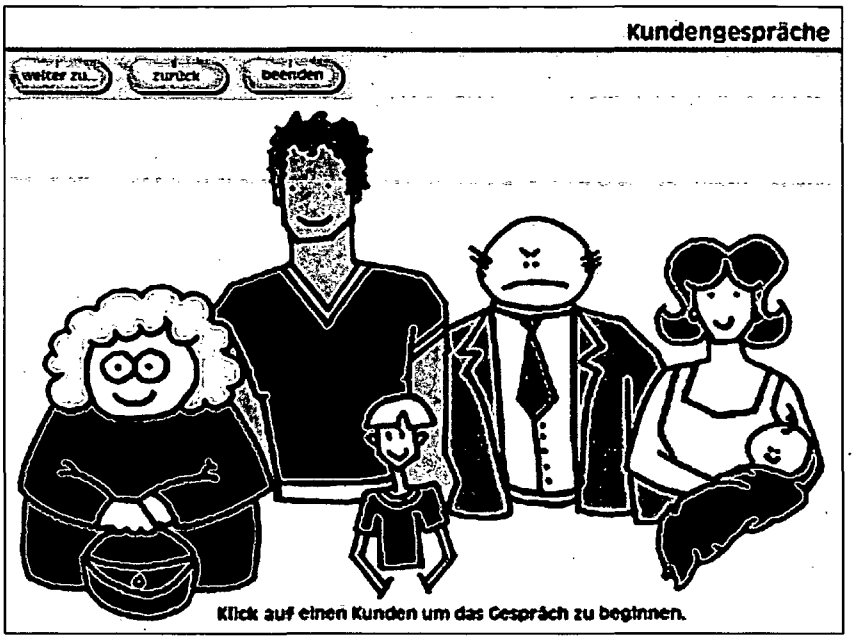

Figure 6c: Hypermedia Elearning Kundegespräche Home Page

Here, users are presented with 5 typical pharmacy customers; a woman of advanced age, a male tourist in his 20's, a young boy, a disgruntled looking man of middle age, and a woman with her baby. Soft greens and blue colors served as simplistic[459] yet meaningful[460] and motivating background colors[461]. Likewise, screens contained text and graphics with adequately contrasting link colors.

Clicking on a customer leads to additional hypertext screens with multiple choice interactive scenario-based "conversations" as presented below in Figure 6d: *Hypermedia Program Oma, Mann, Pharmacist Screens.* In this way, the hypermedia program environment was constructed to support simulation-based learning[462]. Traditionally, practice in the area of customer communications requires real-life experience. Decisions made in these real-life experiences are not always effective or correct. Virtual experiences in this program invited learners to engage in real-life situations. These hypertext simulation activities catered well to the content, and provided practice within a safe, non-threatening environment in which learners were able to take time, react, rethink, and re-visit experiences with virtual customers.

[459] Schaeffer & Bateman (1996), in section 4.5.3.3 *Use of Color.*
[460] Pett & Wilson (1996), in section 4.5.3.3 *Use of Color.*
[461] Green (1984), Nowell, et al. (2002) in section 4.5.3.3 *Use of Color.*
[462] Section 4.3.5.1 *Interactive Simulation Activities.*

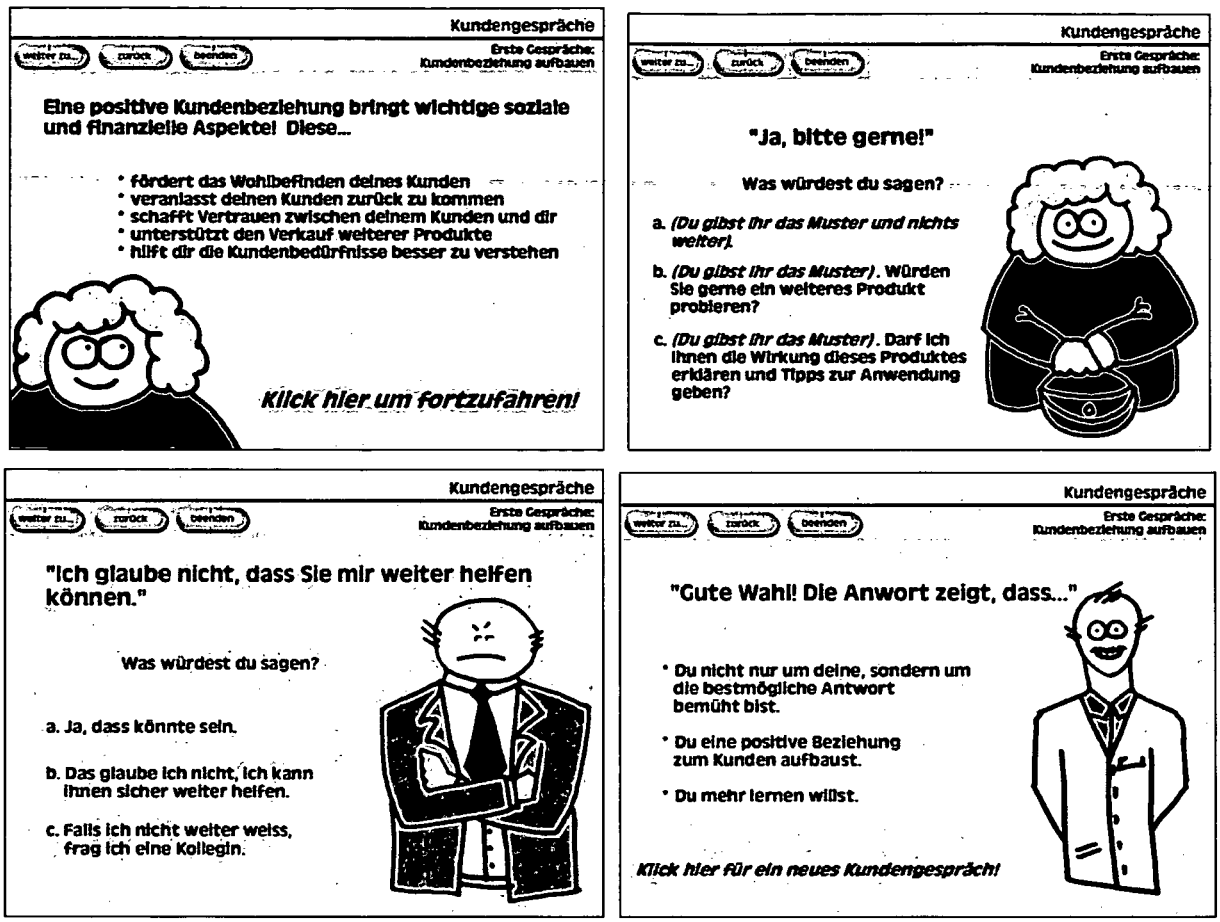

Figure 6d: Hypermedia Program Oma, Mann, Pharmacist Screens

On these subsequent interactive screens, the virtual customer would present a question, comment or their intentions were specified. The user would have a choice of responsive questions, comments or actions. After each option, an additional screen would provide feedback on best choices or encourage better knowledge and understanding of secondary choices[463]. These activities supported an element of authenticity in the program.

As a basis for the hypermedia program, models such as Wlodkowski's[464] Time Continuum Model, Keller's[465] ARCS model and Malone and Lepper's[466] model were integrated. The Time Continuum Model was followed through elements such as continued elearner feedback, and ensuring initial experiences with first learning chunks were stress-free and interesting. ARCS was adhered to through incorporating novel, interesting and perhaps even surprising events, changing elements, using language meaningful to the elearner, allowing elearners to succeed within the program, providing feedback, adequate interactivity timing, multiple

[463] Thalheimer (2004), section 4.3.5.1 *Interactive Simulation Activities.*
[464] (1985), section 4.5.1 *Models for Hypermedia and Motivation.*
[465] (1987), section 4.5.1 *Models for Hypermedia and Motivation.*
[466] (1987), section 4.5.1 *Models for Hypermedia and Motivation.*

learner intelligences and engagement. Malone and Lepper's model was followed by incorporating creating learning objectives at a realistic level of difficulty in order to keep users interested and comfortable, having elements of curiosity through audio and visual information, supporting motivation through allowing learners a sense of control through multiple choice and learning chunk choices, and incorporating fantasy-like elements that were intrinsically motivating.

An element of gaming was implemented throughout the hypermedia program based on research by Amory and Crawford[467]. Gaming created a way elearners could interact with microworld environments, and become active parts of that world, constructing knowledge as they navigate through. Elearners are allowed to interact with non-real characters, promoting creativity and encouraging thoughtfulness and intelligence. By adding simulations such as multiple choice, panoramic navigation and characters in the hypermedia program, and simulation case-studies and character graphics in the linear text program, heightened levels of elearner motivation and life-long learning could be supported. In the same section, Crawford's suggestions for placing high emphasis on graphics and sound, emphasizing interaction, and involving learners in pleasantly frustrating problem-solving scenarios, was included in both hypermedia and linear text programs.

The hypermedia program was also designed to support life-long learning development. It has, for example, the potential to be further developed into various expertise or objective levels. The Kundengespräche topic has the potential to first include interactive activities with various customers. Later, over a course of relevant interactive learning chunks with these virtual customers, conversations between user and customer could evolve, leading to new and innovative learning opportunities.

Specifically in the hypermedia program, the psychophysics of the interface design was a very important element. For example, Horton's[468] suggestions on successful interface design were taken into consideration and included focusing on appealing design, integrating short text synopsis and scenarios, having interesting text, quality programming without technical errors, game-play, meaningful learning, recognition of learner achievement, and facilitator feedback. Norman's[469] list was also adhered to. His suggestions took the form of; being consistent in

[467] (2001), (1990), in Laurel, section 4.3.5 *Gaming Integration.*
[468] (2000), section 4.4 *Interface Design.*
[469] (1988), section 4.4.1 *Shneiderman Guidelines.*

actions, terminology, colors, layout, fonts, menus and prompts, enabling shortcuts, consistently offering informative feedback, allowing users to reverse actions, supporting user control, and reducing short-memory load by using pull-down screens, menus and the like.

6.1.1.2 Linear Text Program

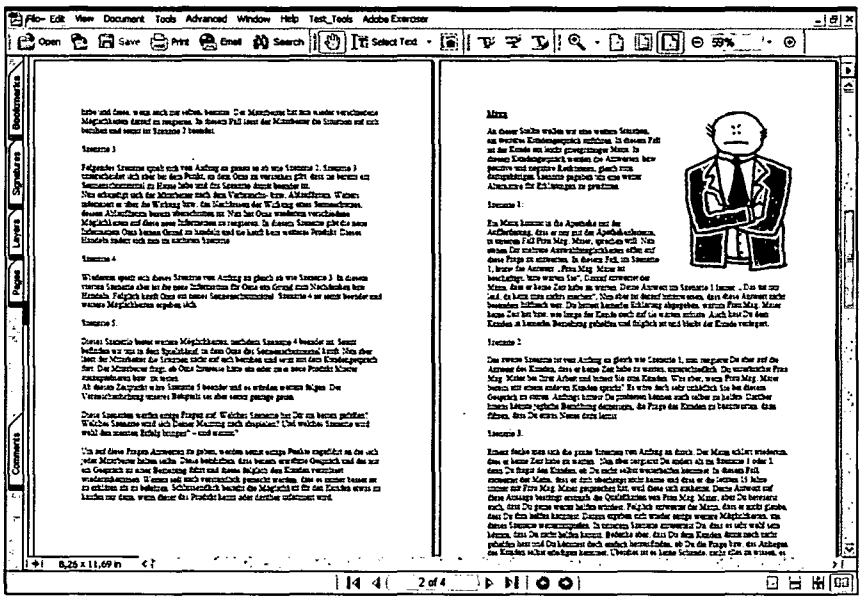

Figure 6e: Linear Text PDF

The linear text environment consisted of a series of black and white, text-based, case-study scenarios and related explanations in PDF format, as shown above in Figure 6e: *Linear Text PDF*. This program contained the same learning material as was presented in the hypermedia program. The full linear text document can be found in section 8.4 *Linear Text Program.*

The linear text program took into consideration relevant factors such as text, language, style, font and size, but was implemented without extensive hypermedia elements. Instead, this PDF based program included limited graphics used from the hypermedia program to support the scenarios given[470]. Next to each customer scenario, a character was pictured representing the content of the scenario. For example, relevant pictures were included to assist learning, help learners understand and remember content, help support non-written information, and assist those learners with poor reading skills. No pictures were used that were not referred to

[470] Williams, Lock, Crisp and Longstaffe (1995), in section 4.5.3.1 *Text and Graphics.*

in the text. In the above Figure 6e, the picture of the ornery Mann reflects his ornery nature in the text[471].

Text was generally written in a plain, black, 14 point[472], Times New Roman[473]. Text was presented on a white PDF page, for reasons of contrast[474]. Text was used in a slightly conflicting manner with same font, differing sizes, and bold, underlined titles. White space density balance was also a significant consideration in this program. Line length, spacing between lines and between text and characters was designed in accordance with Spool[475], in that an uncomplicated, yet evoking balance was achieved. In addition, a jagged right margin format for the text was used to support easier reading[476].

To support Contiguity Theory, characters were presented directly next to the text, and specifically next to the text associated[477], as seen in the figure above. In addition, characters were placed on the upper, right-hand side of the PDF page. This was done to encourage readers to quickly glance at the character, but to spend more time and effort with the text scenarios. In comparison, the PDF program begins with an introduction to the Kundengespräche learning content theme, before customer scenarios are given. This introduction is presented by the "Pharmacist"- an elderly gentleman character drawing, as seen giving feedback in the hypermedia program in Figure 6d: *Hypermedia Program Oma, Mann, Pharmacist Screens*. To ensure that readers note a difference between the pharmacist character, which presents learning content and gives feedback, from the customer characters, the pharmacist was placed at the upper left-hand side of the PDF page, next to his respective text as well.

The style and language used in the text program was also carefully constructed. Language was written after short headings[478]. In the tested PDF program, the headings "Oma" and "Mann" were used. Scenarios were presented in passive, informal, simple language, with

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[471] McCloud (1993), in section 4.5.3.1 *Text and Graphics*.
[472] Section 6.3.2.3 *Pilot Test Results* further explains the reasons behind using 14, as opposed to 12 font in this program.
[473] Misanchuk, et al. (1996), in section 4.5.3.1 *Text and Graphics*.
[474] (1994), in section 4.5.3.1 *Text and Graphics*.
[475] Festa (1998), in section 4.5.3.1 *Text and Graphics*.
[476] Schwier & Misanchuk (1993), in section 4.5.3.1 *Text and Graphics*.
[477] Bernard (1990), Mayer & Gallini (1990), Mayer & Anderson (1991, 1992), in Sanger (2001), in section 4.5.3.2 *Representational Placement*.
[478] Nielsen (1997).

simple sentence structure[479]. Text was written in "du" form, using uncomplicated explanations and vocabulary. Language and scenario explanations were also written for the educational level and age of the apprentice population.

6.1.1.3 Additional Design Priorities

The design of the two elearning systems was supported a great deal by information gathered from the literature review as well as evaluatory methods implemented throughout the development process. Priority elements such as learner-centered design, theory, multiple intelligences and motivational factors were included in both programs. Research on specific issues such as simplicity, color, text and graphics, placement of objects, and animation were taken into consideration[480]. These elements supported the most attractive elearning environments possible[481]. Also, the lure of seductive augmentation elements was regulated[482]. That is to say, no elements were included in either program that were not significant to the content or design.

Elements imperative for life-long learning were also taken into consideration in both programs[483]. Specifically, these included integrating real-world practices and environments, attaining learning objectives through problem solving, having tasks that reflect real-world experiences, inclusion of case-study situations that could be referred back to, allowing re-visitation, and integration of elements of interaction between people and characters, specifically in the hypermedia program through hypertext options.

One specific example of this interaction is allowing users re-visitation and interactivity to support learner content. Therefore, in the Oma-based learning scenarios, there is not only one correct answer. As is reality, there are more than one way to ensure effective customer communication. In addition, life-long learning was touched upon by the idea that the programs could be easily expanded. Each of the 15 apprentice learning topics had expansion potential to be written with a countless number of relevant lessons, scenarios, activities and resource links. Elearners would be able to choose which topic or elearning chunk they wished

[479] Kilian (1999).
[480] Schwier & Misanchuk (1993), and Lynch & Horton (1997), section 4.5.2 *Guidelines for Hypermedia Design.*
[481] Section 4.3 *Attractive Motivational Factors.*
[482] Thalheimer (2004), section 4.6 *Seductive Augmentation.*
[483] Fischer (2000), section 2.1 *Elearning and Life-Long Learning.*

to use, resulting in higher levels of interest and learner efficiency[484]. The basis of the system could be expanded to cater to each of the three different apprenticeship years, diverse ages or genders, or cultures if necessary.

Both the linear text and hypermedia programs were developed with various user implementation elements in mind[485]. The two programs were built to be able to be expanded to a great extent in the future. Even for this research study, implementation options for the user included on-demand elearning factors that would constitute as-needed ware for jukeboxes of content, and reoccurring self-paced learner needs. This content could be divided into organized, re-usable/re-visitable learning objects as a realistic way to support learner goals. This structure could also be used as a knowledge-base, as learners would be able to access material on a self-regulatory basis and create learning experiences independently through their own choices.

In both the hypermedia and the linear text program, meaningful scenarios were constructed from real-world situations within a normal pharmacy environment to enhance elearner content. These scenarios were constructed with feedback and suggestions, yet open-ended conclusions, allowing learners to come to their own conclusion through problem solving. Learners had the opportunity to rethink and revisit these scenarios at will, and engage in "collaborative" learning efforts with drawn characters in the hypermedia program, and also simulated scenarios with characters and graphics in the linear text program.

An element of creativity[486] was also integrated to support elearner motivation and attraction in these programs. This was done to encourage elearners to think in new and creative ways in order to solve problems- paralleling foundational constructivist theory. These creative elements were guided by Shneiderman's[487] GENEX list. Two of these implemented guidelines include the idea that, as in the two programs on a constructivist level, new knowledge is based on previous knowledge (as viewed in developing information chunks), and that meaningful tools support creativity in thinking and interactions with real-world experiences result in the development of intelligence. In addition, integrating what-if simulations and problem scenarios would encourage elearners to use their own sense of

[484] Xu, et al. (2003), 4.3.3 *Interaction and Timing*.
[485] Section 3.2.2 *Implementation Options.*
[486] Vivacqua, et al. (2003),and Clements & Samara (2003), section 4.3.4 *Creativity.*
[487] (2000).

decision control to create multiple scenarios and reflect on their outcomes in order to safely broaden their understanding of the content and the result of their decisions, supporting learner creativity.

The idea of authenticity[488] was noted as a supporter of elearner motivation and life-long learning in the hypermedia and linear text programs. Various elements were included in both programs to ensure authenticity was included; real-life relevancy of content, open-ended tasks and activities, possibilities for elearners to investigate and re-investigate concepts and tasks, opportunities for elearners to examine tasks from various perspectives, collaboration (in hypermedia program with characters), reflection opportunities, activities that can be applied to various settings, and opportunity for diverse learner outcomes.

Cartoon-like characters were used as the learning facilitators of both programs. This was done with the contention that simply drawn illustrations are more attractive for learners who will spend less time with programs[489]. This decision was also made with the idea that such illustrated elements ignite motivation and thus a desire to learn, encourage interaction, and thus life-long learning[490]. Here, too, the necessary appearance of the illustrated character was determined[491]. Lastly, Baecker and Small's[492] guidelines were taken into consideration for the use and placement of such illustrated characters. Specifically, characters are positioned on the screen to accommodate the best view from the user, the characters create positive impacts on the rest of the screen components/colors, and characters are drawn with the best light and shading elements to support their use.

Using theory as a basis for the design and delivery of both programs in this study was an important factor. As discussed from Winans, et al. and Clancey[493], learner theory is a foundational necessity for successful elearning environments. Xu, et al.[494] additionally reiterated that connecting computer-based learning programs directly with learner theory results in higher levels of user motivation and performance. The hypermedia program for this research study was constructed mainly with constructivist theory from Dewey, Piaget and

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[488] Section 4.3.2 *Authenticity.*
[489] Laurel (1993), in Preece (2002), McCloud (1993), in section 4.5.7 *Animations and Cartoon Drawings*, and Williams, et al. (1995), and Scaife & Rogers (2001), section 4.5.3.2 *Representational Placement.*
[490] Hutchinson (1945), Williams (1995), Davis (1997), Versaci (2001), Morrison, et al. (2002), in section 4.5.7 *Animations and Cartoon Drawings.*
[491] Preece (2002), in section 4.5.7 *Animations and Cartoon Drawings.*
[492] (1990), in Laurel, in section 4.5.7 *Animations and Cartoon Drawings.*
[493] (1988), (1992), section 4 *Designing Elearning Environments.*
[494] (2003), section 4 *Designing Elearning Environments.*

Vygotsky. In this way, as discussed by Bruner and Wonacott[495], the elearner is an active participant in the learning process, acquiring knowledge by interactions with the learning environment. Similarly, the situated learning theory discussed by Lave and Wenger[496] also supports the constructivist view used in the hypermedia program by contending that the learning taking place is a result of learner/environment interaction.

Interaction, as was determined from Piaget and Vygotsky, is an important part of design and elearner motivation. This interaction further supports Preece, Rogers and Sharp's[497] "10 minute rule", and Tong's[498] contention that speed and timing are top design priorities. Additionally, Vygotsky's cognitive apprentice theory as unfolded by Collins, et al. and also Gottlieb[499] likewise supports constructivism and the hypermedia program by placing learning tasks and processes in real-life contexts to form relevance for the learner now and in the future.

The close relationship between vocational education and constructivist views was also taken into consideration. The idea that facilitators organize tasks and allow learners to develop their own knowledge at their own pace reflects this consideration, as suggested by Stevenson[500].

Constructivist theory was conceptualized into a working example by the base structure of the hypermedia program specifically. In the hypermedia program, learners are given a package of pre-organized learning chunks. Their navigation, repetition, reflection, and advancement through the program is a self-controlled, self-regulated process completely at their individual pace and control. Likewise, Vygotsky's Zone of Proximital Development theory[501], also mentioned in the same section, affected the hypermedia program, in that the multiple choice possibilities gave learners control over their choices. Anchored instructional theory by Bransford, et al. [502] also takes the form of various case-study and problem scenarios in both programs.

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[495] (1960), (2000), section 4.1 *Learner Theory.*
[496] (1990).
[497] (2002), section 4.3.3 *Interaction and Timing.*
[498] (2001), section 4.3.3 *Interaction and Timing.*
[499] (1989), (2000).
[500] (1994), section 2.3.2 *Vocational Education, Constructivism and ZPD.*
[501] Bockarie (2002).
[502] (1990).

Motivational theory was likewise taken into consideration, as a key component to success as offered by Dick and Carey, and Clements and Sarama[503]. Elements from Abas' Motivation Wheel[504] were also integrated into the programs. Examples include increasing community interaction in the hypermedia program with elearner/character interaction, and involving learners in both the hypermedia and linear text programs through engaging, interesting content. Community interaction with the graphic characters was in part supported by artificial intelligence based research[505]. Also, motivating graphics were included in the PDF based linear text program, and Halliday and Hasan, and Conner's[506] views on coherence and cohesion were included in the content.

In accordance with ISO 9241's usability standards[507] as well as Quesenbery[508], both interfaces were designed as efficiently, effectively, engagingly, error tolerant, easy and satisfyingly as possible. These elements helped support elearner comfort with the programs as well as pleasing nature of the two environments. No extravagant or unnecessary elements or moving animations were included in the programs, by Nielsen's[509] suggestion. Overall as supported by Preece[510] in the same section, less was more in these program designs, and a limited amount of color, font and size differences, and graphic elements were used. Simplistic interface design kept the hypermedia program user-friendly, and consistent placement of necessary elements also supported elearner usability. To this, ensuring buttons and links looked like they could be interacted with, as prioritized by Shneiderman, Brandon and Horton[511], was also noted. Clarity also fell into usability elements, as the use of frosted language in both programs was kept to a bear minimum[512]. Additionally, text content in both programs was written according to Morkes and Nielsen, and Kilian[513]. The most important information was written first, in journalistic style, and text was passive, using concrete language, simple sentence structure, avoiding clichés, using strong verbs, and with a consideration of dialect variations in mind.

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[503] (1996), (2003), section 4.3.1 *Motivational Theory.*
[504] (2003), section 4.3 *Attractive Motivation Factors.*
[505] Section 4.3.5.2 *Artificial Intelligence Agencies.*
[506] (1976), (1984), in Levy (1997), section 4.5.4 *Linear Text.*
[507] Section 4.4.2 *Usability.*
[508] (2003).
[509] (1997).
[510] (2000).
[511] (1998), (1996), (1994), section 4.5.2 *Guidelines for Hypermedia Design.*
[512] Section 4.5.2 *Guidelines for Hypermedia Design.*
[513] (1997), (1999), section 4.5.3.1 *Text and Graphics.*

With information collected from Spool[514], particular emphasis was made to ensure a balanced amount of text and/or graphics in comparison to background colors were coordinated. Likewise, as suggested by Williams[515], contrasting elements in relation to type, size, line thickness, shape and space were also considered when balancing screen elements. Balance was ensured by carefully placing objects and color-weight values on the screen, and also text and graphics. Williams, Lock, Crisp and Longstaffe's[516] list of points to consider when assessing text and graphics were used. Here, it was ensured that the pictures were relevant to the text, that the pictures could help the learner understand and remember, that the pictures could substitute for words as non-verbal information, that learners may not make full use of overly complex illustrations, and that pictures could help with learners having poor verbal skills.

On the home page of the hypermedia Kundengespräch topic program, for example, linear banners run equally across the top and bottom of the screen in complementary, but not distracting colors and tones of green and blue. Button links are placed on the left side of the top banner to navigate to other areas of the program, while the name of the program and the lesson theme are placed to the right of the banner. The background color to this screen is a subtle light blue that connects these two banners, but also provides a pleasant and positive backdrop for the five customer characters. The customer characters are placed in the center of the screen. Their linear drawn quality reflects the font and text of the rest of the screen elements, and the colors of their clothing stand out from the backdrop encouraging interaction without creating aesthetic dissonance.

According to Horton, Braden, Anglin, et al., and Koroghlanian and Klein[517], using graphics was an important way to enhance learning in the two environments. Graphics were chosen according to Levie and Lentz, and Misanchuk, Schwier and Boling[518]. Due to this information, graphics only of utmost relevance were used. These were realistic in nature and simply drawn, as determined from Russell and Redhead, and Bristol University[519]. In

[514] (1998), in Festa.
[515] (1994).
[516] (1995).
[517] (1994), (1996), (1996), (2004).
[518] (1982), (1996).
[519] (1991), (1995), in Williams, et al.

accordance with Contiguity Theory, an effort was made not to place illustrations on separate screens[520].

6.1.2 Evaluation and Data Collection

Evaluation and data collection was implemented throughout the entire research process from the onset, and through the final user testing as well. Planning for these evaluations was made before the research process began. Suggestions from Vivet[521] supported the idea that such pre-planning is necessary for the development of successful elearning environments. This was done to ensure each decision made for the two programs- from learner needs, content, design, and delivery, was as reliable and relevant for the apprentice population as possible.

Boehm's[522] Spiral Process evaluation framework was used to ensure continuous planning, assessment, design, trial, and redesign. In addition, Abas'[523] ADDIE model was adhered to in the mentioned "updated" form of AEDEDEIE. This was accomplished by **a**nalyzing learner population facts, **e**valuating significances for elearning for this population, **d**esigning the elearning systems and **e**valuating them, **d**eveloping the systems further from those evaluations, and then **e**valuating them further, **i**mplementing test group studies, and finally **e**valuating the test groups again. These evaluations were made and collected on a qualitative and quantitative level. This supported the most reliable and credible research possible. Specific evaluations implemented, parties involved, and the analyzed results are further explained in detail in section 6.3 *Study Results* from the initial study to the final user testing.

6.1.2.1 Quantitative Evaluation

Quantitatively, various questionnaires were implemented to relevant groups throughout the research process. This was done in accordance with Brown, et al.'s[524] suggestion. Questionnaires were designed to collect information from a generally large test population, as was necessary for this study. These quantitative evaluation tools assisted in assessing a range of details from the test group. Final user testing questionnaires were designed around

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[520] Bernard, Mayer & Gallini (1990), Mayer, Anderson & Baggett (1990, 1991, 1992), in Sanger (2001), (1984), in Sanger (2001), in section 4.5.3.2 *Representational Placement.*
[521] (1996), section 4 *Designing Elearning Environments.*
[522] (1988).
[523] (2003), section 4.1 *Learner Theories.*
[524] (1996), in section 5.3.2.2 *Questionnaires.*

numerical measuring opinions on a Likert Scale scheme. The questionnaires implemented in this study were also designed around Robson's guidelines for writing effective questionnaires[525]. Guidelines included avoiding long or compound sentences, avoiding jargon and difficult language, avoiding leading questions, and being conscious of biases such as race and gender. Working examples of the questionnaires used in this study are presented fully in section 6.3 *Study Results*.

6.1.2.2 Qualitative Evaluation

Qualitatively, as many interested parties as possible were consulted throughout the project process in order to support valid and reliable evaluation of the programs. This decision was made with suggestions by Preece, et al.[526]. These included formal and informal interviews with university professors in related fields, professional elearning designers, pharmacists, pharmacy employees, Berufsschule teachers, Polytechnischeschulen teachers, WIFI teachers and students, representatives from the WKÖ, BMWK, IBW, MA2 (Lehrlingsmanagement), Apothekerkammer Wien, private firms developing and offering traditional and technology-based learning programs for pharmacy employees, marketing experts, communication and German language experts, sales experts, and gender/learning technology experts. Naturally, the opinions and suggestions of pharmacy apprentices were also taken into suggestion throughout the design and evaluation process, as suggested by Preece, et al., Gould and Lewis, and Tognazzini[527].

Interviews with these parties were designed around pre-organized or specific topics, or open conversations around related elearning/pharmacy apprentice issues. Various tools were also brought to these interview sessions as part of the evaluation process. These included drawings of the programs, sketches of character possibilities, blueprint flow diagrams, prototypes of program screens, rapid prototyping or working CD's of the programs. Detailed accounts of these qualitative evaluations are included in section 6.3 *Study Results*, below.

In addition to the qualitative and quantitative methods used throughout the Spiral Process evaluations, many more specific evaluations were made on elements used in the two programs. These included the evaluation of usability, metaphors, and technology. An attempt

[525] (1993), in Preece, et al. (2002).
[526] (2002), section 5 *Evaluating Elearning*.
[527] (2002), (1985), (2002), in Preece, et al. (2002).

was made throughout evaluation processes to adhere to Nielsen's[528] guidelines for proper and sound usability evaluations. Various attempts and examples from the programs can be noted here. First, ensuring that the system provided appropriate feedback in a timely manner was exemplified in the hypermedia program by the instant feedback screen presented when positive or negative choices were made by the user. Second, text in both programs was written in simple language with real-world transferability, as noted in the apprentice/customer scenarios given- taken directly from real-world scenarios at the pharmacies. Third, the user's position of control was recognized as they have the option to read the linear text program, or click through the hypermedia program. A third guideline of Nielsen was presented through visible objects in both programs such as links, panoramas and characters. Next, users had the ability to act within both programs by clicking in the hypermedia program or scrolling in the linear text program. They had the opportunity to make decisions from the multiple choice options in the hypermedia program as well. Finally, also following Nielsen's guidelines of usability, both programs offered opportunities for short cuts; in the linear text program, users could simply scroll past a certain character and read only those scenarios with characters of their choice. In the hypermedia program, users could use button links to pass over certain screens to reach others of their choice. Finally, Nielsen's guidelines were adhered to with the minimalist design of both programs.

Erickson's[529] suggestions on evaluating metaphors were used to assess the pharmaceutical concept in the hypermedia program. This was done by answering his five evaluatory questions. First, the metaphor must provide a clearer, more understandable structure for the system. This was accomplished by using an overall virtual pharmacy metaphor that supported a unity to the program without being distracting. Second, the metaphor must be relevant to the overall learning concept. This was accomplished by using a pharmacy door for the entrance to the learning program, using a 360° pharmacy panorama for the home of the program, using interface colors that reflected pharmacy fields and medicine capsule depictions for button links.

The technology used for the two programs was also assessed. Various international standards were reflected in the design, implementation and evaluation of these programs, in particular the hypermedia program[530]. Particular attention was put on reflecting numerous ISO 9241

[528] (1994), section 5.3.2.3 *Interviews*.
[529] (1990), in Laurel (1990), section 5.3.2.5 *Prototypes and Testing*.
[530] Section 5.2 *Standards and Evaluatory Consortiums*.

guidelines throughout the project. The ISO being one of the most significant voices for such standards, as many other consortiums base their guidelines in ISO as well. For example, Part 10 of these ISO guidelines, Dialogue Principles[531], was reflected through human-computer interaction, interface ergonomics, task suitability, learning suitability, user expectations and individualization. Part 12, Presentation of Information[532] was reflected in areas of presentation of information on the screen, screen layout, and design. Part 13 User Guidance[533] was reflected in its suggestions for design and evaluation of user guidance including feedbacks. Part 14 Menu Dialogues[534] was reflected in menu design, structure, navigation, and presentation. Part 16 Direct Manipulation Dialogues[535] was reflected through the manipulation of objects, design of metaphors, and other graphical user interface options.

The evaluation of an appropriate technological delivery method was also evaluated. A CD-ROM was used in part due to its uncomplicated nature, and also by similar suggestions from Fahy[536], Tuckey[537], Harasim,[538] and Barbules and Callister[539]. Using a CD allowed users to have the possibility to take the learning content with them, and use it at will wherever they are. This supported the idea that the technology stayed a tool in the learning process, and not an extravagance, or encumbrance[540]. In addition, positive vocational education and elearner success research findings elaborated by Misko, Swan and Jackman, Willis and Joyner, and Petty and Brewer[541] concerning learner assessments, performance results and perceptions on elearning were taken into consideration.

6.2 Hypotheses

The following section provides hypothesis statements pertaining to this research study. The formulation of these hypotheses was based on information gathered in the literature review, in addition to related interviews. These hypotheses are clustered in three important areas; the technology, the program design, and the learning content. These hypothesis statements were

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[531] (1996), ISO.
[532] (1998), ISO.
[533] (1998), ISO.
[534] (1997), ISO.
[535] (1999), ISO.
[536] (2000).
[537] (1993).
[538] (1996).
[539] (2000), in Meyer (2002), section 5.1.2 *Technology,* and section 3.2.1 *Methods of Delivery.*
[540] Section 5 *Evaluating Elearning.*
[541] (2000), (2000), (2000), (2002), section 4.2.1 *Empirical Research.*

then directly evaluated through the final user testing questionnaires and subsequent interviews. By analyzing and comparing the results from these hypotheses, an answer to the research question, "*Which elearning delivery and design method is more attractive for Austrian pharmacy apprentices- linear text or hypermedia*?" could be determined. The full questionnaires can be found in section 6.3.2.1 *Pilot Test Method.*

Overall Hypothesis: An attractively designed and delivered hypermedia or linear text program for pharmacy apprentices may be directly related to positive perceptions of motivation, technology, program design and learning content factors.

Technical Hypothesis: Elearning programs that are easy to start, load, and navigate, require no secondary assistance, and instigate no technical problems may contribute to an attractive learning tool for pharmacy apprentices.

Program Design Hypothesis 1: An attractive elearning program for pharmacy apprentices may be directly related to affinity to program design in relation to text, color, multimedia agents, graphics and organization.

Program Design Hypothesis 2: User motivation may be directly related to affinity to elearning program design.

Learning Content Hypothesis 1: User motivation may be directly related to clarity and understanding of elearning content.

Learning Content Hypothesis 2: User fun and motivation may be directly related to users perceptions on elearning content transferability to the work place.

Learning Content Hypothesis 3: User perceptions on elearning content transferability may be directly related to user affinity to learn with such programs.

6.3 Study Results

The following sections present details concerning the initial study with pharmacy owners/managers before program design, the pilot test and the final user testing. Information

here includes the specific methods of evaluation involved in these tests, the population tested, and the qualitative and quantitative results of these studies. In addition, a short introduction to procedures made before testing, as well as analysis and alterations made afterwards, are given.

6.3.1 Initial Study

In order to ascertain whether or not there was a true foundational basis for this project, qualitative information from literature reviews and interviews was gathered on a variety of levels before any formal testing was implemented[542]. This included information on elearning reforms, apprenticeship education, the pharmacy market, and the learning content of the pharmacy apprentice program in Austria. To design and administer attractive elearning programs used for this study, much information concerning the user population and their learner needs was necessary. Could pharmacy apprentices benefit from an elearning program anyway? Was it needed? Would it fit with their goals and objectives? Many foundational questions such as these required answers before taking any further step in developing. In accordance with Steed[543], such a sense of the end-user is imperative.

6.3.1.1 Initial Study Method

The following initial questionnaire presented below, "Apotheker Fragebogen" was given to pharmacists to determine population sample and learning content for the research study programs. Questionnaires were presented to work-related, as opposed to educational-related institutions to support current and life-long learning efforts for apprentices. Questionnaires were directed toward pharmacy owner/managers. The rationale behind this was to uncover what learning mastery expert pharmacists believed was lacking in their apprentice-employees' dual-system experience. The questionnaire was also implemented to acquire a variety of related information. This was done in order to more effectively design the elearning environment, understand perceptions of owner/managers and their commitment to elearning, and connections with life-long learning. Information included results pertaining to:

- Who is the population that will be using this program?

[542] Section 6.2.2 *Evaluation and Data Collection.*
[543] (2002), section 5.3.1 *Frameworks.*

- What is the learning material they need?
- What are their thoughts on life-long learning?
- What are their thoughts and background with technology, the Internet and elearning?
- What are their thoughts on job training?

Apotheker- Fragebogen

Bezirk: _____ **Name der Apotheke:**_____
Kontaktperson, Manager/Besitzer: _____

Alter der Kontaktperson: unter 30 31-55 über 55

Anzahl der Mitarbeiter: _____ män.: _____ weib.: _____
Anzahl der derzeitigen Lehrlingsangestellten: _____ män.: _____weib.: _____
In welchem Lehrjahr befinden sich die Lehrlinge? 1 2 3
Durchschnittliches Alter der Mitarbeiter: _____

Angeführt sind die Bereiche, welche im Rahmen eines Lehrprogramms behandelt werden. Bitte bewerten Sie jene Bereiche, in denen Ihrer Meinung nach noch mehr oder weniger Informationsbedarf für Ihre Mitarbeiter besteht bzw. eine Herausforderung darstellt:

1: kein zusätzlicher Informationsbedarf notwendig
2: geringer zusätzlicher Informationsbedarf notwendig
3: großer zusätzlicher Informationsbedarf notwendig

Unterpunkte bitte mit „X" kennzeichnen (Mehrfachnennungen möglich)

_____ **Religion**
_____ **Politische Bildung**
_____ **Deutsch Kommunikation**
_____ **Berufsbezogene Fremdsprache**
Welche Fremdsprache? _____
_____ **Wirtschaftskunde im Schriftverkehr**
_____ Wirtschaft
_____ Der Betrieb
_____ Handelsbetrieb
_____ Kaufvertrag
_____ Geld- u. Kreditwesen
_____ Gewerbeordnung u. Apothekengesetz
_____ Der Kaufmann
_____ Unternehmen
_____ Gesundheitswesen
_____ Marketing
_____ Außenhandel
_____ Versicherungen
_____ Personalwesen
_____ Steuern
_____ Schriftverkehr
_____ **Rechnungswesen**
_____ Mengen- u. Preisberechnungen
_____ Durchschnittsrechnung
_____ Personalverrechnung
_____ Verteilungsrechnung
_____ Spar- u. Finanzierungsformen
_____ Controlling
_____ Ergänzende Rechenfertigkeiten
_____ Grundlagen der Buchführung
_____ Nebenaufzeichnungen
_____ Einfache Buchführung
_____ Doppelte Buchführung
_____ **Computerunterstütztes Rechnungswesen**
_____ Funktion u. Bedienung eines Computers
_____ Organisation des Computerunterstützten Rechnungswesens

_____ Praxisbezogene Anwendungen

_____ **Botanik und Pharmakognosie**

_____ Botanik
_____ Morphologie und Physiologie
_____ Pharmakognosie
_____ Monographie
_____ Herbarium und Drogensammlung
_____ Natur- und Umweltschutz
_____ Drogen

_____ **Chemie und Physik**

_____ Chemie
_____ Physik

_____ **Somatologie, Pathologie und Pharmakologie**

_____ Somotologie
_____ Pathologie
_____ Pharmakologie
_____ Pharmakodynamik
_____ Pharmakokinetik
_____ Pharmaka

_____ **Körperpflege- und Krankenpflegewaren**

_____ Haut und Hautanhangsgebilde
_____ Produkte

_____ **Ernährungslehre**

_____ Ernährung
_____ Diätetik
_____ Produkte

_____ **Apothekenkunde**

_____ Apothekenpraxis
_____ Arzneimittel
_____ Rechtliche Bestimmungen
_____ Kalkulation

_____ **Textverarbeitung**

_____ Zehn-Finger-Tastschreiben
_____ Schriftstückgestaltung
_____ Textverarbeitungsprogramme

_____ **Kundenberatung und Werbetechnik**

_____ Werbung
_____ Werbegestaltung
_____ Fertigungstechniken
_____ Warenpräsentation
_____ Kundengespräch
_____ Phasen des Verkaufsgespräches
_____ Besondere Gesprächssituationen

_____ **Laborpraktikum**

_____ Labor
_____ Labortechnische Arbeiten
_____ Identitätsprüfung
_____ Mitwirken an der Magistralanfertigung
_____ Mitwirken an der Serienherstellung

Bitte auch eigene Punkte/ Bereiche (falls gegeben/ erwünscht) anführen?

Sollten sich Mitarbeiter laufend und ständig Weiterbilden? Ja Nein
Besitzt Ihre Apotheke einen Internetzugang? Ja Nein
Haben Sie, oder Ihre Mitarbeiter jemals ein Computerprogramm für Weiterbildungszwecke verwendet? Ja Nein
Wenn ja, welche?:

Können Ihre Mitarbeiter den Internetzugang in Ihrer Apotheke für Weiterbildungszwecke verwenden ? Ja Nein
Können Ihre Mitarbeiter den Computer für Weiterbildungszwecke auch während der Arbeitszeit verwenden? Ja Nein
Wäre es von Vorteil, wenn Sie ein Computerunterstütztes Lernprogramm für Ihre Mitarbeiter hätten? Ja Nein

Haben Sie noch weitere Kommentare im Zusammenhang mit Computer-Lernprogrammen und Apotheken in Österreich?

Kann der Namen der Apotheke in der Doktorarbeit verwendet werden? Ja Nein
Kann Ihr Name in der Doktorarbeit verwendet werden? Ja Nein
Hätten Sie gerne eine Kopie der Ergebnisse? Ja Nein

6.3.1.2 Initial Study Population

Questionnaires were personally presented to 50 pharmacy owner/managers around Vienna from 14 different districts. 30 of the 50 pharmacists agreed to participate in the questionnaire. These questionnaires were implemented face-to-face in order to answer any questions the pharmacists may have, and to collect any relevant comments or suggestions from pharmacists or their apprentices.

6.3.1.3 Initial Study Results

Questionnaires

A full detailed account of all questionnaire results can be found in section 8.1 *Initial Questionnaire Detailed Results*, with summarized interpretations here. The average age of pharmacy owners was between 31 to 55 years old. This data was collected to determine if pharmacy owner/manager age would significantly relate to perceptions pertaining to employee life-long learning, computer skills, or overall elearning perceptions. Result analysis later showed owner age was not a determining factor of other specific opinion trends. 87% of general pharmacy employees were female, between 30 and 40 years of age. Of the 30 responding pharmacists, 11 of those pharmacies currently had apprentices, most female, in their 1st, 2nd and 3rd apprenticeship year. These apprentices were approximately 15-17 years old.

In the pharmacy apprenticeship program, students are expected to master 15 topics before they conclude their dual system program. Pharmacists were asked which of these 15 were the most difficult for their apprentices. They were allowed to choose more than one if applicable. Pharmacists responded that the most difficult mastery area was Kundenberatung und Werbetechnik. Comments pertaining to these challenges included:

"Nicht nur, dass die Lehrlinge nicht mit den Kunden sprechen, sie zeigen auch keinerlei Bemühungen dieses zu tun. Je mehr Kunden in die Apotheke kommen, umso mehr erinnern sie sich, dass noch unfertige Arbeiten im Hinterzimmer auf sie warten."

"Ja, unsere Angestellten sprechen mit den Kunden, aber nur hallo zu sagen ist noch kein Sprechen. Viele unserer Kunden benötigen ein Gespräch jede Woche. Dies ist eine andere Art des Kommunizierens und es benötigt Übung."

"Kundenberatung und Werbetechnik gehen Hand in Hand, aber die meisten unserer Angestellten erkennen dies nicht. Für sie bedeutet Kundenberatung das bloße Grüßen eines Kunden. Unter Werbetechnik verstehen sie das Anbringen eines Posters im Schaufenster."

18 pharmacists agreed this was a priority challenge area for their apprentices. Next most challenging was Berufsbezogene Fremdsprache. The third most challenging area for employees was Ernährungslehre, followed by Botanik und Pharmakognosie, and then Körperpflege- und Krankenpflegewaren.

In addition to the 15 main mastery topics areas, each of these was sub-divided into smaller related issues also prioritized in the pharmacy apprentice program. Challenging learning topics chosen by pharmacists were further detailed by marking specific sub-challenge areas. In the most challenging area of Kundenberatung und Werbetechnik, the following sub-areas were noted in order of priority; Kundengespräch, Warenpräsentation, Werbung, Phasen des Verkaufsgespräches, Besondere Gesprächssituationen, and Werbegestaltung. When asked why, specifically one pharmacist commented,

"Sie sprechen einfach nicht mit den Kunden. Der einzige Kontakt ist vielleicht ein Guten Tag, oder ein Auf Wiedersehen. Nur wenn ich ein Gespräch mit dem Kunden führe, hören sie manchmal zu und nur dann, wenn es Schwierigkeiten oder Probleme gibt, oder es handelt sich um Probleme mit Neuheiten im Versicherungswesen. Dies passiert aber nicht sehr oft. Wenn es um ein Problem geht, will ich nicht, dass sie mit den Kunden reden. Sie sind viel zu jung und wissen nicht was sie sagen sollten."

Pertaining to pharmacist perceptions and ideas, all 30 of respondents agreed that life-long learning should be encouraged throughout the careers of their apprentices and employees. When discussing life-long learning with one pharmacy owner, they commented,

"Ich denke schon. Wir müssen uns auch immer wieder weiterbilden, so dass wir über neue Medizin, oder neue Konzepte und Strategien bescheid wissen. Es wäre also normal, dass auch unsere Lehrlinge sich weiterbilden. Ob sie dies nun gerne tun würden oder nicht ist ein anderes Thema..."

28 of the 30 pharmacies had Internet access, and 15 of the 30 pharmacists said they had used some form of elearning at one time. 23 of the 30 pharmacists agreed all employees could use the pharmacy Internet/computer for job-related learning. 12 of the 30 pharmacists said this job-related learning could be done during work hours. One pharmacist offered they would even discuss paying employees for their elearning time in the pharmacy if the learning content

was significant to their on-the-job performance. 22 of the 30 pharmacists voiced their interest in attaining employee job-related elearning programs in challenge areas.

Pharmacists

In addition, many pharmacists expressed more detailed concerns around Kundengespräche issues and apprentices, and possible reasons it might be a challenge. These comments consisted of reasons stemming from the pharmacist themselves, to reasons they believed stemmed from the apprentices. Many pharmacists simply did not allow their apprentices to speak to customers at all citing for example; apprentice immaturity, lack of education, inexperience, lack of trust and respect from customers, and poor language, negotiation and problem management skills. Other pharmacists that had at times supported their apprentices concerning Kundengespräche issues stated they gave up their efforts soon after. These pharmacists related most apprentices believed they did not need training in speaking with customers, and usually came across to customers as defiant and disrespectful. Two pharmacists gave more positive feedback concerning their apprentices' mastery of Kundengespräche skills, but also expressed a need for further apprenticeship support in this area. These pharmacists believed Kundengespräche success was directly related to apprentice personality type. Generally, the more kind, humble and respectful the apprentice, the more success they had speaking to customers.

Apprentices

In addition, brief one-to-one interviews were also made with four apprentices in order to note differences in opinions compared to the pharmacists. When asked if they agreed with the results from the pharmacist questionnaires, they responded that Fremdsprache was the most challenging area. All five of the apprentices disregarded Kundengespräche as a challenge area. Apprentices expressed that Kundengespräche was not a skill that need to be learned, that they had no problems speaking with customers, and in three cases reiterated that they were not allowed to speak with customers at their pharmacy regardless. As one apprentice conveyed,

"Ich hatte noch nie Probleme mit jemanden zu sprechen. Ich mag es mit Leuten zu sprechen. Sollte jemand unhöflich und böse sein, drehe ich mich um und gehe. Warum sollten wir Kommunikation lernen?"

Educational Institutions

Due to the fact that the pharmacy, the apprentice and also the educational institution work together for the sake of the dual system program, further inquiry was made to uncover the opinions of related schools. Interviews were conducted with Vienna-based pharmacy apprentice institutions such as WIFI and the Berufsschule. Additionally, an email was sent to all 9 Berufsschule in Austria with pharmacy apprentice programs asking:

- Wie alt (ungefähr) sind Ihre Pharma- Studenten/Innen?
- Welche Lehrthemen sind am schwersten für Ihre Pharma- Studenten/Innen?
- Welche Lehrthemen sind am leichtesten für Ihre Pharma- Studenten/Innen?
- Kommuniziert Ihre Berufsschule mit relevanten Firmen (Apotheken)? Wie?
- Wie werden Kundengespräche gelehrt? Welche Unterlagen (Bücher, Skripten, IT, etc.) werden verwendet?
- Was sind die Lehrziele für Kundengespräche?

Results from the returned emails contended that educational institutions had their own ideas of student learning challenges. Students ranged from 15- 20 years old. The most difficult topics for the students were believed to be Botanik, and Chemie. Schools believed the easiest topics for the students were Politische Bildung, Deutsch, Rechnungswesen, Labor, and Kommunikation- zufriedenstellende Beratung, and Verkauf des Produktes. The topic of Kundengespräche was taught through roll-play and worksheets with lists of common communication mistakes. Schools contended they communicated with the pharmacy market through excursions and field trips, visitations from related firms and organizations, free tickets to related Fairs, telephone conversations, emails and fax.

Related Firms

Interviews with a related pharmacy warehouse and delivery firm commonly visited by pharmacy Berufsschule programs were also conducted. As a leader in the Austrian pharmacy market, the chosen firm offers an extensive pharmacy learning program with both traditional and technology based classes. Sessions are available for both pharmacists and employees in learning areas necessary for pharmacy success in today's market. Currently, classes have been developed around computer skills, management, marketing, and communication. Interviews at the firm with two members of the board, the director of the learning program, the sales director, and the marketing director further uncovered the extent of communication made with the Berufsschule.

Despite the fact that this firm has yearly contact with the Berufsschule for field trips, little communication is exchanged in the area of apprentice learning. For the most part, the firm organizes field-trips in order for apprentices to better understand how pharmacy products are made, studied and delivered to pharmacies. Nonetheless, this firm has more direct contact with pharmacists and offers traditional classroom-based courses in areas such as communication skills and effective marketing. Skills such as these have been sought after by pharmacists, but supporting these necessary skills in apprentices and employees have yet to hold high priority. Despite this gap, pharmacists seem to recognize the necessity of proper communication mastery- unlike Berufsschule perceptions. As one board member related,

"Apotheker können sich nicht viel länger auf Rezepte verlassen. Um mithalten zu können müssen sie zusätzliche Produkte verkaufen. Im Zuge der EU- Erweiterung gibt es bereits neue Regelungen und Veränderungen in Österreich. Dies bringt viele Herausforderungen mit sich. Apotheker und speziell ihre Angestellten müssen diesen neuen Ansprüchen mit neuen Marketinginstrumenten gerecht werden. Kundengespräche müssen beraten, argumentieren und vermarkten und sich nicht nur auf „small- talk" beschränken. Spezieller Unterricht, der von unserer Firma angeboten wird, unterstützt diese neuen Bedürfnisse."

Conclusions

These initial results were helpful in the design of an elearning environment for pharmacy apprentices in a variety of ways. Foremost though, these results made clear there was a grave communication gap between apprentice, pharmacy and school learning perceptions and goals. The test elearning programs would cater then to the overall need of apprentices, therefore learning objectives would focus on content in the area of Kundenberatung und Werbetechnik, and specifically on the topic of Kundengespräch. Secondarily, this content would consist of communication skills in a variety of scenarios, as to allow apprentices the greatest exposure to a number of diverse communication scenarios- from marketing, to negotiating, to difficult situations and general knowledge. Programs would also be developed to motivate and interest the apprentice, and to counterbalance their false perception that customer communications was not a necessary skill.

6.3.2 Pilot Test

Before the pilot test was implemented, various professional interviews, brainstorming sessions and notes and sketches were made to support evaluation of the two programs. The following Figure 6f exemplifies such sketch-making efforts, as were completed during two of the brainstorming sessions with a pharmacist. Figure 6g shows a flow diagram blueprint of

the interactive hypermedia program. This diagram was used for various evaluatory measures including user and professional cognitive walkthroughs[544].

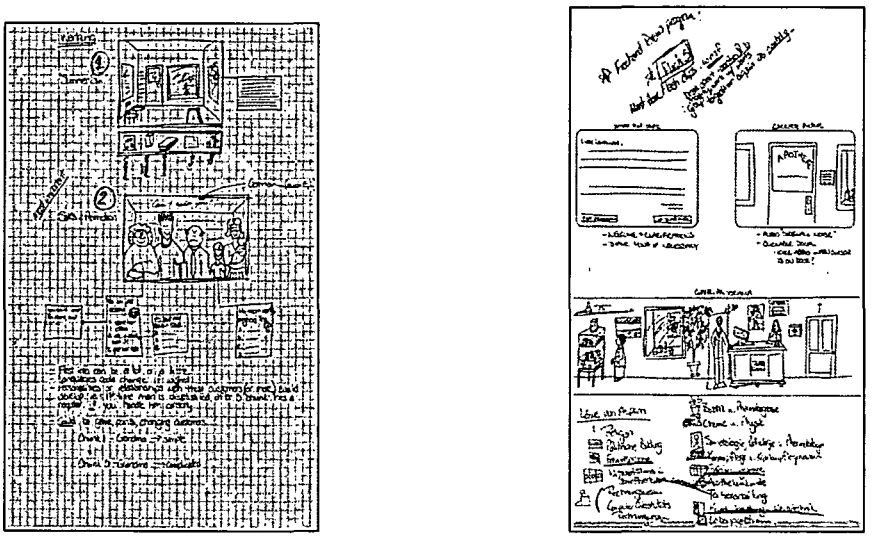


Figure 6f: Brainstorming Sketches

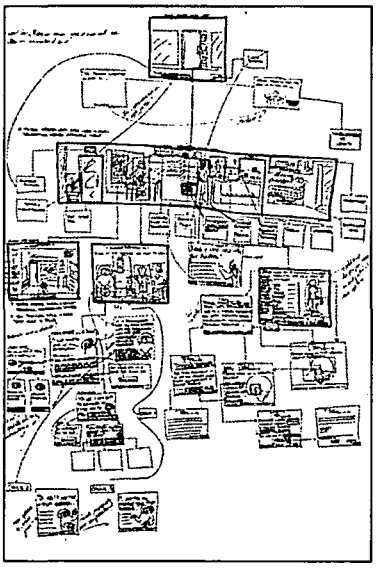


Figure 6g: Blueprint Flow

Audio files were noted above each screen in the program blueprint, blue arrows signified links, and red boxes surrounded clickable buttons, characters and objects. This blueprint flow was discussed with professionals for opinions, quick and dirty observations[545] and cognitive walkthroughs. These professionals included pharmacists, apprentices, professional elearning designers, university professors, and vocational education teachers. Additionally, an expert

[544] Section 5.3 *Evaluation and Data Collection.*
[545] Section 5.3.2.6 *Observations*, and section 5 *Evaluating Elearning.*

concerning the levels of interactivity of the programs, motivation, creativity, usability, visualization, technology and overall perception[548]. These results would be gathered through a Likert scale questionnaire as shown below for both the linear text and hypermedia programs, as well as group and individual discussions. During the study, anecdotal and environmental notes were taken for more accurate qualitative data collection according to Robson[549]. Combined results would be used to realistically determine attraction- including motivation and technical elements, the elearning program had for learners in this population.

Fragebogen Text

män. weib. Lehrjahr_____ Alter____

Bitte umkreise alles was auf Dich zutrifft. Welche Art des Lernens bzw. mit welchen Unterlagen bevorzugst Du zu lernen?

visuell/räumlich	verbal/Sprache	logisch/mathematisch
körperlich/kienästhetisch	Musik/rhythmisch	Interpersonal
Intrapersonal	naturalistisch/lebensnah	spirituell

Bitte umkreise und beurteile nach Schulnotensystem. 1 = sehr gut, 5 = nicht genügend.

<u>Technologie</u>					
Dieses Programm war leicht zu laden und zu starten.	1	2	3	4	5
Ich konnte ohne weitere Unterstützung das Programm bedienen.	1	2	3	4	5
Man navigiert relativ rasch durchs Programm.	1	2	3	4	5
Bei der Verwendung gab es keine technischen Probleme.	1	2	3	4	5
<u>Programmieradapter</u>					
Dies ist ein motivierendes Programm.	1	2	3	4	5
Ich mag den Stil der verwendeten Schrift.	1	2	3	4	5
Mir gefällt wie Text und Graphik organisiert sind.	1	2	3	4	5
Die Graphik hilft den Text besser zu verstehen.	1	2	3	4	5
Die Graphiken gefallen mir.	1	2	3	4	5
Die Größe der Buchstaben ist gut bzw. passend.	1	2	3	4	5
Die Schriftart ist gut bzw. passend.	1	2	3	4	5
Die verwendeten Farben sind angenehm.	1	2	3	4	5
Ich konnte mich leicht durchs Programm navigieren.	1	2	3	4	5
<u>Lehrinhalt</u>					
Mit diesem Programm zu lernen macht Spaß.	1	2	3	4	5
Ich verstehe den Lehrinhalt des Programms.	1	2	3	4	5
Der Lehrinhalt ist motivierend.	1	2	3	4	5
Das zu Lernende ist klar und verständlich.	1	2	3	4	5

[548] Section 6.2 *Hypothesis.*
[549] Preece, et al. (2002), in section 5.3.2.6 *Observations*, and section 5.3.2.7 *Prototypes and Testing.*

interview was conducted with 3 pharmacists who did not participate in the initial questionnaire. Interviews with pharmacy apprentices from the Berufsschule were also implemented, as well as additional silent pharmacy observations around Vienna. The data gathered from these evaluations, interviews and observations solidified specific details for both the linear text and the hypermedia programs concerning realistic and relevant customer communication topics, graphics, interface design, hypermedia metaphor, learning goals, and language.

To ensure that the content for both programs was as identical and relevant to this learner population as possible, two other experts supported content design. One expert was included from the communication coaching field. The other from marketing and sales. The communication coaching expert's involvement ensured that the German used in the two programs would support learning the topic of customer communications as effectively as possible. This expert also ensured that effective German, and specifically new German grammar rules were consistent in both programs. In addition, the communications coach was interviewed to make sure the content used in the test programs could effectively support learners of this particular population age and education level. The marketing expert was consulted due to the strong connection the learning content had with marketing and sales. As Parkin[546] stated, the inclusion of marketing forms a valid basis for soft skill topics such as communications. Before the pilot testing, the program CD was additionally discussed with ten related experts from the pharmacy, university, apprentice and Berufsschule fields.

To implement the pilot study, hypermedia and a linear text elearning prototype[547] programs were constructed on CD-ROM containing all elements previously discussed. Learning activities and materials were built with Macromedia Dreamweaver and Fireworks. The 360° panoramic on iShell, QuickTime Virtual Reality, PT GUI and PanoTools.

6.3.2.1 Pilot Test Method

The goal of the pilot study was to attempt to credibly answer the research question concerning whether or not, and which elearning design and delivery method was most attractive for this population group. Additionally, objectives of the pilot study were to attain information

[546] (2002), section 4.2.3 Soft *Skills and Elearning Content.*
[547] Schön, in Preece, et al. (2002), Rettig (1994), in Preece, et al. (2002), Preece, et al. (2002), in section 5.3.2.7 *Prototypes and Testing.*

concerning the levels of interactivity of the programs, motivation, creativity, usability, visualization, technology and overall perception[548]. These results would be gathered through a Likert scale questionnaire as shown below for both the linear text and hypermedia programs, as well as group and individual discussions. During the study, anecdotal and environmental notes were taken for more accurate qualitative data collection according to Robson[549]. Combined results would be used to realistically determine attraction- including motivation and technical elements, the elearning program had for learners in this population.

Fragebogen Text

män. weib. Lehrjahr_____ Alter____

Bitte umkreise alles was auf Dich zutrifft. Welche Art des Lernens bzw. mit welchen Unterlagen bevorzugst Du zu lernen?

visuell/räumlich	verbal/Sprache	logisch/mathematisch
körperlich/kienästhetisch	Musik/rhythmisch	Interpersonal
Intrapersonal	naturalistisch/lebensnah	spirituell

Bitte umkreise und beurteile nach Schulnotensystem. 1 = sehr gut, 5 = nicht genügend.

<u>Technologie</u>					
Dieses Programm war leicht zu laden und zu starten.	1	2	3	4	5
Ich konnte ohne weitere Unterstützung das Programm bedienen.	1	2	3	4	5
Man navigiert relativ rasch durchs Programm.	1	2	3	4	5
Bei der Verwendung gab es keine technischen Probleme.	1	2	3	4	5
<u>Programmieradapter</u>					
Dies ist ein motivierendes Programm.	1	2	3	4	5
Ich mag den Stil der verwendeten Schrift.	1	2	3	4	5
Mir gefällt wie Text und Graphik organisiert sind.	1	2	3	4	5
Die Graphik hilft den Text besser zu verstehen.	1	2	3	4	5
Die Graphiken gefallen mir.	1	2	3	4	5
Die Größe der Buchstaben ist gut bzw. passend.	1	2	3	4	5
Die Schriftart ist gut bzw. passend.	1	2	3	4	5
Die verwendeten Farben sind angenehm.	1	2	3	4	5
Ich konnte mich leicht durchs Programm navigieren.	1	2	3	4	5
<u>Lehrinhalt</u>					
Mit diesem Programm zu lernen macht Spaß.	1	2	3	4	5
Ich verstehe den Lehrinhalt des Programms.	1	2	3	4	5
Der Lehrinhalt ist motivierend.	1	2	3	4	5
Das zu Lernende ist klar und verständlich.	1	2	3	4	5

[548] Section 6.2 *Hypotheses.*
[549] Preece, et al. (2002), in section 5.3.2.6 *Observations*, and section 5.3.2.7 *Prototypes and Testing.*

Das Gelernte kann ich in der Praxis gut verwenden.	1	2	3	4	5
Ich würde gerne mit Programmen wie diesen lernen.	1	2	3	4	5

Aus diesem Programm habe ich gelernt…

Zusätzliche Kommentare:

Fragebogen Hypermedia

Bitte umkreise und beurteile nach Schulnotensystem. 1 = sehr gut, 5 = nicht genügend.

Technologie

Dieses Programm war leicht zu laden und zu starten.	1	2	3	4	5
Ich konnte ohne weitere Unterstützung das Programm bedienen.	1	2	3	4	5
Man navigiert relativ rasch durchs Programm.	1	2	3	4	5
Bei der Verwendung gab es keine technischen Probleme.	1	2	3	4	5

Programmieradapter

Dies ist ein motivierendes Programm.	1	2	3	4	5
Mir gefällt wie Text und Graphik organisiert sind.	1	2	3	4	5
Die Graphik hilft den Text besser zu verstehen.	1	2	3	4	5
Die Graphiken gefallen mir.	1	2	3	4	5
Die Größe der Buchstaben ist gut bzw. passend.	1	2	3	4	5
Die Schriftart ist gut bzw. passend.	1	2	3	4	5
Die verwendeten Farben sind angenehm.	1	2	3	4	5
Die Geräuscheffekte unterstützen das Programm.	1	2	3	4	5
Das Panorama ist eine gute Navigationshilfe.	1	2	3	4	5
Tasten und links sind leicht zu finden und zu verwenden.	1	2	3	4	5

Lehrinhalt

Mit diesem Programm zu lernen macht Spaß.	1	2	3	4	5
Ich verstehe den Lehrinhalt des Programms.	1	2	3	4	5
Der Lehrinhalt ist motivierend.	1	2	3	4	5
Das zu Lernende ist klar und verständlich.	1	2	3	4	5
Das Gelernte kann ich in der Praxis gut verwenden.	1	2	3	4	5
Ich würde gerne mit Programmen wie diesen lernen.	1	2	3	4	5

Aus diesem Programm habe ich gelernt…

Zusätzliche Kommentare:

The following pilot study plan was used as a guideline for the implementation of the pilot study as well as the final study. After, a diagram of the testing environment from the pilot study was made as shown in Figure 6h: *Pilot Testing Environment.*

Pilot Study Plan

Introduction (to be explained to test users):

- Introduction to me and university project
- This is a study about electronic learning programs for pharmacy apprentices
- Your participation is totally voluntary
- You may stop when you wish
- Take all the time you need

The Study (to be explained to test users):

- You will receive two CD-programs with similar learning content about effective customer communications- one with Oma, the other with a Mann
- Use the first CD, then answer the questionnaire
- Then use the second CD, and answer the second questionnaire
- After, we will have a group discussion

During the Study (to do while test users are involved with test process):

- Sketch study environment
- Note time taken with programs
- Write down Robson's (1993) guidelines: space, actors, activities, objects, acts, events, goals, feelings

Group Discussion (to discuss with test users):

- Wie ist dein Gesamteindruck?
- Was hat dir gut/nicht gut gefallen?
- Wie findest du den Aufbau des Programms?
- Ist irgendetwas verwirrend?
- Wie ist die Navigation durch das Programm?
- Stil? Ist das Programm langweilig?
- Wie gefällt dir die graphische Darstellung? Was gefällt dir besonders?
- Welches Programm würdest du lieber verwenden? Warum?
- Von welchem Programm hast du mehr gelernt? Erklär warum?
- Wie würdest du deine Computerkenntnisse einschätzen? Kennst du dich mit elearning aus?
- Würdest du eines der beiden Programme gerne in deiner Ausbildung verwenden? Warum?

For the pilot study implementation, two apprentices were first assigned to the hypermedia elearning program, and the other two were assigned first to the linear text elearning program. Computers were set up with two learners using the same condition program facing away from the other two users back to back. Once users were finished with their first program, they were asked to fill out the relevant Likert Questionnaire, which can be found in section 6.3.2.1 *Pilot Test Method*. After, they worked through the remaining program, and when finished completed the relevant questionnaire.

6.3.2.2 Pilot Test Population

The pilot study was implemented at a Vienna area firm associated with pharmacy employees. At this firm, many technology-based and traditional work-related seminars take place. For this reason, this firm created a comfortable and familiar testing setting for the pilot study, as recommended by Reeves[550]. Four Vienna-area pharmacy apprentices participated on a voluntary basis[551]. The study was implemented after work hours. This ensured a stable, comfortable environment for the study with only minor outside distractions.

The four apprentices were women in their 3rd year of apprenticeship, within the average apprentice age group. Three of these participants claimed to be visual/special learners, one was also verbal/linguistic, and one logical/mathematical. Three of the study participants confessed their pharmacists did little to support their customer communication skills, and were usually diverted from speaking to customers on a professional level. The other participant revealed she felt her pharmacist welcomed her communication with customers, but also did not receive further instruction on building these skills.

6.3.2.3 Pilot Test Results

The following diagram of notes and testing environment sketch was made during the pilot testing, as discussed above in section 6.3.2.1 *Pilot Test Method.*

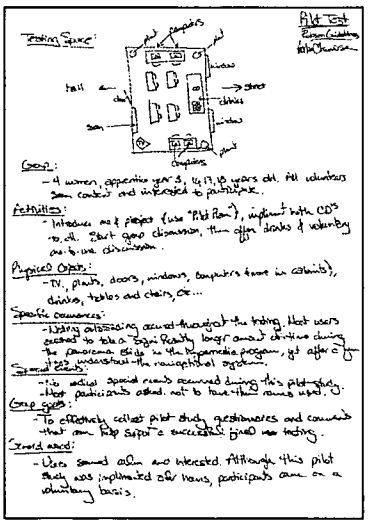


Figure 6e: Pilot Testing Environment

[550] (1993).

[551] Dumas & Redish (1999), in Preece, et al. (2002), in section 5.3.2.7 *Prototypes and Testing.*

Following this pilot study plan, of the four users, two briefly glanced away from the computer screen during the entire approximately 45 minute task process. Although it was not asked for before-hand, no one spoke to another. There were no noticeable signs of frustration or confusion (frowning, verbal distress, etc.) from the facial expressions of the users. Most users looked engaged and relatively wide-eyed when navigating through the virtual pharmacy. One user with a hypermedia program chuckled during navigation through the "Mann" scenario. Overall users with a linear text program took a bit more time than users in the linear text program. When reading through the linear text program, all four users expressed body language signifying thinking. These signs were; chin in hand, hand through hair, readjusting glasses and leaning back in chairs. Also during the "Oma" scenario navigation in the hypermedia program, all four users expressed more significant facial expressions such as grinning, glancing at other users, chuckling, and head nodding. These actions were not noted before this part of the elearning environment.

Full detailed results from the pilot study Likert scale questionnaire can be viewed in section 8.2 *Pilot Study Questionnaire Detailed Results*. A summary of the most significant factors of those results are presented here. Generally, most answers (71%) resulted in a "1", or "sehr gut" for both programs. There were no differences in the ratings of those who received one program first to the other. Ratings for the linear text program were slightly more positive than for hypermedia.

Main areas of less than "sehr gut" results surfaced in both the hypermedia and the linear text program questionnaires. Statements that received less than a "1" were generally those pertaining to motivation, graphics and content transferability for both programs. In both the hypermedia and linear text programs, users claimed a "2" that the program was motivating, fun to learn with, the content was motivating, that the content could be transferred on-the-job, and graphics were enjoyable. Specifically in the linear text questionnaire, lower results were noted for the statements:

- Die Große der Buchstaben ist gut bzw. passend.
- Mit diesem Programm zu lernen macht Spaß.
- Das Gelernte kann ich in der Praxis gut verwenden.

Specifically in the hypermedia questionnaire, lower results were noted for the statements:

- Bei der Verwendung gab es keine technischen Problemen.
- Die Graphik hilft den Text besser zu verstehen.
- Das Panorama ist eine gute Navigationshilfe.
- Der Lehrinhalt ist motivierend.

Group and individual discussions provided a clearer understanding of the reasons behind such results. Generally, test users had good impressions of the two programs. They did relate that because most learning text in the classroom is text-based, the linear program was easier to navigate, and took less time to use than the hypermedia program. Nevertheless, the hypermedia program was more interesting. They offered that it would be much easier to navigate through the hypermedia program once they were familiar with it, or could be introduced to how the program is organized beforehand. In particular, although they gave positive reactions to the 360° virtual pharmacy, they were not fully familiar with the 15 topic areas of their dual-program. Thus, they found it at first difficult to realize the Oma customer represented Kundegespräche lessons. This contributed then to lower results for the statement, "Das Panorama ist eine gute Navigationshilfe."

The test group suggested that the Oma graphic was better than the Mann graphic- perhaps due to the fact that she seemed "friendlier". They agreed that presenting the linear text in a larger letter size of the same font would be beneficial. They also pointed out that the capsule medicine buttons were not easily recognized as medicine capsules, but that these elements did not distract from the hypermedia program. They said environment colors, layout, and font were good to work with. Users also suggested the virtual pharmacy panorama should be a full screen panorama without text, as that would support the effect of being "inside" a virtual pharmacy. They did not feel as if they needed the text directions given on this screen.

Users claimed they would enjoy working with the hypermedia as well as the linear text program in combination in the future. They suggested the hypermedia program would be better to work with at home for extra practice. The linear text program would better support studying customer communications for a test, as the content was presented in a more straightforward manner. As one apprentice perceived,

"Im Text Programm muss man nicht nachdenken. Es ist geschrieben. Im Hypermedia Programm muss man nachdenken was man lernt, aber es ist für Rollenspiele in der Schule besser geeignet."

Despite this, all pilot test participants agreed they really did not need more practice in such a learning topic anyway, and that their skills in Kundegespräche were quite good. This comment proved similar to those given in the initial survey and interviews with apprentices and pharmacists. Users suggested they would rather have the fully expanded elearning program in areas of botany or pathology- two topics they felt they were weak in.

Given the suggestions and discussion from the pilot study, various minor alterations were made to ensure the reliable impact of the final user-testing experiment. These included:

- Increasing the letter size of the linear text program to14 font
- Explaining beforehand that Oma in the panorama represents Kundegespräche lessons
- Decreasing the size of the hypermedia banners
- Including a pharmacists graphic for feedback screens in the hypermedia program

6.3.3 Final User Testing

The final user testing programs were altered given the suggestions from the pilot study test results.

6.3.3.1 Final User Testing Method

For the final user testing, the same method of evaluation was conducted as in the pilot test. This consisted of the same two questionnaires- one linear text and one hypermedia, as presented in section 6.3.2.1 *Pilot Test Method.* In addition, a group discussion was lead using the pilot study plan discussion questions also noted in the same section, and also an open table discussion with apprentices.

6.3.3.2 Final User Testing Population

Due to the lack of a substantial group of apprentices in one given environment, the final testing was broken into three test groups consisting of 12 apprentices each. One group of 12 was traditional apprentice students at the Berufsschule Wien in the pharmacy program, and

was tested at the school in their normal educational setting. They consisted of all female, third year apprentices between the ages of 17-20. The second separated group of 12 consisted of apprentices in their work-place pharmacies. One male, and 11 female apprentices in their first and second year were tested. They were on average between the ages of 15-17, with one less traditional apprentice at the age of 32. Testing was done at pharmacy computers apprentices normally used for day to day tasks, as well as on-the-job learning, as directed by the pharmacist. The third test group of 12 consisted of pharmacy apprenticeship learners at the WIFI, Wien. Two of these learners were male, 10 female. Ages ranged from 15-24 years, in the first and second year of their programs. These students were tested in their normal computer room, which they used as part of their study on a regular basis.

6.3.3.3 Final User Testing Results

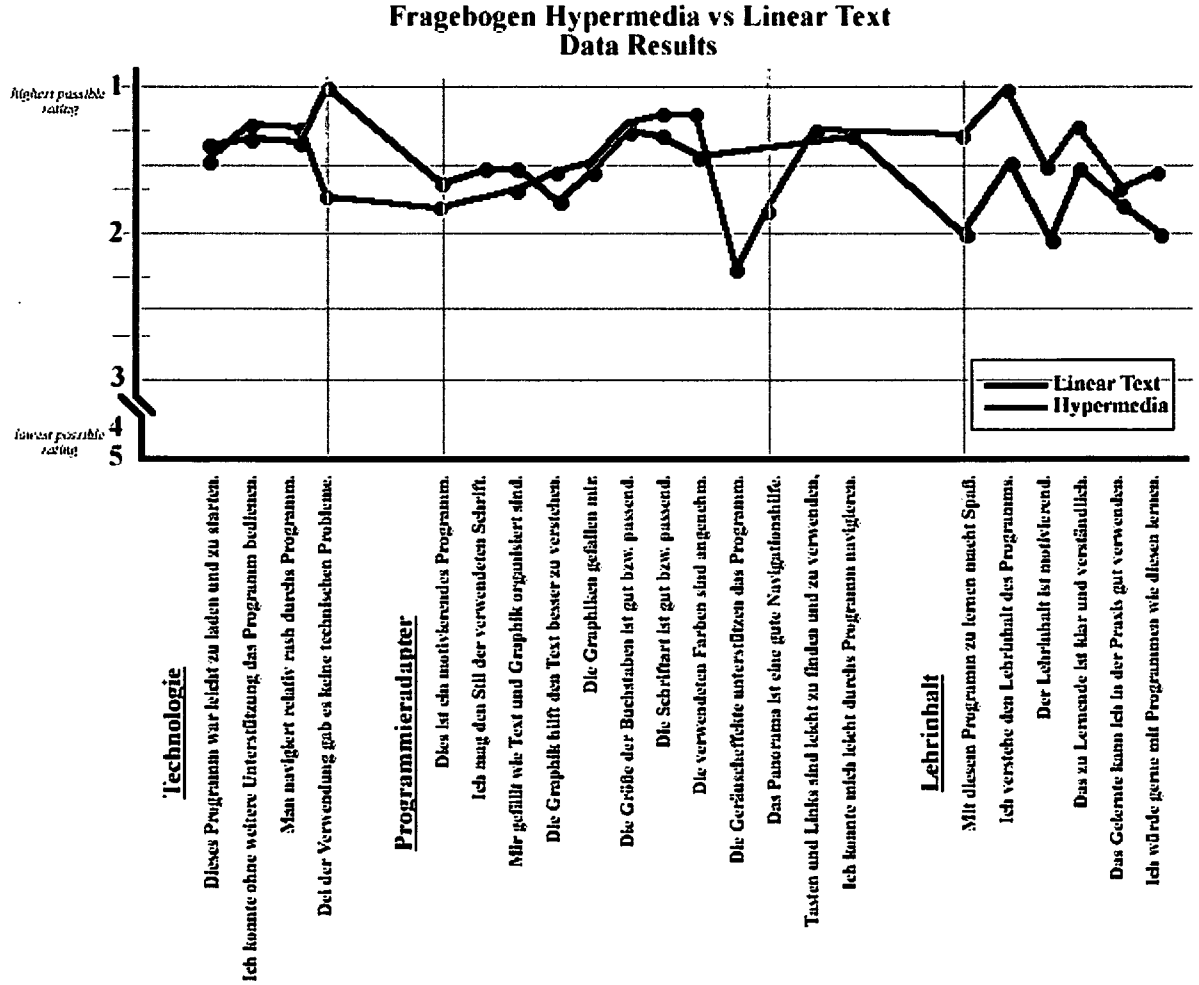


Figure 6i: Fragebogen Hypermedia vs Linear Text Data Results- Average.

Questionnaire and discussion results from the three test groups in the final study proved the overall hypothesis true. An attractive elearning program for pharmacy apprentices may be credibly determined through user evaluation of technology, program design and learning content. Similar to the pilot study test results, ratings in all questionnaire areas (technology, program design and learning content) were generally positive for both programs. Again, no differences were found between those that received the hypermedia program first, or those who received the linear text program first. Neither were any significant differences found according to user age, apprenticeship year, learner type, or gender.

A full detailed account of all linear text and hypermedia questionnaire results for the three test groups can be found in section 8.3 *Final User Testing Questionnaire Detailed Results-Average*. A general graph overview of the linear text program compared to the hypermedia program ratings is presented above in Figure 6i: *Fragebogen Hypermedia vs Linear Text Data Results*. In conjunction with the research hypothesis presented in section 6.2 *Hypothesis*, various statements can be made concerning this results graph. First, as suggested in the technical hypothesis, there is not a significant direct relationship between user perceptions concerning technical factors and overall perceptions of attractive elearning programs. This is exemplified by the technology ratings given to the hypermedia program and linear text program. While general user perceptions for linear text technology factors were greater, overall, the hypermedia program was rated more strongly. It can be assumed then that additional factors of hypermedia programs can counteract weaker perceptions of technology ease, navigation, secondary assistance and problems.

This data shows that, as stated in Program Design Hypothesis 1, an attractive elearning program for pharmacy apprentices is directly related to program design in relation to text, color, multimedia agents, graphics and organization. As the comparison graph shows, stronger ratings in the area of hypermedia program design were directly related to overall attractiveness of the hypermedia program. Program Design Hypothesis 2 suggests that user motivation may be directly related to elearning program design. Data gathered in this study shows that this is not true. Despite the fact that the hypermedia received more positive ratings overall, motivation level perceptions in the area of program design were greater with the linear text program.

As offered in Learning Content Hypothesis 1, this data shows user motivation in the hypermedia program is related to clarity and understanding of learning content. Motivation is established in the questionnaires through data results gathered specifically from the following statements:

- Dies ist ein motivierendes Programm.
- Mit diesem Programm zu lernen macht Spaß.
- Der Lehrinhalt ist motivierend.
- Ich würde gerne mit Programmen wie diesen lernen.

The lower ratings for content clarity and understanding from the linear text program are likewise directly related to lower ratings for motivation. Significant here is also the fact that the rating for content clarity and understanding is almost exactly directly related to ratings for fun in both programs. Similarly, as stated in Learning Content Hypothesis 2, there is a relationship between user perceptions of motivation and elearning content transferability of content on the job. A stronger rating for motivation with the hypermedia program reflected a stronger rating than the linear text program in content transferability. Lastly, these perceptions of content transferability are also directly reflective of overall affinity to elearning programs, as offered in Learning Content Hypothesis 3. Overall perceptions suggested an affinity toward the hypermedia program, and likewise a higher perception on transferability of that content.

Specifically, the least most positive ratings were again given in the areas of motivational program design for the hypermedia program, learning content motivation and fun for the linear text program, and content transferability for the linear text program. Specifically in the hypermedia program, the panorama and street sound effects (in conjunction with the initial pharmacy door) had significantly reduced ratings. In the area of technology, the highest ratings were given in respect to a lack of technological problems for the linear text program. A drop in these technical ratings for the hypermedia program stemmed from the lack of sound files on the WIFI and Apotheke computers, thus blocking the street sounds from being heard. In the area of program design, highest ratings included those for text, font, colors, links and buttons, and speed and ease of navigation through the programs. In the area of learning content, higher ratings were given for the hypermedia program in the areas of understanding learning content presented, and clarity of learning content. Overall then, the hypermedia

program was a more effectively designed and delivered elearning method for Austrian pharmacy apprentices. From the collected data, the hypermedia program would be most successful in a blended learning context, with the option to also use the linear text program depending on learner need.

Comparing data results between the three separate test groups though, provided more specific facts. Below in Figure 6j: *Fragebogen Hypermedia-Test Group Comparison Data Results-Average* and Figure 6k: *Fragebogen Linear Text-Test Group Comparison Data Results-Average* is the graphical comparisons of hypermedia and linear text programs for all three populations. Here, it becomes clear that the three test groups rated the programs significantly different in some areas.

Hypermedia Environment Comparison

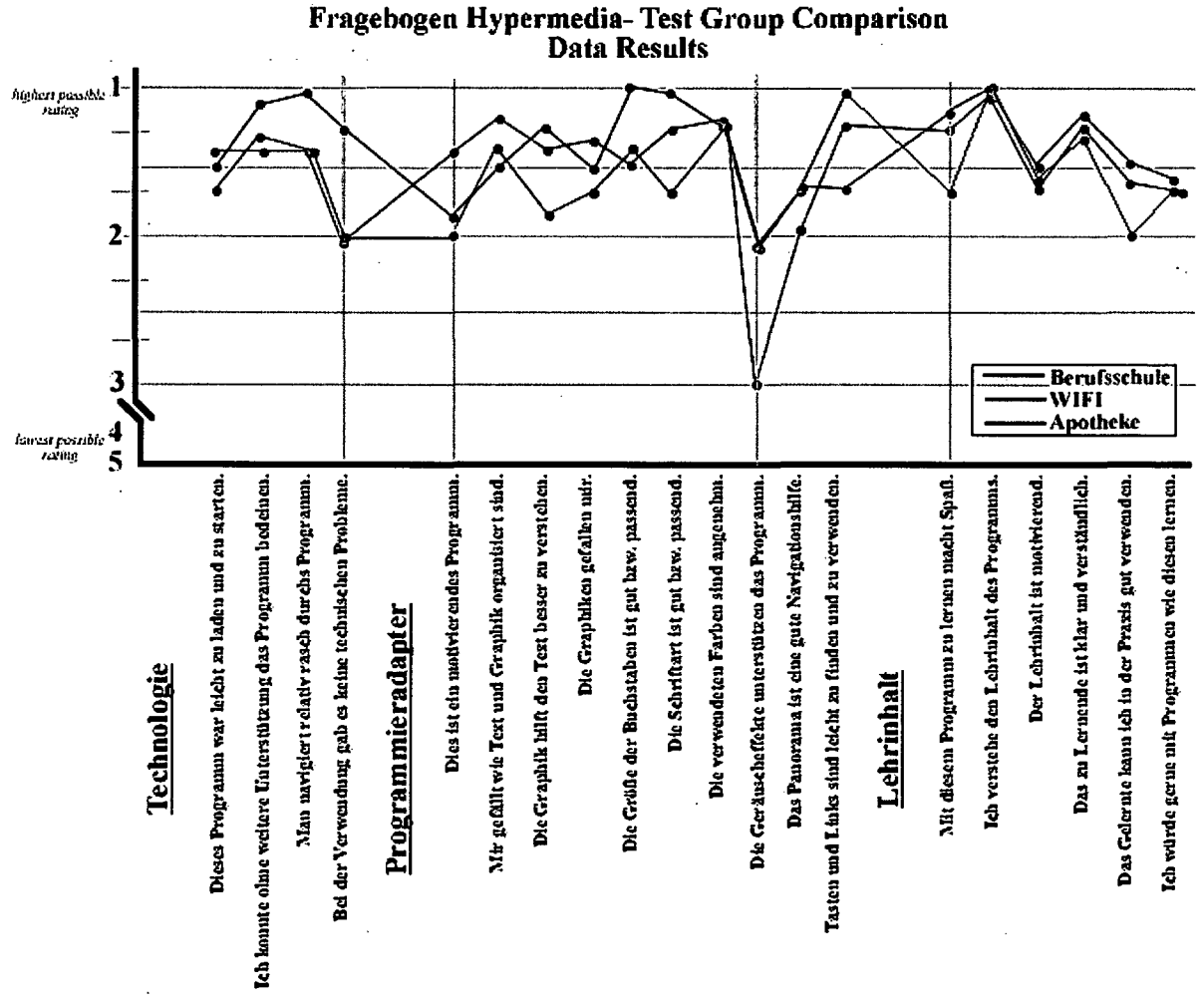


Figure 6j: Fragebogen Hypermedia-Test Group Comparison Data Results- Average

For the hypermedia program, comparison results between the Berufsschule, WIFI and Apotheke test groups were generally similar. The Berufsschule group gave highest ratings of all three groups in the area of technology. Specifically, these included working through the program without assistance, speed of navigation, and program functionality. A lower score for ease of program initiation was attributed to a user apprehension to interact with the first "pharmacy door" screen in order to begin moving through the program. In the area of program design, highest ratings of the three groups were attained in the areas of graphics supporting text, size of letters, and location and use of buttons and links. Lower ratings were given for motivation of program design, and support of street sound effects, specifically. In the areas of understanding and clarity of learning content ratings for the Berufsschule were particularly high. Again, ratings pertaining to fun and motivation were lacking, as well as transferability of content to work. Discussion provided more insight to the lack of program design motivation levels. Students commented that because they believed they already mastered the topic of customer communications, any program, regardless of delivery or design method, was less than motivating. Students were not able to offer an alternative method of learning customer communications- traditional or technology based, that would be more motivating. Due to the fact that the content was not motivating, it was also not particularly fun.

For the WIFI test group, ratings that exceed those of the Berufsschule and Apotheke group surfaced as well. In the area of technology, ease of program initiation provided positive ratings. Technical problems arose when the majority of the computers did not have programs supporting the street sounds audio file for the "pharmacy door". In program design, apprentices noted motivation, organization of text and graphics, positive reactions to those graphics, color, and use of the panorama for navigation strongly. In learning content, level of fun and motivation, understanding and clarity of content, transferability to work, and interest in such programs in the future were rated more positively than the other two test groups.

Ratings from the Apotheke group were generally lower than those from the other two test groups. In the area of technology, ease of program initiation and technical problems were rated poorly. This may have been due in part to age of computer systems used in some pharmacies, as well as a lack of street sounds audio file. For program design, color and placement and ease of use of buttons and links were rated the highest. Motivation, graphics supporting text, use of panorama as a navigation tool and specifically sound effects were rated

nominally. The rating in sound effects can be directly related to the low technology score. Discussions uncovered that the Apotheke test group also disregarded customer communications as a deficit area, which affected their motivation level in the program as well as the content. They did contend however, that the hypermedia program was fun to learn with, and content in other apprenticeship mastery areas such as chemistry would be much more motivating.

Linear Text Environment Comparison

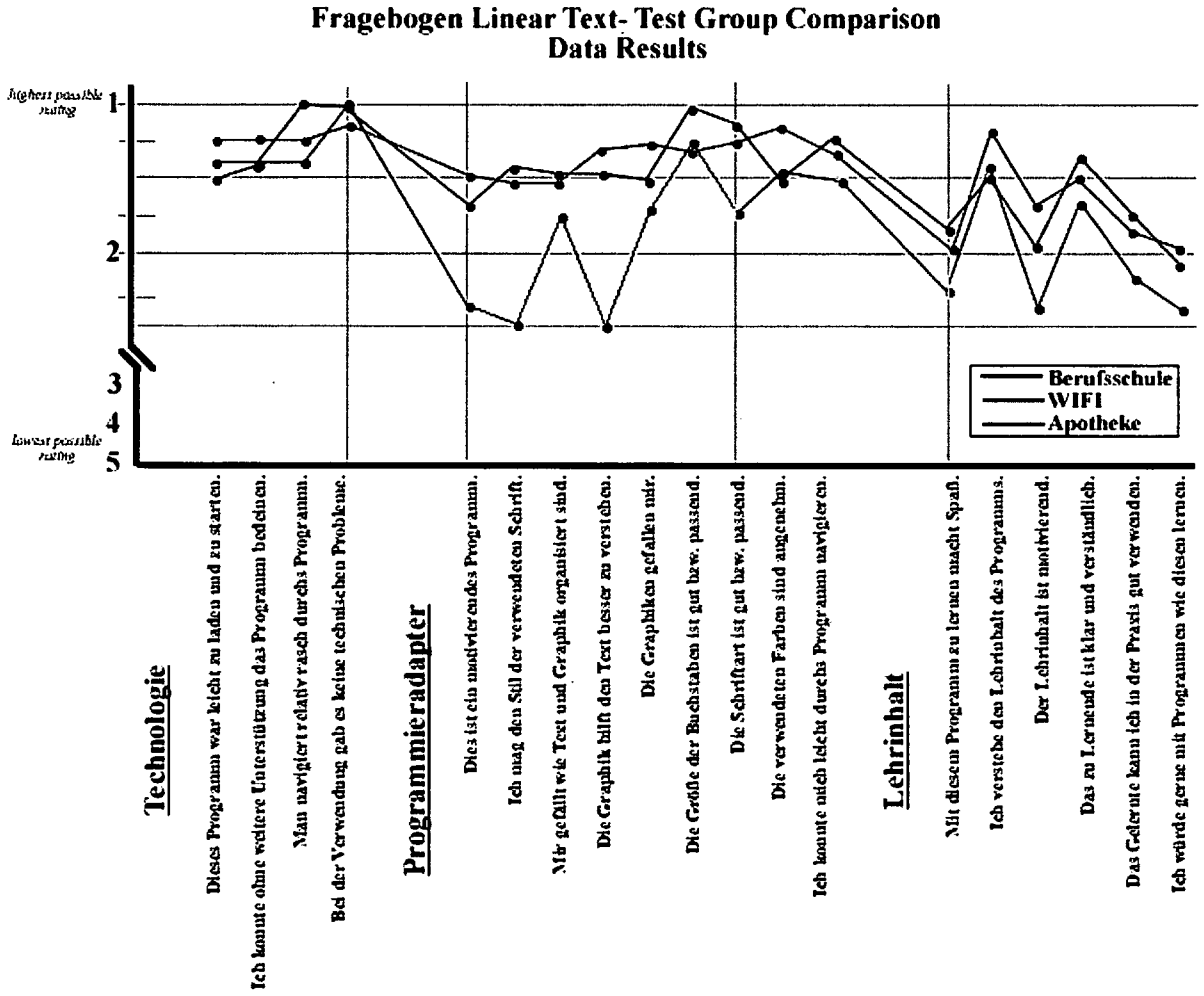


Figure 6k: Fragebogen Linear Text-Test Group Comparison Data Results- Average

In the linear text program, the Berufsschule group gave the highest ratings for technical functionality and technological speed of navigation. This may be supported by the fact that students in the school environment are used to learning with linear text-based materials, as opposed to more open discussion or elearning by WIFI, or face-to-face training as in the

Apotheke. Linear text then, is a normal part of their education. They also gave the lowest ratings for ease of initiating the program. Reasons for this are unclear, as none tested proposed to comment on this score during the open discussion. In program design, the Berufsschule group gave the highest ratings for style of text, organization of text and graphics, size of letters, font and ease of navigation. From all of the three groups, they gave the lowest ratings for color, stating afterwards that they would like the opportunity to change the background colors and colors of the characters clothing at will. This group also gave on average the most positive ratings for learning content. Specifically, their opinions on how fun the program was, how understandable the content was, and its transferability to the work-place were higher than WIFI or the Apotheke group. This may be supported by the fact that experiencing traditional text-based materials through a less used medium such as elearning supported motivation. Due to the fact that Berufsschule instructors also speak openly and consistently with their students about the importance of communicating with customers, content transferability perceptions were heightened.

The WIFI test group gave the most positive technology ratings on average. Specifically, ease of initiating the program was cited, as one apprentice commented, "Man kann nichts falsch machen. Einfach CD einlegen!" This is supported by the fact that WIFI students have considerable access to additional elearning technology programs, and generally have up-to-date systems on hand. This population group also gave the highest average ratings for program design. Positive scores were in the areas of colors, graphics, graphics supporting text learning content, ease of navigation, and interest in using such elearning programs. This can likewise be supported by the fact that these students are comfortable with elearning systems on a daily basis. In the area of learning content, WIFI students rated understanding the learning content and learning content motivation higher than the other two test groups. These students additionally gave high ratings to possibilities to further use such learning programs, as well, inquiring into when a more expanded program would be ready for their use.

The Apotheke group gave perhaps the most significant ratings. Ratings in all three areas of technology, program design and learning content only once exceed those of the other two test groups, and those in the area of ease of program initiation. Nevertheless, highest ratings for Apotheke apprentices were noted in technology functionality, size of letters, colors, and ease of navigation. In the area of learning content, highest ratings were given for understanding of content and clarity of content. Significantly negative ratings for the linear text program

prevailed for this test group. Motivation level of learning content was perceived as very low. This, in addition to the font style and the support of graphics to text were also rated nominally. Likewise, learning content motivation and fun was also rated poorly, as well as transferability of content to the work-place.

Reasons surrounding these ratings surfaced during the discussion session. Many apprentices in the Apotheke group contended that pharmacists diverted their attention from customers to work "behind the wall" (at the back of the pharmacy). This thus left practice and mastery of customer communication skills moot, and motivation to learn such skills low. These findings reflected those collected throughout the study phases. The significance of the Apotheke learner environment to motivation and program perceptions through these results is strong. Compared to the motivation levels of the test groups at the Berufsschule and WIFI environments, the Apotheke was not the most supporting environment for linear text based elearning.

6.3.3.4 Final Observations and Discussion Groups

For the three final testing groups at the Berufsschule, WIFI and at the pharmacies, observations were taken during the testing. In addition, discussion groups were formed after testing to further increase result analysis and credibility in this study. Most of the results from observations and discussion groups supported data gathered from the questionnaires for all three groups. Some information was perceived as insignificant, but noteworthy, and thus also included as factors in the final data analysis. This section uncovers observational and discussion group data from the three test groups, and presents those results in a comparative fashion between the three groups. The comparison is constructed around Robson's observation guidelines[552]. These include: testing space, actors, activities, objects, acts, events, goals and feelings. These results are then supported by discussion group comments and opinions from test group members.

Observations of the three test groups were conducted similarly to observations done for the pilot test[553]. This included answering questions concerning testing space, test user group members, activities taking place, physical objects in the room, specific acts, special events, goals of the test users, and the general mood of the test users[554]. Specific results of the

[552] (1993), in section 5.3.2.6 *Observations.*
[553] Section 6.3.2.1 *Pilot Test Method.*
[554] Section 5.3.2.6 *Observations.*

comparison between the three groups are presented below in Figure 6m: *Final Observation Comparison.*

Figure 6m: Final Observation Comparison

	Apotheke	WIFI	Berufsschule
space	• Back room • Familiar computer • Well lit • General distractions (other colleagues, customer noise, etc.)	• Familiar computer room • Each has own computer • Well lit • No distractions • Desk and chalkboard at front of room	• Familiar computer room • Each has own computer • Well lit • No distractions • Desk and chalkboard at front of room
actors	• 12 pharmacy apprentices in their first and second year • 1 male, 11 females	• 12 pharmacy apprentices in their first and second year • 2 male, 10 female	• 12 pharmacy apprentices in their third year • 12 female
activities	• User testing of hypermedia and linear text programs • Questionnaire and discussion group implementation	• User testing of hypermedia and linear text programs • Questionnaire and discussion group implementation	• User testing of hypermedia and linear text programs • Questionnaire and discussion group implementation
objects	• Desk, chair, desk materials (paper, pens, etc.) • Computer • Pharmacy notes, books • Posters, plants, decorations • Pharmacy equipment (scales, measuring instruments, etc.)	• Desks, chairs for each student • Front desk, chair, desk materials (paper, pens, etc.) • 16 computers, 1 printer • Plant by windows • Pull-down screen • Blackboard	• Desks, chairs for each student • Front desk, chair, desk materials (paper, pens, etc.) • 20 computers, 1 printer, 1 scanner • Plant by windows • Pull-down screen, TV • Blackboard, cabinets
acts/events	• Full concentration from test users during introduction from researcher • Noteworthy seat posture throughout testing • Briefly glancing away from screen • 12 out of 12 test user participation in discussion	• Full concentration from test users during introduction from researcher • No looking away from screens during testing • No smiling or commenting during testing • Not distracted by loud students briefly going by in hallway • 8 out of 12 test user participation in discussion	• Full concentration from test users during introduction from researcher • Reclining in chairs throughout testing • Drinking and eating during testing • Making short, out-loud comments during testing • Smiling and giggling • Repeatedly glancing away from screens during testing • 11 out of 12 test user participation in discussion
goals	• Introduction to testing (from researcher) • Test users try each program, answer respective questionnaire • Discussion group	• Introduction to testing (from researcher • Test group divided in half- one receives linear text first, the other hypermedia • Test users try each program, answer respective questionnaire • Discussion group	• Introduction to testing (from researcher • Test group divided in half- one receives linear text first, the other hypermedia • Test users try each program, answer respective questionnaire • Discussion group
feelings	• Professional, formal	• Concentrated	• Informal atmosphere

	• Listening, polite, making consorted effort during testing • Through, careful writing on questionnaires • General, abstract comments during discussion	• Quiet • Thought-through comments and questions during discussion group	• Positive attitude • Open about feelings toward programs • Open to discuss pros and cons of program implementation

The final testing space for the Apotheke group differed from the testing space for the WIFI and Berufsschule groups. This was due to the fact that each pharmacy apprentice in the Apotheke group was tested at the pharmacy at which they worked. Despite the individuality of each pharmacy, generally testing spaces seemed similar. All computers in the pharmacies were located at the back of the pharmacy, usually in a separate room. These areas were well lit with lights and windows, and generally quiet except for minor sounds from working colleagues and customers. In all Apotheke testing scenarios, no direct contact was made from other colleagues to the test user during testing. Overall then, all Apotheke testing spaces were generally the same.

In all three cases, actors (test users) in these testing groups consisted of pharmacy apprentices in one of the three years of their dual-system apprenticeship. These actors reflected the general population ratio of males to females in the program (more females overall), and also the amount of those apprentices in particular years of study (at the time of this study, most apprentices were determined to be in their first or second apprenticeship year). The Berufsschule group consisted of no male actors, and the Apotheke group and WIFI group had only first and second year apprentices. Despite this, no significant correlation was found between these factors of gender or apprentice year and final test result analysis.

Similar to the testing space observations, objects in the Apotheke testing areas depended to a great degree on the individuality of the pharmacy. Many pharmacies had different styles of general organization, furniture, decoration, plants, and wall colors. This is in comparison to the generally similar objects found in both the WIFI and the Berufsschule testing environments. Despite the individuality of each Apotheke, data results offered no significant relation between objects found in Apotheke testing environments compared to those found in the WIFI or the Berufsschule environments.

Acts and events during the final user testing varied between the three groups. These acts and events seemed to correlate directly with the general feelings and overall mood observed for these three groups, also as noted in Figure 6m: *Final Observation Comparison.* Overall, all

three groups signified levels of full concentration when presented with directions for the testing process. This was noted in the test user's eyes on the researcher, questions of understanding and clarity presented ("Habe ich das richtig verstanden... sollen wir den Fragebogen ausfüllen, bevor wir mit dem zweiten Programm anfangen?"), nods of understanding, and ensuring pencils/pens were ready before beginning the testing process.

The Apotheke test group generally expressed a feeling of quiet, polite, professionalism. They generally sat up straight in their seats, had quiet hands and feet during the testing process, made few if any glances away from the computer screen, and hardly smiled, giggled, or made facial expressions that would convey confusion or excitement. Such attitudes and actions during the testing process reflect the environment. Due to the fact that testing was implemented at the place of work, a generally more formal and professional attitude may be expected. Likewise, test users in this group usually took time to carefully fill out each questionnaire, and had short or general comments during the discussion groups. These comments included, "Ja, gut.", "Ich finde es nett.", "Die Kunden waren spitze!", "Haben sie für Botany auch ein Programm?", and "Nein, ich finde das Programm gut. In der Praxis würde ich das Lineartext Programm verwenden, und das Hypermedia Programm für zu Hause. Ich habe mehr Zeit zu Hause."

The WIFI group also presented a quiet, concentrated atmosphere during testing. Generally, members of this group were highly concentrated on the programs, and despite loud students going by in the hallway, did not glance up from their computer screens. Despite the fact that only 8 test users in this group participated in the discussion afterwards, comments were specific and seemed to reflect genuine opinions towards the programs. Comments included:

"Ich würde ein Programm wie dieses verwenden, aber es wäre gut, wenn man die Farbe der Kleider der Kunden verändern könnte. Außerdem würde ich manchmal die Buchstaben ändern. Die schauen immer gleich aus. Die Buchstaben für Oma könnten hübscher sein. Die Buchstaben für den Mann sollten gleich bleiben."

"Wird das Programm mit der Apotheke, in der wir uns befinden, verbunden werden? Könnte ich es meinen Kolleginnen emailen?."

"Können wir nicht reinschreiben, was wir zum Kunden sagen würden? Ich würde auch gerne etwas sagen und sehen was sie dazu sagen. Sie wissen schon, eintippen."

These observations may reflect the fact that WIFI has a history of using various elearning programs in many areas of study. Such methods of learning are then not only familiar to students, but also provide an alternative way to learn necessary material. Due to the fact that

WIFI itself is an alternative education institution for apprentices, testing elearning programs such as those for this research study may reflect the significance they may have in the future for this population, thus increased concentration and detailed commentary.

The Berufsschule test group presented a comparatively informal atmosphere overall. Test users generally reclined in their seats during testing, a few ate snacks or drank soda, many made appropriate, yet out-loud comments such as "Oh, schau!", "Wie süß!", and "Warum können wir nicht auf den großen Mann hier klicken?", in addition to giggling and laughing. Test users also glanced repeatedly around the room or away from the computer screen during testing, but then immediately returned to their own screens. This test group was also open concerning their thoughts and opinions about the programs, with 11 individuals offering contributions to the discussion group. These discussions became open forums around particular comments and included:

"Ich mag das Programm, aber wir können das in der Apotheke sicher nicht verwenden. Die Apotheker würde mich niemals etwas verkaufen lassen. Sie bräuchten ein Programm für Apotheker und für uns!"

"Wie und warum sollten wir das verwenden, wenn wir keine Probleme mit der Arbeit haben?"

"Die Oma ist die Beste, - gibt es mehrere Leute zur Auswahl? Was ist mit dem Apotheker? Wir müssen mit ihm jeden Tag reden, und dabei haben wir Probleme."

"Nein, den Lineartext würde ich nur für einen Test verwenden. Dann könnte ich einfach nur lesen. Wenn es mehr Konversationen mit den Kunden geben würde, würde ich das Hypermedia Programm hier in der Schule verwenden. Wir können den Computerraum verwenden."

"Haben sie das den Apothekern gezeigt? Was haben die dazu gesagt? Werden wir das hier oder in der Apotheke verwenden? Ich würde es gerne hier, in der Schule verwenden."

"Die Kunden sind cool und die Oma ist super. Ich denke man kann damit leicht lernen. Ich weiß aber nicht, ob wir das in der Arbeit verwenden dürfen. Ich denke es ist aber jedenfalls gut zum Üben. Wir können es hier in der Schule üben. Manchmal machen wir Rollenspiele. Wir können am Computer üben und danach mit einem Rollenspiel in der Schule üben."

The observed general mood of this test group and their actions may be reflective of their apprenticeship year. As the only test group in their third year, apprentices at this level generally have a more thorough impression of their learner needs and goals, and their possibilities on the job at the pharmacy. This means these test users may understand and feel more comfortable about expressing specific opinions and thoughts significant to them. In addition, the Berufsschule provides a familiar and safe learning environment throughout their

three year apprenticeship program. This supports an informal atmosphere that caters to the expression of both positive and constructive opinions without a fear of being "formally polite". Thus, comments from the Berufsschule test group provided feedback that was open, detailed, supported by test user feelings and experiences, and followed by questions and concerns relative to their learner goals and life-long learning possibilities.

7 Conclusive Remarks

This research dissertation has covered various themes and important topics dealing with the design and delivery of elearning programs for apprentices. Designing elearning programs that support soft skill themes such as customer communications for pharmacy apprentices is not a simple task. Not only is there more than one way to deliver and design elearning environments, the soft skills based content used in this research project introduced an additional challenge. For what reason the elearning is used also presented an additional factor. Linear text, for example, was perceived by apprentices to cater to those learning for an exam, while hypermedia would cater more attractively to those learning for extra practice or fun. Lastly, the added variable of where the learning environment is- work place or educational, resulted in another significant element to elearning for pharmacy apprentices.

Despite these issues, from the qualitative and quantitative data analysis executed, it can be determined that for this population group, generally both the hypermedia and the linear text programs are attractive methods for delivering this learning content to some extent. Hypermedia programs though, rated slightly higher overall. A blended model of both elearning possibilities, combined with the support of traditional methods of customer communications learning in the classroom, would be the best possible method. In that way, both linear text and hypermedia programs can support learners depending on their learner needs and goals in ways uncovered in this study.

Perhaps the real potential of apprentice learner support lies in the effective collaboration and communication between the pharmacies, Berufsschule, apprentices and elearning program. This communication would ensure apprentices are getting the support they need for the workplace and for their life-long learning goals. Furthermore, this research has provided a reliable and valid basis on which to continue elearning efforts for Austrian pharmacy apprentices in the future. As Bernthal, et al.[555] mentioned, learning soft skills is always more successful over time. Continued exposure to such themes and programs aids in the development of knowledge, retention and ownership. The programs and themes used for this research study are no different.

[555] (2003).

In this final section, an overview of the most relevant points of this research is made. Second, a discussion of baseline necessities for the future of these elearning programs is presented. Lastly, an introduction and explanation of potential areas of program expansion, planning, cooperation/collaboration, and use is unfolded.

7.1 Relevancy

The relevance of this project on the whole can be determined in part by the variety of interested parties involved in supporting efforts such as have been dealt with in this research. Naturally, the relevancy of the learning content and the delivery and design methods used to compose these programs has been established throughout the literature review. Although relevancy has been discussed throughout this dissertation, an overview of those who support and benefit from elearning, and specifically elearning efforts for the research population, are warranted.

This research supports elearning efforts for life-long learning in vocational and regular education. This has been a priority of both national and EU-wide reforms, organizations, and projects such as VOCADE, eFit Austria, and Goal 2010. For pharmacists, clearly the research has determined there is a strong need for apprentices to receive learning support on the topic of customer service. Developing elearning-based environments connects these two priority concerns. For pharmacists, this not only means more competent employees, but also stronger customer contact that will positively influence pharmacy marketing and product sales. Similarly, for related professionals such as pharmacy warehouses that supply products to pharmacies, marketing experts in the field of pharmaceuticals, and pharmacy organizations, such additional training creates a more profitable pharmaceutical market all around.

For the Berufsschule and WIFI, programs such as those used in this research project provide continuous necessary exposure to priority area learning topics, despite students' limited time in formal classrooms. For the apprentices themselves, elearning-based environments give learners a chance to interact within new and interesting virtual environments, and develop learning at their own pace with the support of interactive programs, and graphic characters. By interacting with virtual characters, learners are able to "safely" experience customer communication scenarios and change their reactions and actions as they learn more. This allows learners to interact and learn constructively even within a topic area where they have

be documented to think they don't need help, as discussed in Section 6.3 *Study Results*. Naturally, these programs also give learners the luxury of learning when and where they wish, and can be motivating ways to deliver content. Basing these elearning programs on learner theory and empirical research helps ensure sound structure for the learner. Factors such as these make elearning for apprentice learners inviting platforms for life-long use on relevant topics.

The relevancy of this research as well as its reliability was handled with priority throughout this study. Structured organization of the research process that helped isolate the research question has made this project a valid contribution to elearning and vocational learning efforts. By developing the research project on sound learner theory for example, the relevancy of the entire project was strengthened. Also, a detailed literature review containing empirical study as well as case scenarios and interviews also contributed to the solidity of research decisions. By combining thoughts, study, theories, evaluations and practices explained in this paper, the most valid research possible could be extracted.

7.2 Baseline Necessities

Baseline necessities are those elements of which must be taken into consideration given the study results. Without the incorporation of these findings, the success of future endeavors in the area of elearning design and delivery for pharmacy apprentices is at a loss. In summary, there are three foundational baseline necessities required for further development; program expansion, variant learning modes, and player collaboration.

Perhaps the most significant factor of this research is the necessity for program expansion. The learning content elements used in this research- two customer communications scenarios with two customers, is simply a very small part of what must be a significantly extended elearning experience. Although the programs used in this study were quite adequate to corner the research question involving elearning design and delivery for the test population, actual implementation for learning purposes is quite different. For successful learner *knowledge* facilitation, the elearner must have the opportunity to engage in many more scenarios with the customers to form significant communication scenario theories on their own. In addition, there can naturally be more content delivered in these programs than just communication scenarios. Customer communication theory, or online chat rooms with expert coaches may

also contribute to learner success in this area. Also, learner sensitivity and knowledge with customer communications can only be developed over an extended period of time, with similar problem cases, various customer characteristics and content that can be re-visited. Without significantly expanding even this one priority learning theme; the impact of the learned retention and ownership would be greatly reduced. As forethought then, various additions have been considered and listed as part of section 7.3 *Future Potential.*

Secondly, an opportunity for various types of learning methods is also warranted for future developments. The final user test groups consisted of various learner types, and no one learner type presented significantly different results than another. Despite this, many apprentice learners commented on the possibility for individuality in the programs, such as changing the font type or color in the linear text program, or altering the clothing on the five customers in the hypermedia program. For these reasons, it may be beneficial to ensure learners were allowed some choices for their elearning environment. Also, the addition of learning content outside that of elearning environments is absolutely necessary, which will be further discussed below with the third point. What is foremost here is the idea that the learning content will not reach its full potential without the blended learning approach explained above, that caters to the population of pharmacy apprentice learners while also supporting the individual. Further ideas on how this can be achieved are also expanded in section 7.3 *Future Potential.*

Thirdly, as mentioned above, programs such as those developed for this research project cannot be fully useful or successful without the total collaboration and support from all those involved. That is to say, elearning cannot stand alone! Elearning should, as discussed throughout this dissertation, be used as a support tool to traditional means of knowledge delivery. In the case of our testing population, that means elearning needs the support of the pharmacies, the dual system educational institutions, and the apprentices themselves. Without this triangulation, attractive elearning in this field will fall short.

Educational institutions, for example, must continue to realize the priority of customer communications learning for the apprentices and the pharmacy market. They must make efforts to include lessons in this area in a more traditional fashion, and be open to expose their apprentice students to other means of content delivery such as elearning programs, and reiterate the significance of such programs again in the traditional school setting. They must

continue to find additional means by which to include other professionals into the customer communications content such as marketing and personal coaching experts in order to support the elearning program content, and the traditional classroom lessons as well. These efforts must then be voiced to the pharmacies, so the level of apprentice expertise can be used positively in the workplace to benefit all.

Accordingly, pharmacies must do the same to ensure that what theories and ideas students learn in the educational institutions and from the elearning content can be encouraged, supported and facilitated in the work place. In addition, communication between the pharmacies and the schools is necessary in order to ensure elearning content is relevant and mirrors realistic issues.

Even apprentices themselves are a necessary part of this collaboration. If pharmacies and schools point out the significance of customer communication needs, and assess openly their apprentices' mastery on the topic, apprentices will in turn develop the sensitivity and motivation to learn more. They provide the essential feedback necessary to ensure elearning programs are providing the environment and content design and delivery in a motivating way. This in turn supports their own life-long learning potential, and thus a stronger pharmacy success in the future. By collaborating together, elearning for pharmacy apprentices can be designed in an effective way to bind and support what factors are necessary for the success of all involved.

7.3 Future Potential

In order to support the baseline necessities discussed in the previous section, a brainstorm of future potential elements and expansions for the elearning programs in particular follow. The following list and subsequent figures have been organized partly with the thoughts and opinions of pharmacies, related professionals, apprentices, test study participants, questionnaires, and interviews. Significant areas of expansion include:

- Option to print out linear text program
- Inclusion of elearner personality tests in relation to character personalities
- Online chat rooms with apprentices and their customer communication experiences
- Email opportunities with communication coaches

- Electronic resource library on all related apprentice topics
- Electronic resources on theory as well as practical knowledge
- Gaming options for hypermedia program (points for products sold, etc.)
- Expansion of whole programs to include all 15 apprenticeship topics
- Options to change font or font color in linear text program
- Connection between programs- customer communications and foreign language issues
- Consecutive elearning programs for each year of apprentice program
- Opportunities to individualize program interface colors, etc.
- Online discussion groups with pharmacists, Berufsschule instructors, etc.
- At least 10 conversations with each customer, with growing relationships

Naturally, the design and organization of elearning efforts containing all of these suggestions is a great and complicated task. Nevertheless, as previously determined, baseline necessities are essential for more significant efforts to succeed. It is clear that the learning program for pharmacy apprentices has challenges. These have surfaced in the form of communication gaps between involved parties and collaboration issues, not to mention time and funding challenges. Nonetheless, elearning helps to provide a common strand between pharmacies, Berufsschule and apprentices. For this reason, it is even moreso a necessity than not. In addition, the potential electronic options such as online chat rooms with professionals and colleagues help to provide needed time and experience hindered by lack of funding in the schools. All in all, elearning programs such as those developed for this research project act as foundational prototypes for what could be vital ties for pharmacy apprentice knowledge in the future. Continuing elearning efforts for this population then is then a necessary and vital conviction.

8 Research Documents

The following section reveals the detailed results gathered from the initial Likert questionnaire, the pilot study questionnaires, and the final user testing questionnaires. In addition, a complete copy of the linear text program is included.

8.1 Initial Questionnaire Detailed Results

30 questionnaires were implemented in the following Vienna districts:

districts	*1*	*3*	*4*	*5*	*9*	*12*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	
# of questionnaires	2	2	2	3	3	2	1	2	2	2	2	3	3	1	**=30**

Ages of the pharmacists ranged from:

4	30 years old or younger
18	between 31 and 55
8	55 years old or older

Of all employees (30 pharmacies, 289 employees), including apprentices, males and females included 13% male, 87% female

The average age of these employees was 35

Of all 30 pharmacies, 11 had apprentices. The 23 apprentices were both males and females in the following apprenticeship years:

	First year	***Second year***	***Third year***
Males		2	
Females	7	5	9

Pharmacists choose the following themes as great challenges for their employees (scored as "3" on questionnaire):

Theme	***# of pharmacists agreeing***
Kundenberatung u. Werbetechnik	**IIIII IIIII IIIII III**
Berufsbezogene Fremdsprache	**IIIII IIIII IIIII II**
Ernährungslehre	**IIIII IIIII IIIII I**
Botanik u. Pharmakognosie	**IIIII IIIII IIIII**
Körperpflege- u. Krankenpflegewaren	**IIIII IIIII IIII**
Somatologie, Pathologie u. Pharmakologie	**IIIII IIIII I**
Laborpraktikum	**IIIII III**
Apothekenkunde	**IIIII I**
Textverarbeitung	**IIIII**
Deutsch Kommunikation	**IIII**
Chemie u. Physik	**IIII**
Computerunterstütztes Rechnungswesen	**IIII**

Wirtschaftskunde im Schriftverkehr	III
Rechnungswesen	II

Specific challenges in the area of Kundenberatung u. Werbetechnik included:

Kundengespräch	5 (# of pharmacists agreeing)
Warenpräsentation	5
Werbung	4
Phasen des Verkaufsgespräches	4
Besondere Gesprächssituationen	3
Werbegestaltung	2

Of "Berufsbezogene Fremdsprache", the following languages were said to be needed:

Language needed	*# of pharmacists agreeing*
English	IIIII IIIII IIIII IIIII IIII
Turkish	IIIII IIIII I
Serbo-Croatian	IIIII IIII
French	IIIII I
Italian	IIIII I
Spanish	II
Asian	I
Polish	I
Greek	I
Slovenian	I
Hungarian	I
Czech	I

Specific challenges in the area of Ernährungslehre included:

Ernährung	2
Diätetik	2
Produkte	2

Specific challenges in the area of Botanik u. Pharmakognosie included:

Botanik	3
Pharmakognosie	2
Morphologie u. Physiologie	2
Herbarium u. Drogensammlung	2
Drogen	2
Natur- u. Unweltschutz	1
Monographie	1

Specific challenges in the area of Somotologie, Pathologie u. Pharmakologie included:

Pharmakologie	3
Somatologie	2
Pharmakodynamik	2
Pharmakokinetik	2
Pharmaka	2
Pathologie	1

Specific challenges in the area of Laborpraktikum included:

Identitätsprüfung	4
Mitwirken an der Serienherstellung	3
Mitwirken an der Magistralanfertigung	2
Labor	1
Labortechnische Arbeiten	1

Specific challenges in the area of Apothekenkunde included:

Kalkulation	1
Apothekenpraxis	1
Arzneimittel	1

Specific challenges in the area of Textverarbeitung included:

Zehn-Finger-Tastschreiben	1
Schriftstückgestaltung	2
Textverarbeitungsprogramme	2

Specific challenges in the area of Computerunterstütztes Rechnungswesen included:

Funktion u. Bedienung eines Computers	2
Praxisbezogene Anwendungen	2
Organisation des Computerunterstützten Rechnungswesen	1

Specific challenges in the area of Wirtschaftskunde im Schriftverkehr included:

Steuern	2
Gewerbeordnung u. Apothekengesetz	1
Gesundheitswesen	1
Personalwesen	1
Marketing	1
Geld u. Kreditwesen	1
Versicherungen	1
Schriftverkehr	1
Kaufvertrag	1

Specific challenges in the area of Rechnungswesen included:

Personalverrechnung	2
Spar- u. Finanzierungsformen	2
Verteilungsrechnung	1
Controlling	1
Einfache Buchführung	1
Mengen- u. Preisberechnungen	1
Durchschnittsrechnung	1
Doppelte Buchführung	1

- All 30 pharmacies agreed employees should continue to learn throughout their careers.
- 28 of the 30 pharmacies had Internet access.
- 15 of the 30 pharmacists said they had used some form of elearing at one time.
- 23 of the 30 pharmacists agreed employees could use the pharmacy Internet/computer for job-related learning.
- 12 of the 30 pharmacists said this job-related learning could be done during work hours.
- 22 of the 30 pharmacists would like employee job-related elearning programs.

8.2 Pilot Test Questionnaire Detailed Results

The Linear Text questionnaire revealed:

Likert Scale Statements	rating (number of participates)			
Dieses Programm war leicht zu laden und zu starten.	1(4)			
Ich konnte ohne weitere Unterstützung das Programm bedienen.	1(3)	2(1)		
Man navigiert relativ rasch durchs Programm.				
Bei der Verwendung gab es keine technische Probleme.				
Dies ist ein motivierendes Programm.		2(2)	3(2)	
Mir gefällt wie Text und Graphik organisiert sind.	1(4)			
Die Graphik hilft den Text besser zu verstehen.	1(1)	2(3)		
Die Graphiken gefallen mir.		2(4)		
Die Größe der Buchstaben ist gut bzw. passend.			3(3)	4(1)
Die Schriftart ist gut bzw. passend.	1(4)			
Die verwendeten Farben sind angenehm.	1(4)			
Mit diesem Programm zu lernen macht Spaß.		2(3)	3(1)	
Ich verstehe den Lehrinhalt des Programms.	1(4)			
Der Lehrinhalt ist motivierend.		2(4)		
Das zu Lernende ist klar und verständlich.	1(4)			
Das Gelernte kann ich in der Praxis gut verwenden.		2(2)	3(1)	4(1)
Ich würde gerne mit Programmen wie diesen lernen.	1(1)	2(3)		

The Hypermedia questionnaire revealed:

Dieses Programm war leicht zu laden und zu starten.	1(3)	2(1)		
Ich konnte ohne weitere Unterstützung das Programm bedienen.	1(2)	2(2)		
Man navigiert relativ rasch durchs Programm.	1(4)			
Bei der Verwendung gab es keine technische Probleme.		2(3)	3(1)	
Dies ist ein motivierendes Programm.	1(4)			
Mir gefällt wie Text und Graphik organisiert sind.	1(4)			
Die Graphik hilft den Text besser zu verstehen.				4(4)
Die Graphiken gefallen mir.		2(4)		
Die Größe der Buchstaben ist gut bzw. passend.	1(4)			
Die Schriftart ist gut bzw. passend.	1(4)			
Die verwendeten Farben sind angenehm.	1(4)			
Die Geräuscheffekte unterstützen das Programm.		2(1)	3(3)	
Das Panorama ist eine gute Navigationshilfe.			3(2)	4(2)
Tasten und links sind leicht zu finden und zu verwenden.	1(4)			

Mit diesem Programm zu lernen macht Spaß.	1(1)	2(3)		
Ich verstehe den Lehrinhalt des Programms.	1(3)	2(1)		
Der Lehrinhalt ist motivierend.		2(3)	3(1)	
Das zu Lernende ist klar und verständlich.	1(4)			
Das Gelernte kann ich in der Praxis gut verwenden.	1(1)	2(3)		
Ich würde gerne mit Programmen wie diesen lernen.	1(4)			

8.3 Final User Testing Questionnaire Detailed Results

The final user testing questionnaires used are divided into three test groups; the WIFI group, the Berufsschule group, and the Apotheke group. Furthermore, data from these three groups is also collected for linear text and additionally hypermedia programs.

8.3.1 WIFI

Linear Text:

	rating (number of participates)			
Dieses Programm war leicht zu laden und zu starten.	1(9)	2(3)		
Ich konnte ohne weitere Unterstützung das Programm bedienen.	1(9)	2(3)		
Man navigiert relativ rasch durchs Programm.	1(9)	2(3)		
Bei der Verwendung gab es keine technische Probleme.	1(10)	2(2)		
Dies ist ein motivierendes Programm.	1(6)	2(6)		
Ich mag den Stil der verwendeten Schrift.	1(6)	2(5)	3(1)	
Mir gefällt wie Text und Graphik organisiert sind.	1(7)	2(4)		4(1)
Die Graphik hilft den Text besser zu verstehen.	1(9)	2(2)	3(1)	
Die Graphiken gefallen mir.	1(9)	2(3)		
Die Größe der Buchstaben ist gut bzw. passend.	1(8)	2(4)		
Die Schriftart ist gut bzw. passend.	1(9)	2(3)		
Die verwendeten Farben sind angenehm.	1(10)	2(2)		
Ich konnte leicht durchs Programm navigieren.	1(10)	2(1)		
Mit diesem Programm zu lernen macht Spaß.	1(5)	2(4)	3(2)	4(1)
Ich verstehe den Lehrinhalt des Programms.	1(10)	2(2)		
Der Lehrinhalt ist motivierend.	1(5)	2(6)	3(1)	
Das zu Lernende ist klar und verständlich.	1(7)	2(4)	3(1)	
Das Gelernte kann ich in der Praxis gut verwenden.	1(4)	2(6)	3(2)	
Ich würde gerne mit Programmen wie diesen lernen	1(3)	2(7)	3(2)	

Hypermedia:

Dieses Programm war leicht zu laden und zu starten.	1(8)	2(3)	3(1)	
Ich konnte ohne weitere Unterstützung das Programm bedienen.	1(7)	2(4)	3(1)	
Man navigiert relativ rasch durchs Programm.	1(6)	2(5)	3(1)	

Bei der Verwendung gab es keine technische Probleme.	1(2)	2(5)	3(1)	4(1)	
Dies ist ein motivierendes Programm.	1(9)	2(1)	3(2)		
Mir gefällt wie Text und Graphik organisiert sind.	1(10)	2(2)			
Die Graphik hilft den Text besser zu verstehen.	1(7)	2(5)			
Die Graphiken gefallen mir.	1(8)	2(4)			
Die Größe der Buchstaben ist gut bzw. passend.	1(7)	2(4)	3(1)		
Die Schriftart ist gut bzw. passend.	1(9)	2(3)			
Die verwendeten Farben sind angenehm.	1(10)	2(2)			
Die Geräuscheffekte unterstützen das Programm.	1(3)	2(7)	3(1)		5(1)
Das Panorama ist eine gute Navigationshilfe.	1(7)	2(4)			5(1)
Tasten und links sind leicht zu finden und zu verwenden.	1(5)	2(6)	3(1)		
Mit diesem Programm zu lernen macht Spaß.	1(10)	2(2)			
Ich verstehe den Lehrinhalt des Programms.	1(12)				
Der Lehrinhalt ist motivierend.	1(6)	2(6)			
Das zu Lernende ist klar und verständlich.	1(10)	2(2)			
Das Gelernte kann ich in der Praxis gut verwenden.	1(7)	2(4)	3(1)		
Ich würde gerne mit Programmen wie diesen lernen	1(6)	2(5)	3(1)		

8.3.2 Berufsschule

Linear Text:

	rating (number of participates)				
Dieses Programm war leicht zu laden und zu starten.	1(6)	2(5)	3(1)		
Ich konnte ohne weitere Unterstützung das Programm bedienen.	1(8)	2(3)	3(1)		
Man navigiert relativ rasch durchs Programm.	1(12)				
Bei der Verwendung gab es keine technische Probleme.	1(11)	2(1)			
Dies ist ein motivierendes Programm.	1(9)	2(1)		4(1)	5(1)
Ich mag den Stil der verwendeten Schrift.	1(8)	2(4)	3(1)		
Mir gefällt wie Text und Graphik organisiert sind.	1(9)	2(1)	3(1)	4(1)	
Die Graphik hilft den Text besser zu verstehen.	1(9)	2(1)		4(1)	5(1)
Die Graphiken gefallen mir.	1(7)	2(4)		4(1)	
Die Größe der Buchstaben ist gut bzw. passend.	1(11)	2(1)			
Die Schriftart ist gut bzw. passend.	1(10)	2(2)			
Die verwendeten Farben sind angenehm.	1(7)	2(4)		4(1)	
Ich konnte leicht durchs Programm navigieren.	1(9)	2(3)			
Mit diesem Programm zu lernen macht Spaß.	1(7)	2(2)	3(2)		5(1)
Ich verstehe den Lehrinhalt des Programms.	1(7)	2(3)	3(1)		
Der Lehrinhalt ist motivierend.	1(6)	2(3)	3(1)	4(2)	
Das zu Lernende ist klar und verständlich.	1(8)	2(4)			
Das Gelernte kann ich in der Praxis gut verwenden.	1(6)	2(4)	3(1)	4(1)	
Ich würde gerne mit Programmen wie diesen lernen	1(6)	2(3)		4(2)	5(1)

Hypermedia:

Dieses Programm war leicht zu laden und zu starten.	1(8)	2(2)	3(2)		
Ich konnte ohne weitere Unterstützung das Programm bedienen.	1(10)	2(2)			
Man navigiert relativ rasch durchs Programm.	1(11)	2(1)			
Bei der Verwendung gab es keine technische Probleme.	1(10)	2(1)	3(1)		
Dies ist ein motivierendes Programm.	1(6)	2(3)	3(2)	4(1)	
Mir gefällt wie Text und Graphik organisiert sind.	1(6)	2(6)			
Die Graphik hilft den Text besser zu verstehen.	1(9)	2(3)			
Die Graphiken gefallen mir.	1(8)	2(3)		4(1)	
Die Größe der Buchstaben ist gut bzw. passend.	1(12)				
Die Schriftart ist gut bzw. passend.	1(11)	2(1)			
Die verwendeten Farben sind angenehm.	1(10)	2(1)	3(1)		
Die Geräuscheffekte unterstützen das Programm.	1(4)	2(2)	3(1)	4(1)	5(4)
Das Panorama ist eine gute Navigationshilfe.	1(6)	2(4)	3(1)	4(1)	5(1)
Tasten und links sind leicht zu finden und zu verwenden.	1(11)	2(1)			
Mit diesem Programm zu lernen macht Spaß.	1(7)	2(2)	3(2)	4(1)	
Ich verstehe den Lehrinhalt des Programms.	1(12)				
Der Lehrinhalt ist motivierend.	1(7)	2(2)	3(3)		
Das zu Lernende ist klar und verständlich.	1(9)	2(2)	3(1)		
Das Gelernte kann ich in der Praxis gut verwenden.	1(6)	2(2)	3(2)	4(2)	
Ich würde gerne mit Programmen wie diesen lernen	1(6)	2(4)	3(1)	4(1)	

8.3.3 Apotheke

Linear Text:

	rating (number of participates)				
Dieses Programm war leicht zu laden und zu starten.	1(9)	2(1)	3(2)		
Ich konnte ohne weitere Unterstützung das Programm bedienen.	1(9)	2(1)	3(2)		
Man navigiert relativ rasch durchs Programm.	1(8)	2(3)	3(1)		
Bei der Verwendung gab es keine technische Probleme.	1(12)				
Dies ist ein motivierendes Programm.	1(4)	2(5)		4(1)	5(2)
Ich mag den Stil der verwendeten Schrift.	1(4)	2(3)	3(1)	4(3)	5(1)
Mir gefällt wie Text und Graphik organisiert sind.	1(6)	2(4)	3(1)	4(1)	
Die Graphik hilft den Text besser zu verstehen.	1(5)	2(2)	3(2)		5(3)
Die Graphiken gefallen mir.	1(7)	2(2)	3(3)		
Die Größe der Buchstaben ist gut bzw. passend.	1(9)	2(3)			
Die Schriftart ist gut bzw. passend.	1(7)	2(3)	3(1)	4(1)	
Die verwendeten Farben sind angenehm.	1(8)	2(2)	3(2)		
Ich konnte leicht durchs Programm navigieren.	1(8)	2(2)	3(1)	4(1)	

Mit diesem Programm zu lernen macht Spaß.	1(6)	2(2)		4(3)	5(1)
Ich verstehe den Lehrinhalt des Programms.	1(9)	2(1)	3(2)		
Der Lehrinhalt ist motivierend.	1(4)	2(4)	3(1)	4(1)	5(2)
Das zu Lernende ist klar und verständlich.	1(6)	2(4)	3(2)		
Das Gelernte kann ich in der Praxis gut verwenden.	1(5)	2(4)		4(2)	
Ich würde gerne mit Programmen wie diesen lernen	1(4)	2(4)	3(1)	4(1)	5(2)

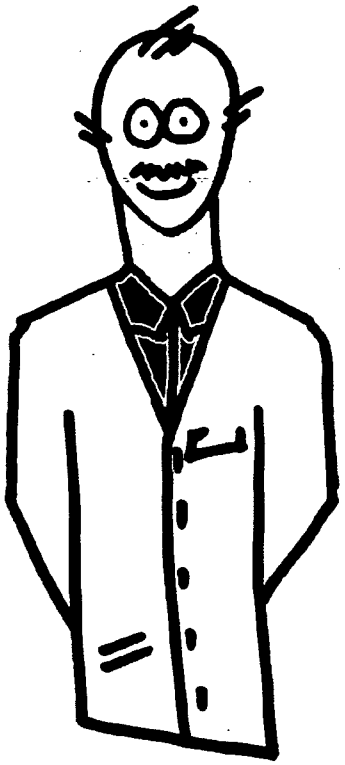
Hypermedia:

Dieses Programm war leicht zu laden und zu starten.	1(6)	2(4)	3(1)	4(1)
Ich konnte ohne weitere Unterstützung das Programm bedienen.	1(8)	2(4)		
Man navigiert relativ rasch durchs Programm.	1(8)	2(3)	3(1)	
Bei der Verwendung gab es keine technische Probleme.	1(5)	2(3)	3(3)	4(1)
Dies ist ein motivierendes Programm.	1(4)	2(5)	3(2)	4(1)
Mir gefällt wie Text und Graphik organisiert sind.	1(9)	2(2)	3(1)	
Die Graphik hilft den Text besser zu verstehen.	1(4)	2(6)	3(2)	
Die Graphiken gefallen mir.	1(8)	2(2)		4(2)
Die Größe der Buchstaben ist gut bzw. passend.	1(9)	2(2)	3(1)	
Die Schriftart ist gut bzw. passend.	1(6)	2(5)		4(1)
Die verwendeten Farben sind angenehm.	1(9)	2(3)		
Die Geräuscheffekte unterstützen das Programm.		2(3)	3(6)	4(3)
Das Panorama ist eine gute Navigationshilfe.	1(4)	2(5)	3(3)	
Tasten und links sind leicht zu finden und zu verwenden.	1(8)	2(4)		
Mit diesem Programm zu lernen macht Spaß.	1(10)	2(1)	3(1)	
Ich verstehe den Lehrinhalt des Programms.	1(11)	2(1)		
Der Lehrinhalt ist motivierend.	1(6)	2(3)	3(3)	
Das zu Lernende ist klar und verständlich.	1(9)	2(3)		
Das Gelernte kann ich in der Praxis gut verwenden.	1(7)	2(2)	3(3)	
Ich würde gerne mit Programmen wie diesen lernen	1(8)	2(2)	3(1)	4(1)

8.4 Linear Text Program

The following is a full copy of the linear text program as was delivered on PDF file for the pilot and the final user testing.

Kundengespräche



Es gibt viele Bereiche und Teilbereiche rund um Apotheken und Apothekendienste, welche einige Aufmerksamkeit, Vorbereitung, Wissen und selbstverständlich Kompetenz verlangen und voraussetzen.

Einer der wohl wichtigsten Themenbereiche im Zusammenhang mit Apotheken beschäftigt sich mit dem Gespräch oder auch der Kommunikation mit dem Kunden, mit dem so genannten Kundengespräch. Es fängt damit an, dass jegliches Gespräch, sei es auch nur eine kurze Begrüßung, bereits eine Beziehung im weitesten Sinn darstellt. Diese Kundenbeziehung schafft Wohlbefinden, Vertrauen und hilft dir die Kundenbedürfnisse besser zu verstehen. Dadurch ist der Kunde eher veranlasst zurück zu kommen und dies unterstützt den Verkauf weiterer Produkte. Eine Beziehung basiert immer auf einem Erstkontakt. Auf eine erste Information folgt somit die Beziehung zum Kunden. Somit sind wir beim wichtigsten Punkt, welcher für jegliches Gewerbe bzw. jegliche Dienstleistung und somit auch für Apotheken gilt. Eine Apotheke braucht Kunden - ohne Kunden keine Apotheke.

Oma

Die folgenden Szenarien illustrieren Gespräche zwischen einem Mitarbeiter einer Apotheke (du) und einem Kunden. In unserem Fall handelt es sich bei dem Kunden um eine „Oma".

Die Szenarien beschreiben Anfragen und Reaktionen seitens der Oma und darauf angemessenes oder unangemessenes Verhalten deinerseits.

Szenario 1:

Oma kommt in die Apotheke aus einem, einzigen und bestimmten Grund. Sie hat ein Rezept vom Arzt bekommen und will nun die Medikamente kaufen. Nun hast du einige Möglichkeiten darauf zu reagieren. In unserem Fall, im ersten Szenario kommst du der Aufforderung der Kundin nach, belässt die Situation damit und verabschiedet sich höflich, wenn Oma die Apotheke verlässt.

Szenario 2:

Das zweite Szenario ist von Anfang an gleich wie Szenario eins, aber nun belässt du die Situation nicht, sondern fragst nach einem weiteren möglichen Anliegen von Oma. Diese Information bezieht sich nicht auf die eigentliche Anfrage des Kunden, sondern du informierst über neue Produkte bzw. macht auf diese aufmerksam. Als Vereinfachung stelle man sich ein gängiges Produkt vor, wie zum Beispiel, eine Handcreme. Also fragst du, ob Oma schon eine Handcreme hat oder ob sie noch eine benötigt.

In diesem Fall gibt Oma zu verstehen, dass sie bereits mehrere Jahre eine zu Hause hat und diese, wenn auch nur selten, benutze. Nun hast du wieder verschiedene Möglichkeiten darauf zu reagieren. In diesem Fall lässt du die Situation auf sich beruhen und somit ist Szenario 2 beendet.

Szenario 3:

Folgendes Szenario spielt sich von Anfang an genau so ab wie Szenario 2. Szenario 3 unterscheidet sich aber bei dem Punkt, an dem Oma zu verstehen gibt, dass sie bereits eine Handcreme zu Hause hat und das Szenario damit beendet ist.

Nun erkundigst du dich nach dem Verbrauchs- bzw. Ablaufdatum. Weiters informierst du über die Wirkung bzw. das Nachlassen der Wirkung der Handcreme, deren Ablaufdatum bereits überschritten ist. Nun hat Oma wiederum verschiedene Möglichkeiten auf diese neue Information zu reagieren. In diesem Szenario gibt die neue Information Oma keinen Grund zu handeln und sie kauft kein weiteres Produkt. Dieses Handeln ändert sich nun im nächsten Szenario.

Szenario 4:

Wiederum spielt sich dieses Szenario von Anfang an gleich ab wie Szenario 3. In diesem vierten Szenario aber ist die neue Information für Oma ein Grund zum Nachdenken bzw. Handeln. Folglich kauft Oma eine neue Handcreme. Szenario 4 ist somit beendet und weitere Möglichkeiten ergeben sich.

Szenario 5:

Dieses Szenario bietet weitere Möglichkeiten, nachdem Szenario 4 beendet ist. Somit befinden wir uns in dem Spielablauf, in dem Oma die Handcreme kauft. Nun aber lässt du die Situation nicht auf sich beruhen und setzt mit dem Kundengespräch fort. Du fragst, ob Oma Interesse hätte ein oder zwei neue Produkt Muster auszuprobieren bzw. zu testen.

Ab diesen Zeitpunkt wäre Szenario 5 beendet und es würden weitere folgen. Der Veranschaulichung unseres Beispiels sei aber somit Genüge getan.

Diese Szenarien werfen einige Fragen auf. Was ist dein Zuständigkeitsbereich? Welches Szenario hat dir am besten gefallen? Welches Szenario wird sich deiner Meinung nach abspielen? Und welches Szenario wird wohl den meisten Erfolg bringen? – und warum?

Um auf diese Fragen Antworten zu geben, werden somit einige Punkte angeführt, an die sich jeder MitarbeiterIn halten sollte. Kenne die Grenzen deiner Zuständigkeit und sei dir deiner Verantwortung bewusst. Weiters beinhalten diese Punkte, das bereits erwähnte Gespräch und

dass nur ein Gespräch zu einer Beziehung führt und dieses folglich den Kunden veranlasst wiederzukommen. Zusätzlich soll auch verständlich gemacht werden, dass es immer besser ist zu erklären als zu belehren. Schlussendlich besteht die Möglichkeit für den Kunden etwas zu kaufen nur dann, wenn dieser das Produkt kennt oder darüber informiert wird.

Mann

An dieser Stellte wollen wir eine weitere Situation, ein weiteres Kundengespräch anführen. In diesem Fall ist der Kunde ein leicht griesgrämiger Mann. In diesem Kundengespräch werden die Antworten, bzw. positive und negative Reaktionen, gleich zum dazugehörigen Szenario gegeben um, eine weitere Alternative für Erklärungen zu bieten.

Szenario 1:

Ein Mann kommt in die Apotheke mit der Aufforderung, dass er nur mit der Apothekenleiterin, in unseren Fall Frau Mag. Maier, sprechen will. Nun stehen dir mehrere Auswahlmöglichkeiten offen auf diese Frage zu antworten. In diesem Fall, im Szenario 1 lautet die Antwort: „Frau Mag. Maier ist beschäftigt, bitte warten Sie". Darauf antwortet der Mann, dass er keine Zeit habe zu warten. Deine Antwort im Szenario 1 lautet: „ Das tut mir leid, da kann man nichts machen". Nun aber ist darauf hinzuweisen, dass diese Antwort nicht besonders hilfreich ist. In diesem Fall gibst du keinerlei Erklärung, warum Frau Mag. Maier keine Zeit hat bzw. wie lange der Kunde noch auf sie warten müsste. Auch hast du dem Kunden in keinerlei Beziehung geholfen und folglich ist und bleibt der Kunde verärgert.

Szenario 2:

Das zweite Szenario ist von Anfang an gleich wie Szenario 1, nun reagierst du aber auf die Antwort des Kunden, dass er keine Zeit habe zu warten, unterschiedlich. Du unterbrichst Frau Mag. Maier bei Ihrer Arbeit und bittest Sie zum Kunden. Was aber, wenn Frau Mag. Maier bereits mit einem anderen Kunden spricht? Es wäre doch sehr unhöflich Sie bei diesem Gespräch zu stören. Anfangs hättest du probieren können auch selber zu helfen. Darüber hinaus könnte jegliche Bemühung deinerseits, die Frage des Kunden zu beantworten, dazu führen, dass du etwas Neues dazu lernst.

Szenario 3:

Erneut denke man sich die ganze Situation von Anfang an durch. Der Mann erklärt wiederum, dass er keine Zeit habe zu warten. Nun aber reagierst du anders als im Szenario 1 oder 2, denn du fragst den Kunden, ob du nicht selbst weiterhelfen könntest. In diesem Fall, antwortet der Mann, dass er dich überhaupt nicht kenne und dass er die letzten 15 Jahre immer mit Frau Mag. Maier gesprochen hat, weil diese sich auskennt. Deine Antwort auf diese Aussage bestätigt erstmals die Qualifikation von Frau Mag. Maier, aber du beteuerst auch, dass du gerne weiter helfen würdest. Folglich antwortet der Mann, dass er nicht glaube, dass du ihm helfen könntest. Daraus ergeben sich wieder einige weitere Möglichkeiten, um dieses

Szenario weiterzuspielen. In unserem Szenario antwortest du, dass es sehr wohl sein könnte, dass du nicht helfen kannst. Bedenke aber, dass du dem Kunden damit noch nicht geholfen hast und du könntest doch einfach herausfinden, ob du die Frage bzw. das Anliegen des Kunden selbst erledigen könntest. Überdies ist es keine Schande, nicht alles zu wissen, es würde aber deine Bemühung zeigen und die Kundenbeziehung weiter ausbauen.

Szenario 4:

Wiederum spielt sich das Szenario in der Apotheke von Anfang an gleich ab wie Szenario 3. Nun aber ändert sich deine Antwort auf die Aussage des Kunden, dass er nicht glaube, dass du ihm helfen könntest. Du glaubst nämlich sehr wohl an deine Fähigkeiten und überzeugst den Kunden, dass du ihm sicher weiterhelfen könntest. Es ist natürlich gut, dass du so überzeugt bist, aber soeben hast du einem Kunden widersprochen und dies sollte immer vermieden werden. Bei diesem Kundengespräch besteht auch eine große Gefahr, dass du als überheblich eingestuft wirst, auch wenn dies nicht deine Absicht war. Schließlich wäre da noch ein Punkt zu beachten. Was wäre, wenn du „dieses eine Mal" keine richtige Antwort hast bzw. den Kunden bei seinem Anliegen nicht weiterhelfen kannst.

Szenario 5:

Wie wir sehen spielen sich diese Szenarien immer unterschiedlich ab, nämlich immer abhängig von deiner Aktion bzw. Reaktion. Zur Veranschaulichung spielen wir noch ein letztes Szenario durch. dieses ist wiederum von Anfang an gleich wie Szenario 3 und/ oder 4. Der Kunde ist noch immer skeptisch und glaubt nicht daran, dass du ihm weiter helfen könntest. Nun aber gibst du ihm zu verstehen, dass du zumindest probieren willst auf seine Frage zu antworten bzw. seinem Anliegen nach zu kommen und falls dir dies nicht gelingt würdest du, um eine zufrieden stellende Lösung zu finden, eine weitere Kollegin hinzuzuziehen. Dies ist eine gute Antwort bzw. Reaktion deinerseits. Du zeigst damit, dass du nicht nur deine eigene Hilfe anbietest, sondern um die bestmögliche Hilfe bemüht bist. Folglich führt dies zu einer positiven Beziehung mit dem Kunden und du zeigst allen deinen starken Willen etwas dazu zulernen.

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Lebenslauf

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