FAKULTÄT FÜR !NFORMATIK
Faculty of Informatics

e-Learning in the Form of an Interactive Multimedia German Course

DIPLOMARBEIT

zur Erlangung des akademischen Grades

Magistra der Sozial- und Wirtschaftswissenschaften

im Rahmen des Studiums

Masterstudium Informatikmanagement

eingereicht von

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an der
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Betreuung
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Wien, 12.04.2011

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Abstract

In this work e-learning methods have been discussed on the example of a computer language course. After short discussion of the e-learning characteristic and advantages, the work focuses on the psychological and pedagogical aspects of learning as also on the didactic learning theory. The technical realisation of the e-learning methods is reviewed. The issue of the interactivity in e-learning programs is tackled. Subsequently, e-learning software evaluation methods were analysed. The work finishes with an evaluation of an e-learning application for foreign language course in the context of interactivity. For the evaluation, opinions of software users were investigated.

As far as the results of the evaluation are concerned, it was found out that not every level of interactivity was implemented in the investigated application. The guidelines for the interactivity were realised in a reasonable way. The features like graphical navigation, ”clickability” and simulation are well-implemented, however the feedback signals could be optimised.

Kurzfassung

Diese Arbeit befasst sich mit dem e-Learning am Beispiel eines Computersprachkurses. Nach einer kurzen Disskussion über die Eigenschaften und Vorteilen des e-Learnings wurden die psychologische und pädagogische Aspekte sowie Didaktik des Lernens besprochen. Der nächste Punkt der theoretischen Diskussion beinhaltet technische Realisierung der Methoden des e-Learnings. Das Thema der Interaktivität, ihre Bedeutung, Einstufung und Richtlinien, wurde ausführlich behandelt. Außerdem setzt sich die Arbeit mit der Methoden der Softwareevaluierung auseinander. Schlussendlich wurde ein Deutsch-Computersprachkurs im Rahmen von der Interaktivität untersucht. Als die Evaluierungsmetode wurde eine Befragung der Programmanwender eingesetzt.

Die Ergebnisse der Softwareevaluierung weisen darauf hin dass nicht alle Stufen der Interaktivität in der untersuchten Applikation implementiert wurden. Die Richtlinien der Interaktivität wurden allerdings vernünftig realisiert. Die Eigenschaften der Interaktivität wie zum Beispiel "Clickabilität" und Simulationen sind vollständig implementiert. Gewisses Optimierungspotential ist im Bereich des Feedbacks vom Programm zum Student möglich.

Acknowledgments

I would like to express my gratitude to Prof. Margit Pohl for her supervision and her patience during this long-lasting work.

Very special thanks for my Aleksander for his motivation and love.

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1 Introduction

In the times of intensive globalisation the education has become essential issue. In order to be successful in the globalised society, one needs to be well informed and improve continuously his abilities. Since the time that can be spend on education is limited the objectives of the personal development can be hardly met. A possible solution for this problem is e-learning. This learning method allows computer users to have an easy access to knowledge. It is a very flexible learning approach since typically the only required component is a computer. Problematic organisation of teaching schedule and venues is not a case in e-learning. If an e-learning program is designed well it can be used also by the persons with little computer knowledge. The group of interest for e-learning are not only common students but also members of corporations that would would like to save money on traditional training methods.

The development of the e-learning methods took place parallely with the development of the personal computers and with the simple and inexpensive access to the electronic media. The e-learning still evolves dynamically and has already a strong and stable position among other learning methods.

It is hard to define the exact begin of e-learning. Various authors see the historical begin in different times. The e-learning is a complex subject combining various technological solutions as also pedagogical learning methods. The continuous evolution of the e-learning components leads also to evolution of e-learning. In the twenties and thirties of the previous century some general expectations to the subject of education were defined. The following topics were considered: objectives of education, educational measurements and adapting the education to society needs. With the Second World War military started to use films for instructions. In the fifties learning theory was in continuous development. The personnel of the air force was using certain films as learning

materials. In the sixties and seventies the cognitive approaches dominated e-learning. At this time instructional films reached also children in schools. Parallely some assessment procedures were developed. In eighties first microcomputer instructions were used and requirement for the interactivity was noticed. The next decade was the era of personal computers with fast grow-up of e-learning design and development. New technologies and software capabilities laid the foundations for user-friendliness and easy access of e-learning applications. The beginning of the twenty-first century comes with the strong development of internet that makes the e-learning more interactive and interesting.

e-Learning offers users a great variety of learning subjects. In this work, e-learning approaches are described on the example of an application for the foreign language course. First the e-learning in general and its benefits are presented. For better understanding of learning methods the psychological and pedagogical aspects are discussed. Next the work focuses on the typical functions of the e-learning software. This is followed by the issue of the interactivity which is probably one of the most interesting elements of the e-learning.

As commonly know well designed program can be used by the persons with little computer knowledge. In order to verify if an e-learning application is well-designed, software evaluation can be applied. In this document an example of evaluation of an language e-learning application is presented. Using this example the feature of interactivity in the e-learning language course is investigated.

The investigation is based on the opinion of e-learning software users. The main aim of this investigation is the general verification of the level of interactivity as also fulfilment of the guidelines for interactivity as seen by the students/users. In the last section of the work software investigation approaches and questions are presented. The work finishes with the discussion on the obtained results.

2 e-Learning Definitions and Significance

Probably, there are no strict definitions of the e-learning. Understanding of the e-learning depends on the point of view and the e-learning application. The term e-learning can cover many aspects connected with the learning processes that use computers. In this section, basic definitions and terms connected with e-learning are briefly introduced. The definitions should not be treated as strict ones, here they introduce solely theoretical background for further investigations of this work.

2.1 Blended Learning

As it can be understood directly, the blended learning is a learning that involves a mixture of different learning techniques and approaches. Frequently, the blended learning is associated with the learning guided by an instructor that is supported by media and novel methods [1]. In fact, e-learning is strongly connected with the blended learning and the meanings of these therms overlap to some extent.

2.2 e-Learning

Based on the definition of Clark and Mayer the e-learning can be understood as a combination of instructional methods that are delivered by media elements associated with computers. Important feature in the e-learning is the adjustment of learning processes to the student's skills and to his specific learning goals [2]. Typically computers are able to adjust the learning material to the student's skills much faster than a human being. In general, e-learning can be also a type of distant learning using computer techniques and the internet. It is place- and time-independent provided that a suitable internet connection is available. In addition, it can be used in the face-to-face teaching for example in the blended learning. The intention of e-learning is to support pedagogy with help of

computers, CDs/DVDs and the internet.

A possible feature of e-learning is the independence of students. The student can control the subjects and learning tempo on his own. It is in contrast to a traditional class where the theme and method is set from begin to the end. E-learning applications give possibility to choose the best learning method for individual needs.

2.3 Virtual Learning Environment

Virtual Learning Environment (VLE) creates the access to all necessary tools, documents, interactive exercises and data in e-learning programs. Graphical User Interface (GUI) built with icons and navigation menus is supposed to make e-learning user friendly. A scheme of a typical GUI from an e-learning program is presented in Figure (1). One of the main tasks of VLE is to provide the users a clear view of all available information. Using icons, buttons and others visual aids users can find necessary information even with basic computer knowledge. In contrary, Text User Interface (TUI) is not given such options and is not usually considered to be a good basis for e-learning programs. A great advantage of VLE is that most of the users remember automatically or know already the meaning of symbols and work with applications much faster from the very beginning of an e-learning course.

At the universities, VLE is typically employed together with Management Information System (MIS). MIS is a general name for an academic discipline covering the application of people, technologies, and procedures - collectively called information systems - to solve business problems. MIS are distinct from regular information systems in that they are used to analyse other information systems applied in operational activities in the organization. In MIS, all information for specific courses are released on the user interface according to university standards [3].

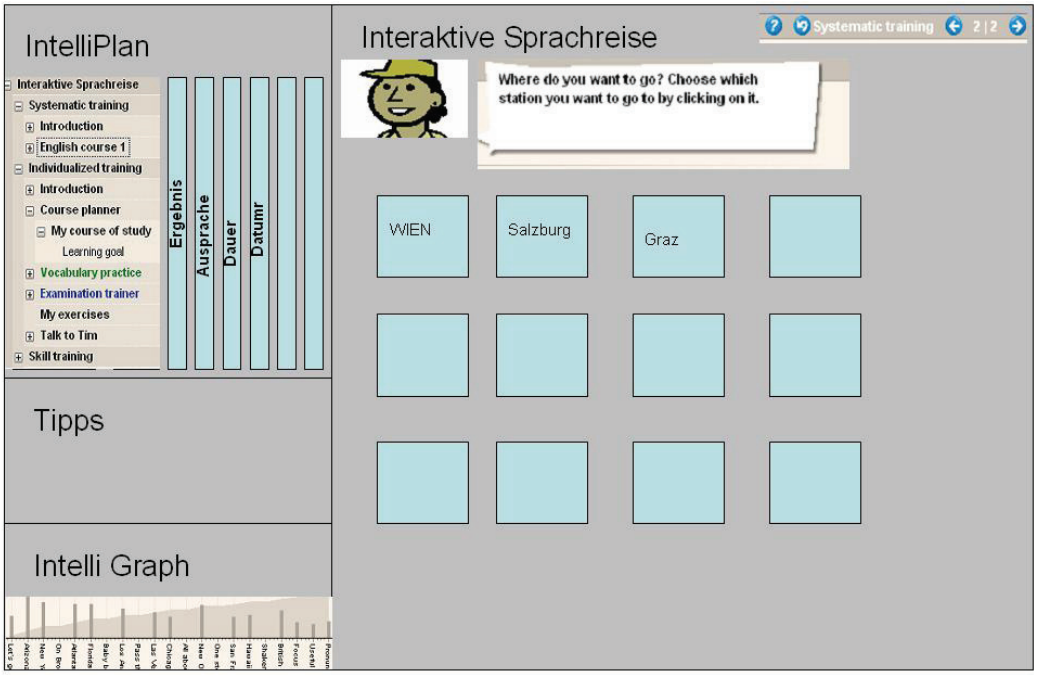

Figure 1: Virtual learning environment

2.4 Online Learning versus Programs on CD/DVD

A form of the e-learning is online learning. An online learning application should contain all features of an e-learning course. Although online-learning creates many possibilities like easy update, global access and easy contact for teacher and student, quite often it is prone to cause new problems. For example, the users of an online learning system can have several internet connections of various types ,and as a result, download rates (i.e. cable, modem, DSL or GPS). A weak point in the online learning method can be the internet connection itself. If the internet connection is not reliable the learning process can be blocked or slowed. Moreover, not all computer users have the same technical possibilities like for instance the high quality of internet connection. Due to that fact, some of them can have problems with downloading data or when using intensive online applications.

One of the main principles of e-learning systems is flexible distant learning that can

be realised by internet connections. At the moment it is not possible to offer all of the users the same internet connection speed. Therefore programs on CD/DVD or other data media provide interesting alternative.

2.5 Computer Aided Assessment

Other major motive in e-learning is Computer Aided Assessment (CAA). Knowledge assessment is a substantial part of every teaching procedure. Teachers as well as students need to obtain information about learning/teaching achievements for further learning program.

In CAA a computer playing a role of a teacher is regarded as less flexible than a human being. Owing to this, methods that are used by computers to control if students are familiar with the subject should be simpler but reliable. In CAA, probably one of the most popular assessment systems is a multiple-choice test [4]. Multiple Choice Questions (MCQ) or items are a form of assessment item for which respondents are asked to select one or more of the choices from a list. Many e-learning programs are constructed in such a way that after having been given answers on few questions, the system will adapt the coming questions to the level of student skills. The intelligent type of assessment that can be easily performed by human teacher, cannot be implemented in CAA with ease.

Applying multiple choice test, it is easy to give marks and prepare clear statistics about progress in learning and the weak points [5]. On the basis of this knowledge, the next learning module can be chosen. MCQ should make the learning process more flexible. A student, having a clear knowledge about his progress, is more motivated to perform further in an e-learning course.

In Computer Aided Assessment the system uses solely positive or negative marks. Additionally the computer takes into account only final results leaving alone the way

that led to these results [5]. It may happen that the computer is not able to consider all possible methods of solving a problem. A human teacher in this issue is more flexible.

3 Benefits of e-Learning

The will to learn is always a very positive property. If this will is provided, probably all of the learning methods, old conventional as well as novel ones are likely to be successful. The learning methods are adjusted to the contemporary times and to the dynamics of society. In this section, common advantages of e-learning methods based on the work of Bielawski and Metcalf [6] and on the work of Rosenberg [7] are listed. The mentioned benefits are illustrated in Figure 2.

3.1 Low Costs of e-Learning

e-Learning is a great alternative to the traditional learning. In comparison to the traditional courses, the costs can be reduced to a large extent. A good example can be the travel expenses and also the infrastructure costs that are practically non-existent in case of e-learning.

Moreover, the e-learning courses on CD's can be used many times to refresh the knowledge after some time or can be given to other users. In contrast, additional costs are generated if the rehearsal of a traditional course is required. Also, in general, traditional courses are regarded as more expensive then their e-learning alternatives.

3.2 Flexibility

As far as traditional courses are concerned, it is frequently difficult to attend them because of time-organisation and technical reasons. As opposed to conventional learning methods, e-learning is place and time independent. Students that are employed or are on a tight schedule due to some other activities, or persons that cannot commute because of variety of reasons may prefer many different e-learning offers rather than traditional learning approaches. The e-learning can be accessed 24/7 and everywhere if computer

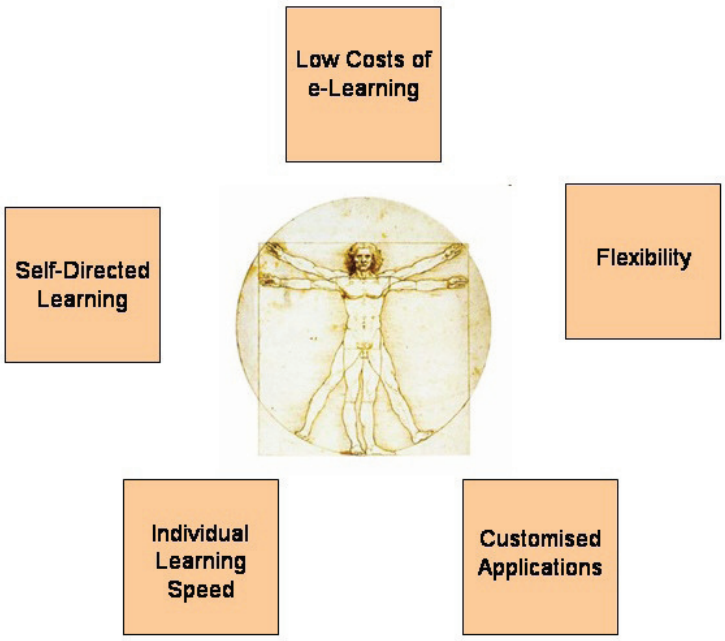

Figure 2: Benefits of e-learning for humanity

is provided, hence the e-learning method is truly global.

3.3 Self-Directed Learning

The student is confronted with the learning material and can decide on his own how the learning process proceeds. During e-learning the student is exercised to look for some additional learning materials and to learn without the assistance of a tutor. As a result, the students get to know how to perform researches and work independently.

3.4 Customised Applications

In the traditional learning, an individual is usually taught in groups. Therefore, he gets the content in the same way as other do. The taught material is mainly adjusted to the average needs of the group and there is no place or time for the adjustments to the individual preferences.

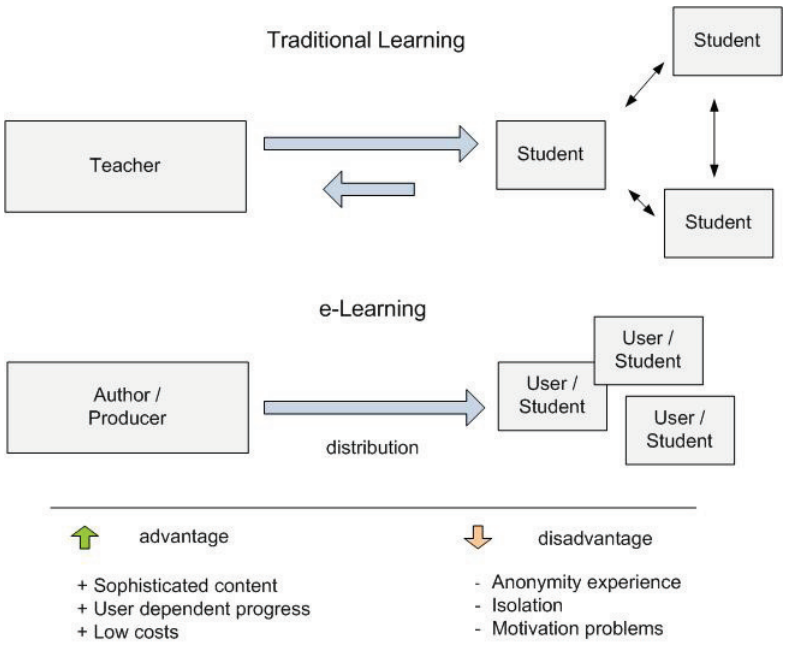

Figure 3: Advantages and disadvantages of e-learning versus traditional learning

The conventional learning methods depend strongly on teachers' skills and experiences. This means, that the students being on the same level and doing the same course, but with a different tutor, will not proceed or perform equally. The great advantage of e-learning is the ability to customise the learning program to the different needs and expectations. If the customisation is done in a rational way, every student is given a good chance to be successful.

3.5 Individual Learning Speed

Every user of the e-learning application can select an e-learning tempo that is optimal to his abilities. In comparison to the traditional learning where the learning tempo is given by the teacher, e-learning is considered more user-friendly as it is ready to adjust the learning speed to the individual needs. Also the frequency of the lessons can be adjusted to the optimum. The individual learning speed of e-learning is a true benefit especially for the students with strong self-motivation.

3.6 Possible Drawbacks

If one considers e-learning as an application that is used locally on a personal computer, the E-learning has a great number of intrinsic advantages over traditional learning. Actually, e-learning is not equal to traditional learning and in the point of view of traditional learning certain drawback of e-learning can be noticed. Some problems that can be observed in e-learning methods are anonymity experience, feeling of isolation and lack of motivation. These problems are typically much easier to avoid in traditional learning. The main source of the mentioned drawbacks of e-learning come from the fact that the teachers and other students are not present during tuition and that the human assistance cannot be fully substituted by the computer (Figure 3.

On the other hand e-learning has some great advantages that cannot be easily met in traditional learning. These are cost reduction, sophisticated content and single-user-dependent content.

4 Philosophical and Pedagogical Aspects

In the philosophy and pedagogy of the traditional as well as the e-learning, there are four fundamental currents: behavioral perspective, cognitive perspective, emotional perspective and constructive perspective. The e-learning methods source from all of these paradigms. The summary of the main pedagogical and philosophical perspectives together with their properties are summarised in Table 1.

4.1 Behavioral Perspective

The main focus of behaviourism in the process of learning are the processes that occur in consciousness. The consciousness is treated like a ”black box”. The physical part of learning plays the main role for behaviorism researcher. Only measurable learning processes are taken into account, i.e. processes that have results and that can be concisely interpreted in one way. According to the theory of behaviorism, it is not possible to follow the cogitations, hence only the physical situations and results are traced.

American behaviourist B. F. Skinner believed that emotions were conditioned by habit, and could be learned or unlearned. To influence the habits behaviourists used the method of punishment and award [8, 9]. Behaviourists believe that every action will result in a corresponding reaction. On this basis they try to control all processes in order to become acquainted with learning processes.

Some elements of behaviourism are also observable in e-learning. Learning applications are implemented in way that allow the system to save results of a test that was performed by the user. Programs can measure the human knowledge and using it can decide if the user can switch to the next step in a course. The learning model is based on the atomic unity. Bigger subjects are split into small (atomic) parts. Students get a small portion of information and should repeat them so long until they can repeat the infor-

mation correctly. The learning process is supported by the method of punishment and reward. The example is: if results of tests are excellent, students get verbal stimulation like: ”Good!” or ”That’s right!” [10].

4.2 Cognitive Perspective

Cognition is a science that deals with mental processes in the human brain, tries to explain, simulate and model them. Cognition science concentrates on the knowledge development as well as thinking, knowing, remembering, problem solving and judging.

The purpose of the cognitive psychology is to investigate the characteristics of the aforementioned abilities and to describe them as far as possible in formal models. Then these models can be realised as a cognitive architecture on a computer. The main meaning of this cognition in computer architecture is explained by a Nobel laureate Herbert Simon [11]:

”AI can have two purposes. One is to use the power of computers to augment human thinking, just as we use motors to augment human or horse power. Robotics and expert systems are major branches of that. The other is to use a computer’s artificial intelligence to understand how humans think. In a humanoid way. If you test your programs not merely by what they can accomplish, but how they accomplish it, they you’re really doing cognitive science; you’re using AI to understand the human mind.”

In the cognition science, the language usually plays a central role. The linguistic control belongs to the prominent cognitive abilities of the human being. Without language many thoughts could not be thought and many problems could not be solved. On one hand, the question is, how the control of linguistic skills is possible. On the other hand it can be asked how this control can be implemented in machines. Another question of cognition science is: how it is possible, that people are able to learn languages? Till the twentieth century, the opinion ruled that, the linguistic acquisition can

be explained through filtering out the linguistic rules. Basing on this theory, Noam Chomsky [12] expanded the understanding of human linguistic skills. He states that people are equipped genetically with a linguistic organ which makes the linguistic acquisition possible. The linguistic organ is settled in the brain. Chomsky argues that the linguistic acquisition through cognition methods can not be explained. The linguistic input of the people was not enough to fix the rules of the correct language. On the one hand, the spoken language is very often ungrammatical. On the other hand, by the children learning the input admit grammatical mistakes, but the children don't do these mistakes. Chomsky believes that there must be innate linguistic knowledge on which the linguistic acquisition can be built. This innate knowledge is in particular a grammatical knowledge and universal grammar would be given to all people during their birth [12].

The cognitive learning theory shows a several ideas how the learning process can be explained. This theory says that human memory has two main channels that are used for information processing. The first channel is visual and the second, auditory. The human brain uses only a small percent of its capabilities and the processing information is limited by human memory. Therefore the learning process is not an easy task. Learning happens through active processing in human memory system (rehearsal). New knowledge has to be connected in the long-term memory with all ready existing knowledge. This process is called encoding. During the process of retrieval, the knowledge will be transferred from long-term memory again in the working memory.

4.3 Emotional Perspective

The emotional aspect of learning contains subjects like motivation, fun on learning, commitment etc. Fulfillment and emotions are the main motivation for all activities. Frequently the term 'affective perspective' is used on place of the 'emotional perspec-

tive' [13]. According to the authors this perspective takes into account emotional state of the student. Hence, the computer system can make decisions on an appropriate learning tactics. The methods based on the emotional perspective concentrate often on keeping positive mood of the student. This strategy can be often noticed in the e-learning programs.

4.4 Constructive Perspective

Constructivism is a perspective in philosophy that sees the process of getting knowledge as constructing. It tries to analyse what is the nature of human learning. To construct the knowledge many conditions are necessary for example: the teacher should know social convention, have good perception and social experience. Constructivism sees the teacher as person that will support students in learning processes but does not have to teach them. Teacher should show where to get the information from and how to get it. According to this theory every student knows, what is the best learning method for him and how he can learn effectively. This statement concerns mostly adults.

Constructivism provides the basis for experience. Words, symbols and cultural meaning of the symbols are the base for explaining meaning of situations and problems. In general all interactions with the environment are important to construct knowledge. Information learned in this way has structure that can be rebuilt, changed and expanded in a natural way.

4.5 e-Learning and Human Learning

Human memory is based on two channels: visual and auditory. The programmers of a learning program should prepare the guidelines in such a way that information from the lesson will be received by visual and auditory sensors. In this case the guidelines are

Table 1: Philosophical and pedagogical perspectives and their characteristics [14, 15]

Category	Behavioral Perspective	Cognitive Perspective	Constructive Perspective
The mind is:	passive information storage	information processing tool	integrated system
The knowledge is:	stored	processed	constructed
Learning goal is:	right answers	adequate methods for finding answers	coping with complex problems
Paradigm is:	stimulated response	problem solving	construction
Strategy is:	teaching	observing and assisting	cooperating
Teacher is:	authority	tutor	trainer

defined as principles by which a judgment, a determination of a policy or a course of action are made. Afterwards the information is transferred from the working memory into the long-term memory and can be used any time.

4.6 Stages of Learning Process

In general, the learning process can be described in four steps [2]:

- Selection of important paths in the learning materials.
- Reorganisation in working memory due to its limited capacity. This process is called rehearsal.
- Integration of auditory and visual information with already existing knowledge. It is an integration of sensory information from the working memory with the existing information in the long-term memory.

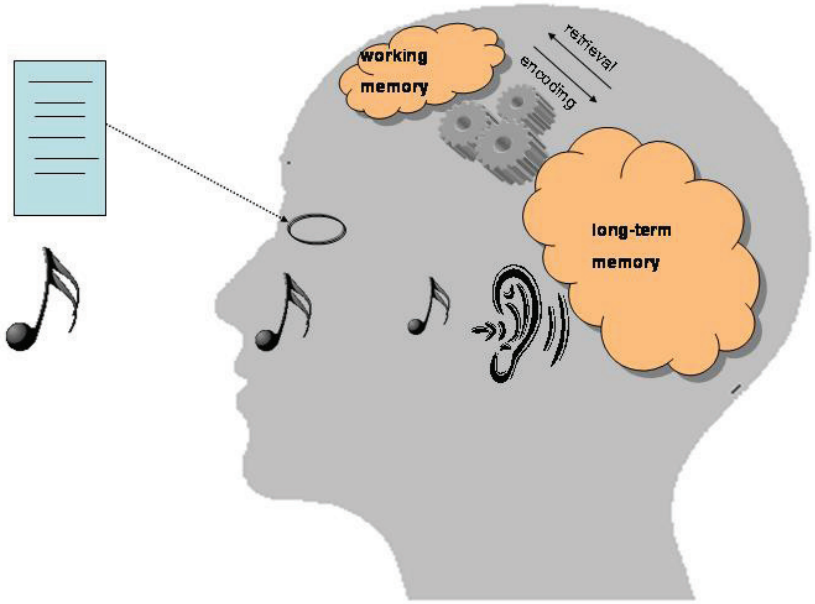

Figure 4: Learning process

- When the information, which is accumulated in the long-term memory, is required, it is passed to the working memory (process of retrieval).

All the aforementioned processes are happening via metacognitive skills.

In order to make the learning process easier, some methods are used to empty the working memory. Excessive numbers of simultaneous visual aids, sounds and texts can lower the learning abilities. On this account, the e-learning courses should try to minimise the irrelevant visual aids, background music and other sounds. The lengthy texts are also not recommended.

4.7 Levels of Practical Knowledge

During learning process, the students appropriate the practical knowledge. It is possible to split the learning process in five stages. Each of the stages describes different skills that can be achieved by a student. The five stages are in detail described in the work

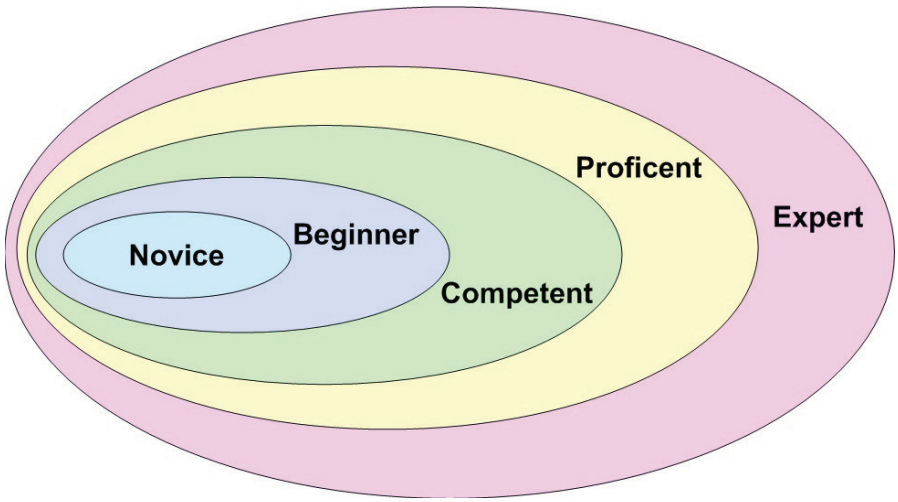

Figure 5: Levels of practical knowledge

of Roehrling [15] and in the work of Markowitsch [16] and can be summarised as described below. To make distinct separation between learning stages, the differences are presented in Table 2. Fig 5 presents the development of the knowledge and its content dependencies.

4.7.1 Novice

The student is starting to learn subjects that are completely new for him. He has no experience and no opinion about the new topic. The first step is to learn basic definitions and rules, that are connected to the branch of knowledge or capabilities that are new for a student. In this phase only the theory is acquainted. This knowledge will be a fundamental basis for the next learning stages.

The possible risk of this stage is, that the student may try to use newly learned knowledge as a final aim. The second problem can occur if the learned rules and definitions are understood as constant and unchangeable. In this point, the students frequently forget (or do not know) that there are often exceptions to the rules. To be able to learn something new there should always be some place for the divergence. Learning rules

Table 2: Summary of the learning stages [15]

Stage	Learned elements	Decision making
Novice	context-free definitions and rules	passive reception
Beginner	using context-free definitions and rules and making first experiences	mimicking and imitation
Competent	using context-free definitions and rules and involving of first simple experiences	analytic
Proficient	ability to recognise distinct situations and making conscious decisions	analytic
Expert	ability to recognise distinct situations and making conscious decisions	intuitive

and definitions should be only a starting point in the learning process.

4.7.2 Beginner

In this stage, the student learns how the application of definitions and the rules depend on the real situations. The ”Know-That” from the novice-stage changes to ”Know-How”. The practical exercises help to build experience but on the other hand also introduce the feeling of insecurity. By asking questions the problem of insecurity can be easily solved. During a learning process with a human tutor it is unlikely that the questions that are asked by student would remain unresponded. When using e-learning programs, it can happen that problems with answering student’s question appear. Presently, the artificial intelligence of the programs attempts to support the student with context help. However there are different stages of development of context help, and it may happen

that a simple context help is not responsive to the student's needs.

4.7.3 Competent

In this stage, the student is working more independently. He makes decisions by himself and also can classify the learned definitions to the context of the situations. The rules of thumb are used in the reasonable and conscious way.

In this stage the student knows already how to choose between the limited number of alternatives. He bases his decisions on the rules and experiences that he has learned until now. He is working actively on his learning process. Unfortunately, his knowledge is dedicated only to a limited spectrum. As a result, the complex situations are often simplified. This simplifications can lead to to confusion in the understanding of the learned topic. Moreover in this stage it frequent that the student overestimates his knowledge.

4.7.4 Proficient

The most important in the stage of proficiency is to understand the situations as a unity, and not to split the understanding to single independent on each other parts. The theoretical knowledge and the practical part of it is now replaced by intuitive behavior. The intuitive reactions are based on the already stored knowledge and experience.

4.7.5 Expert

In the last stage, the student is not actually solving problems and not making decisions any more. He is automatically doing things that are appropriate in the given situations. However, the problems can still occur when the situation is actually different than assumed by the student. Starting from this moment, the student has to start from the

beginning to learn how to act in a new situation, to extend the definitions, experience and intuition.

5 Didactic Method of Language Learning

There is not widely accepted definition of the didactic learning theory. In general the didactic learning theory would help to analyse and structure the learning materials in order to plan a lesson or course. In the recent years, the e-learning has appeared as a new aspect of learning. The technical progress allowed a dynamic development in this area. The pedagogical aspects are realised by the new technology. The interactivity should strongly support the realisation of the pedagogical characteristic. However, building one learning system on experts opinions and technical possibilities is not a trivial task [17].

In the work of Bertin and Grave [17] there are presented some sets of properties that characterise a learning system. They can applied to the computer-mediated learning process.

In the dynamic dimension, the level of the user competence can change (input change). Then the system collects the modification, analyse them and interpret them to transport them into output.

In the structural dimension, the system components' constraints are defined. The following system of elements is fixed: (a) system limits, (b) available elements, (c) where and how the information is stored, (d) information exchange in the system and between systems or environments.

In the functional dimension, the organisation of the temporary processes is done in the system. The following processes are managed in described dimension: (a) transport of input to output, (b) system control, regulation, adaptation and monitoring.

One of the learning models that is considered as versatile is Instrumented Activi-

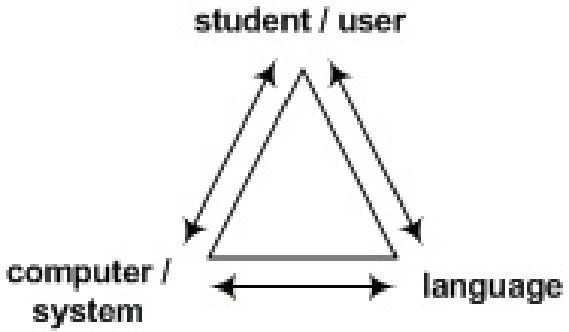

Figure 6: Instrumented Activities Situation Model adapted for e-learning language course [17]
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ties Situation Model (IASM). This model considers three features imported for didactic learning theory. The first is the subject. In the context of e-learning, it would be the user or student of an e-learning application. The second is the instrument, in the case of e-learning, a computer/system and an application are the instruments. The third feature is the object. In an e-learning course of foreign language, object equals language. This model, adapted to the e-learning language courses is presented in Figure (6). The all three components must be considered in the planning of a language course.

6 Main Elements of e-Learning Programs

Nowadays, learning methods try to utilise novel technical methods for learning. This should make the learning process more intelligent and easily accessible. The programs are able to collect informations from the users, subsequently rework them and produce some reasonable feedback. In this section, the main elements of contemporary e-learning programs are shortly presented. Some further problems like culture aspects are also focused in this section.

6.1 Representation of Contents in Digital Media

Representation of the contents is done by various methods like graphics, tone, text and video. In the recent years, the progress in the information technology has created many new possibilities to combine text, graphic and sound. The development of computer technology has opened a new chapter in the e-learning.

In distant past, text was used as the main learning material. Although traditional books are valuable sources of knowledge, they are considered to be not flexible. To rebuild or to add some information to a book, it is necessary to print some extra pages. It is not possible to add new text somewhere in the middle. On the other hand, it can be easily done with the data in the electronic form. In this case, updates of information are quick and easy.

Text as a method of explanation for some problems or situations is not always adequate. Especially in a situation when a completely new subject is taught, pure text can lead to many misunderstandings. The way how text is understood is often very different from the correct meaning. Therefore it is advisable to support written information with graphical interpretation.

By means of graphic representations like pictures and photos, it is realistic that the

Figure 7: A picture that can be interpreted ambiguously

student is able to understand the text. Some people learn faster if the learned material is connected with some visual explanation. Graphics in form of separate objects is basically useful while teaching languages. However, as far as the graphic representation of some situation is concerned, a special care should be taken to consider cultural aspects and differences. The way some representations of situations are associated vary from culture to culture. This cultural differences can cause misunderstandings. The way how the illustrations are interpreted can be also influenced by the past experiences (see Figure (7)). For people that have problems with their stomachs, the Figure (7) will represent a person having stomach pains and screaming from suffer. But for other observers this illustration may exhibit a person that is laughing. The understanding of the meaning can be supported by other media. If the illustration in Figure (7) were supported by sound the meaning would be easier to recognise.

Table 3: Types of e-learning guidelines

Guideline type	Training goals	Examples
Show and tell - receptive	Inform	Product installation
Tell and do - directive	Performance	Training
Problem solving - guided discovery	Performance and problem solving	Analysis and sales skills

To describe actions and situations, probably the best representation is a movie. The optimal compilation of sound, illustration and action is the best way to support the learning process. By means of this medium, every topic can be learned in a natural way, i.e. using observation. A good example for this is, that in east block countries, TV did not offer any programs that were coming from western countries. Some people were bored with the low assortment of programs and got videos in foreign language. It was easy to notice that after some time some set of foreign vocabulary was learned. The similar situation exists in Scandinavian countries, where TV presents programs and movies in original versions. This works excellently as learning method.

If learning systems use animations and movies in a controlled way, they can become an amazingly powerful tool. Knowledge can be absorbed with friendly and easy methods.

6.2 Pedagogical Principles of e-Learning

The success of an e-learning system depends on the pedagogical aspects and also on the graphical form of the program, which is especially important during the first contact

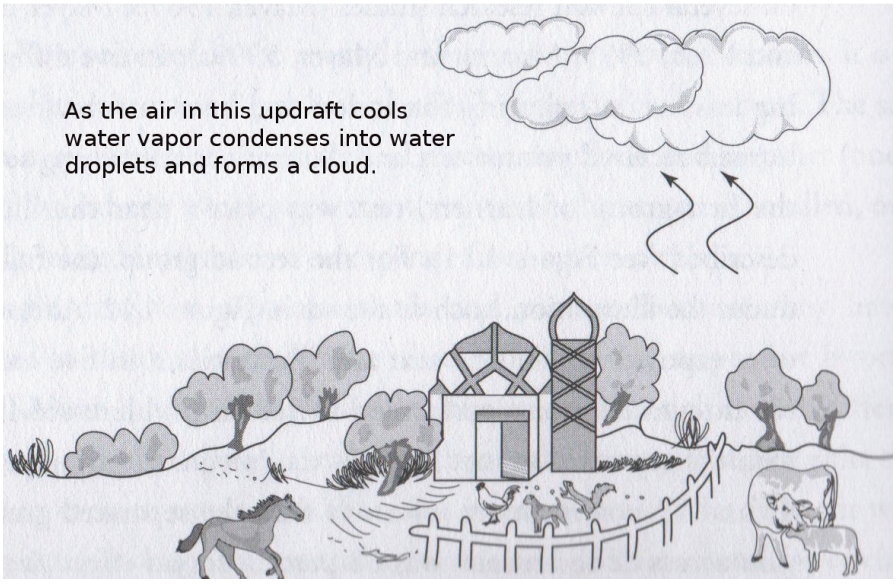

Figure 8: Graphical representation with text [18]

with the program. A clear presentation decides if the student will use the application or not. There are many factors that have influence on the form and structure of an e-learning program. The most important of them are:

- the kind of training that is expected
- culture
- technological constraints
- availability of networks that can be used in learning
- time that student plans to spend on learning
- budget

All these elements influence the form and the content of e-learning applications. Therefore guidelines are recommended to adapt learning environments to students' individual needs [2].

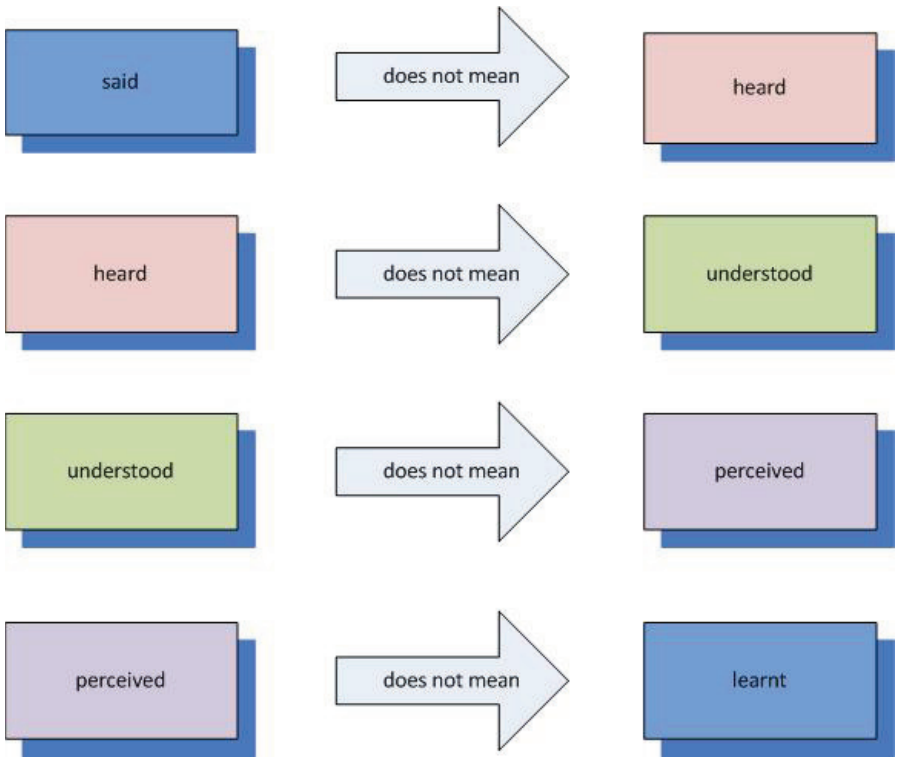

Figure 9: Complications in the process of learning

There are many elements that can be used in the e-learning process, i.e.: text, simple graphics, video, animation, sound or even some games. However, there are some technological constraints that introduce limits to the programming of e-learning applications. Some years ago capacities of memory and computational power were the limiting factor, but it was omitted by introduction of CD/DVD and progress in the development of more powerful personal computers.

Scientific investigations suggest that the best learning method consists of textual explanations of graphics on the screen. This means that pure graphical representation without the text and vice-versa are not so successful as combination of both [2]. An exemplary solution is presented in Figure (8). As it can be seen the combination of text and graphics is a powerful learning method. It helps to avoid misunderstandings which can appear when only textual or graphical explanations are used.

The three types of e-learning guidelines are given in Table 3. All of the three methods can be used separately or they can be mixed with each other. Which components will be used depends on the material that is supposed to be taught.

Communication together with the understanding of problems is typically a long and a complex process. The situation when a student is provided with an information that he is supposed to acquaint does not have to guarantee that he or her has learned the subject. The Figure (9) visualises in a schematic way the examples of the states where the information can be lost in the process of learning.

7 Course Description

In this section, a common, modern, arbitrarily chosen e-learning German course will be described. The title as well as the publisher of the program is not revealed in this work. The program consists of many levels from beginners to advanced. However, solely the first elementary part of the course is focused in this work. From the observations of the author, the investigated German course is relatively popular and widely available on the market.

The author of this work believes that the majority of the popular e-learning courses have many features in common. Therefore the considerations of this work are assumed to be versatile and extrapolable to the other available e-learning courses.

The investigated program consists of relatively large number of different types of exercises and e-learning approaches, they are discussed within the following sections.

7.1 Content of Course Package

Three different media types are provided within the course package. The first one is the learning software, i.e. the multimedia course prepared for PC, which is the key feature of the package.

The second element is the audio CD that can be played on a CD-player. A variety of audio material is included within this CD, mainly narrated stories. The topics of the audio CD have been associated with the interactive course.

The last element of the delivered package is a text book which consists of whole necessary text that is used in the e-learning course. An interesting feature of the package is the possibility to use the text book and the audio CD when no access to a PC is given. Actually, this solutions combines conventional learning methods with the modern e-learning ones.

7.2 Hardware for e-Learning Programs

To use all the functions of this e-learning program two additional hardware elements are necessary: a headset or microphone with speakers. In this case the head-set is not included with the package.

7.3 Description of Main Learning Options

The program offers structured material to meet different learners' needs. Students may choose from the following user languages: English, French, Italian, Spanish, or German. Grammar explanations, translations of words in the vocabulary practice and all help files appear in the selected language. Students can also choose between four learning methods and those are described in the subsections below.

7.3.1 Systematic Training

The complete language course is designed to help the students improve their language skills systematically. The learning of all language elements is included in this approach: grammar, pronunciation, vocabulary, reading and listening comprehension. The learning path in this type of training is predefined. For the student it is not necessary to choose learning subjects.

7.3.2 Individualised Training

In individualised training ("Individuelles Training"), students will find several different ways of using the language course to complement previous knowledge, to reach personal learning goals or to practice specifically targeted skills. Basically there are several approaches to individualise the learning in the investigated e-learning course:

- *Course planner* - in this training section, the student sets a learning goal and the

amount of time he is supposed to study. In case he has any previous knowledge of the foreign language, the evaluation test will determine his strengths and weaknesses. The software will subsequently create a personalised course of study based on student's individual needs.

- *Vocabulary practice* - here new words can be learned with a variety of exercises or using the interactive index card boxes. The words can be copied into the vocabulary training directly from the individual exercises, or even from whole units.

- *Exam generator ("Pruefungstrainer")* - this allows checking if a student is suitably prepared to sit exams under realistic test conditions. Students can determine the exam material, the duration and the number of exercises. The software generates the exam according to the preferences.

- *My exercises ("Meine Uebungen")* - in this training the user can create his personalised training. He is able to copy the desired exercises and units into the "my exercises" folder. Afterwards he can decide exactly which topics he prefers to cover and how long the course should be. He can even print out his own selection of units and create his own textbook (this can be an ideal way to review the course content or reinforce the student's work on a language course).

7.3.3 Skill Training

This part is designed for students that have already preferences for certain subjects. In this section, the student can find a complete pronunciation laboratory in which he can systematically practice from the basic to more difficult words and other specialised vocabulary. Furthermore, he is also provided with topic-related exercises (for example "eating and drinking" ("Essen und Trinken"), or "making complaints" ("Sich beschweren")), a series of reading and listening comprehension exercises and thematically-

organised grammar exercises. In the comprehensive grammar glossary (”Grammatik-glossar”), he can quickly look up relevant grammar topics.

7.3.4 Exam Preparation

Here, the student will find specialised exam preparation courses for internationally-recognised language certificates. He can choose a language certificate that he would like to prepare for. The e-learning software will then offer a course adjusted to his preferences and abilities.

7.4 Video Tours and Buttons

In the investigated learning system, the student is supported by a video tutor in his learning process. The video tutor can be male or female according to the user’s preferences. If the user uses a headset, he can communicate with the tutor calling his or her name and then saying a command like ”play”, ”stop” or ”next”.

The alternative way to voice communication is using buttons. The icons can be easily understood, because they are representing widely known symbols like visualised in Table 4.

7.5 Learning Methods

The described e-learning course uses a great variety of learning approaches. These are combined in user-friendly and entertaining lessons. This subsection focuses on the description of the learning methods that were applied in the program’s lessons.

Table 4: Widely known symbols for navigation in media

Symbol	Description
	play the photo story
	stop
	move to the next part
	return to the begin
	hear the text again
	speak to the microphone

7.5.1 Photo Story

The program presents a scene that is associated with the actual subject of the lesson. It helps to learn the new vocabulary and grammar structures, as well as to work on reading and listening skills. The first step is to listen to the story and read the conversations, in the second step, the listening is done without help of the text. The next step is the pronunciation practice. Additional feature of the photo story is the possibility to navigate by giving voice commands. A typical example for a photo story in an e-learning program is given in Figure (10). According to certain studies the combination of a kind visual presentation (i.e. animation or picture) and a narration is one of the most effective learning methods. For instance, Mayer [19] performed a series of studies on the effectivity of learning in exercises in which animation with narration and animation with pure text were used. He concluded that approximately 69% of the students understood the problem when both narration and animation were used. In contrast, only 31% were

Figure 10: Photo story

able to understand the problem when the animation was supported by the pure text only. The results of the Mayer's study are given in Figure (11).

7.5.2 Exercises

There are various types of exercises to improve specific language skills like: reading speaking and listening. The type of the exercise is identified by a graphical symbol. In order to understand the tasks of the exercises the user can listen to the video tutor's instructions or simply read them.

7.5.3 Exercise Model

In order to complete the exercise, the user can use the dictionary by right-clicking on the unknown word. In the dictionary, it is possible to see the translation and the pronunciation as well as short grammar of the word. The favorite words of the user can be added to "my words" section ("Meine Vokabeln"). They can be afterwards used in the

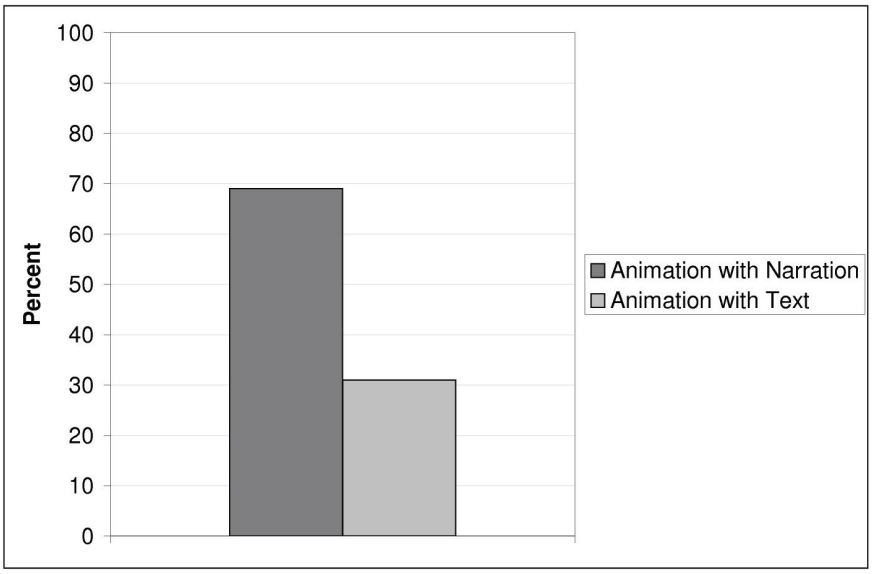

Figure 11: Influence of animation on the learning efficiency Mayer [19]

vocabulary practice section.

7.5.4 Correction

When the exercise is finished the user can start the correction option. The program identifies errors and provides a short hint to correct the mistakes. In case user wishes to see the correct solution, he can choose the option solution (”Loesung”).

7.5.5 Listening and Pronunciation

When the exercise is finished, the other possibility is to practice listening and pronunciation skills using the words that the user was acquainted with during the exercise. Results of the exercises are shown in the plan of the course.

7.6 Types of Exercises

A great number of different types of exercises can be distinguished within the course. They are listed below.

- *Drag-and-drop exercises* - are the actions of clicking on a virtual object and dragging it to a different location or onto another virtual object [20] (Figure (12)).
- *Fill-in-the-gap* - the user should type the correct solution in the gap (Figure (13)).
- *Fill-in-the-gap with alternatives* - this exercise is similar to the previous one. The difference is that the user does not need to tip the words in the gap but click on it as long as the right answer in the window appears (Figure (14)).
- *Multiple choice exercises* - in this training the user can create his personalised training. He is able to copy the desired exercises and units into the my exercises folder. Afterwards he can decide exactly which topics he prefers to cover and how long the course should be. He can even print out own selection of units and create own textbook (This can be an ideal way to review course content or reinforce student's work on the language course) (Figure (15)).
- *Answering exercises* - these are exercises in form of questions to some film story. The user should fill in the gaps with the right answers (Figure (16)).
- *Scrambled sentences* - here, user should construct a sentence by putting the words in the correct order (Figure (17)).
- *Picture choice exercises* - in this type of exercise, the user should place a picture in the correct gap (Figure (18)).

- *Pronunciation exercises* - in this exercise student is asked to imitate a native speaker's pronunciation as closely as possible. The program will automatically compare students pronunciation to that of a native speaker.

- *Speech recognition exercises* - the user chooses a sentence or a word that he wants to be acquainted with. He is asked to pronounce it with the correct accent.

- *Text mark exercises* - the student should correct the false words or sentences and mark the incorrect text.

- *Self-explaining exercises* - here, the tasks in an exercise are already solved. Hence, the student can better and faster understand the backgrounds of the exercised topics. The exercises of this type support the memorising of the material into the long-term memory. Some authors suggest also that these exercises assist to connect new knowledge to the existing knowledge in the long-term memory [2].

- *Pronunciation practice* - these exercises are designed to improve pronunciation skills. The software analyses the pronunciation and recommends the tasks that should be fulfilled in order to improve. They can include: additional practice of the whole sentences, of the sentence parts or of individual words. The results indicate how good is the pronunciation in comparison to a native speaker. The goal is to achieve the correct answers to be at the level of at least 80

- *Listening comprehension* - as soon as an exercise have been correctly solved, the user can hear the text and make the listening comprehension exercise.

- *Language laboratory* - this exercise is designed to practice the pronunciation. The results of pronunciation exercise are saved in the course plan (”IntelliPlan”) and make up the part of the total evaluation score.

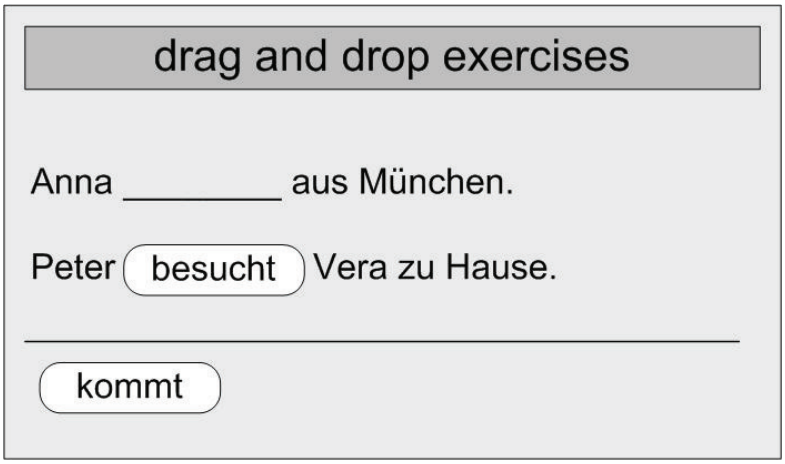

Figure 12: An example for an drag-and-drop exercise

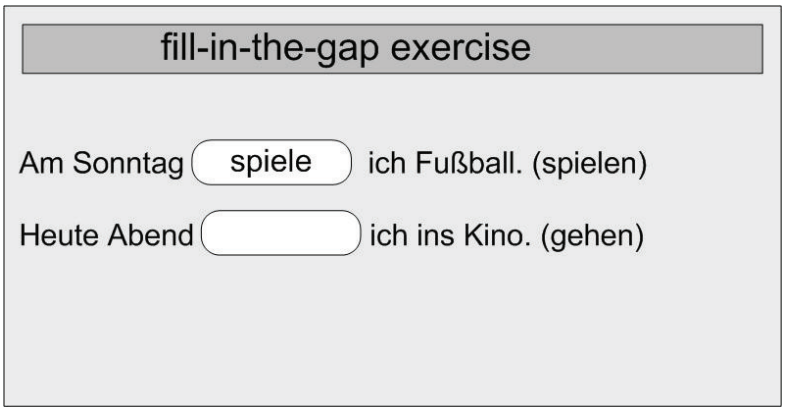

Figure 13: An example for a fill-in-the-gap exercise

- *Video conversation practice* - after the student has successfully completed the first few units of his language course, he can test the newly acquired communication skills. For this reason, the video tutor will engage him in a conversation. Usually, the video tutor asks the student to repeat some sentences.

7.7 Course Planning and Organisation

The course planner takes into consideration the student's goals, his previous knowledge of the language and the amount of time the student is supposed to spend on the course.

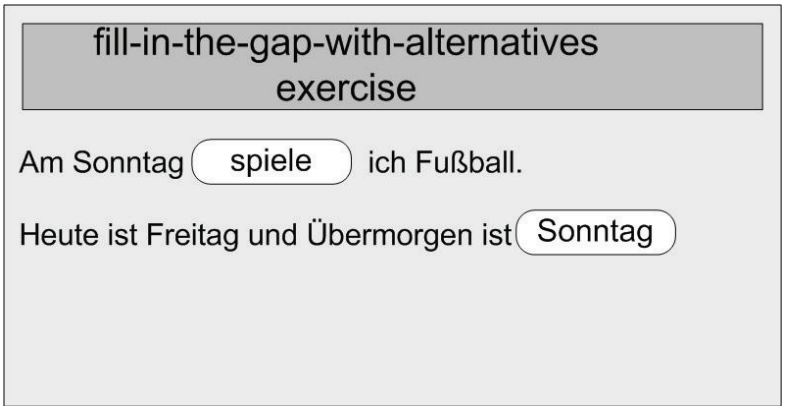

Figure 14: An example for a fill-in-the-gap with alternatives exercise

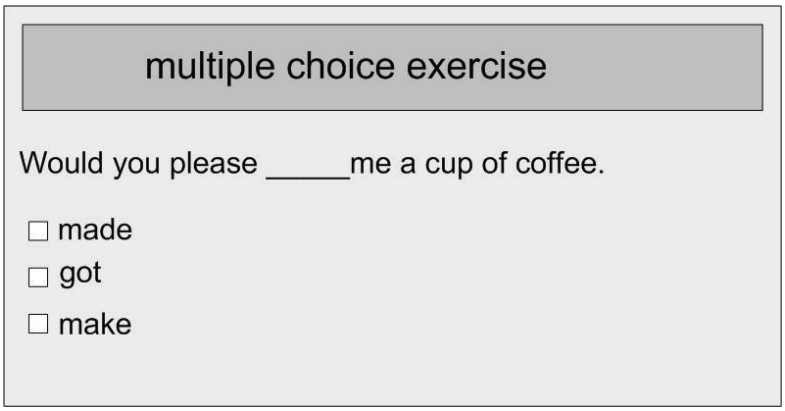

Figure 15: An example for a multiple choice exercise

In order to plan the course the student should provide the program with the necessary information, i.e. the amount of time he would like to spend on the learning and the preferred goals. On account of this information, the program builds a highly efficient language learning system and chooses the right learning method and the learning level. If the student has some previous knowledge on the taught language, he or she can make also the grading-test (”Einstufungstest”) that will show him or her the weak and strong points of the trained language. This can also assist when choosing the goals for the future learning.

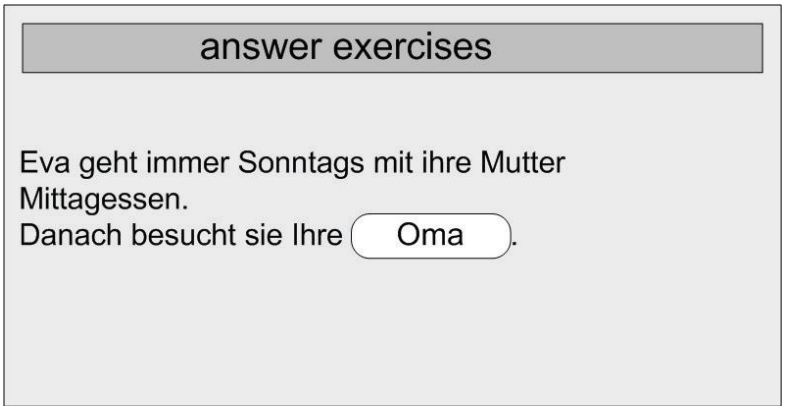

Figure 16: An example for an answering exercise

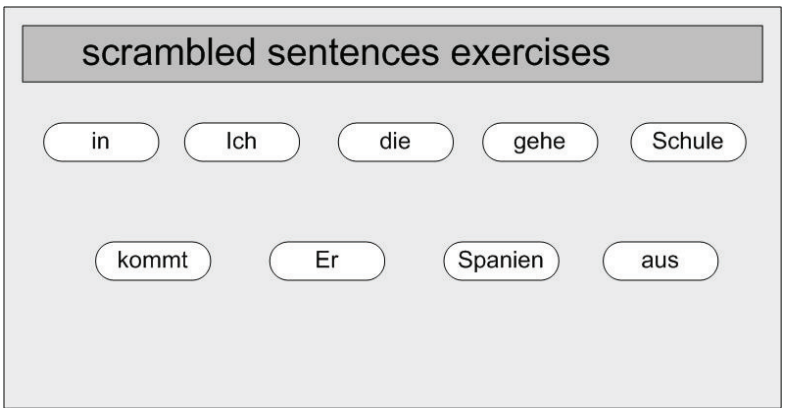

Figure 17: An example for a scrambled sentences exercise

7.8 Tests, Reviews and Examination Trainer

The course offers different features which support the student in the monitoring of his progress. The other options allow to review difficult material and to prepare for exams. The main elements of this section are:

- *Quick check* - at the end of a unit, the user can perform a quick monitoring of his progress.
- *Review* - the system shows the progress, the program pinpoints the areas that are most difficult for the user and then offers an extra review of these topics at the end of a unit.

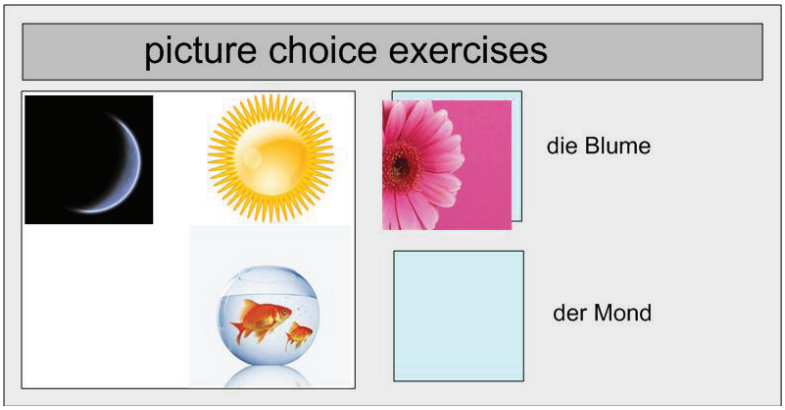

Figure 18: An example for a picture-choice exercise

- *Test* - student decide on his own which exercises he would like to work with.
- *Examination trainer* - testing the knowledge under realistic test conditions. In the section, own exams and tests can be created.

7.9 Focused Learning with Course Planer

The course planner (IntelliPlan) is organised into a hierarchy of folders. There are two main types of folders:

- A course folder contains either another folder or a photo story or exercises and have a plus or minus symbol which may be used to open and close them.
- A test folder contains test exercises which must be completed under test conditions.

Details of the progress are saved in the individual columns of the course planer. The user can observe which sections have been completed , the achieved scores and the subsequent sections that will be taught during next lessons.

The score for every exercise is saved on the same line as the exercise title in the results column (”Ergebnis”). At the folder level, the user will see his exercise and

pronunciation results for the whole unit (all the contents of the folder), the total time spent on the unit and the date on which he last worked on it.

7.10 Vocabulary Practice

In the program there are three main groups of vocabulary practice approaches:

- *Words list ("Vokabelliste")* - it is a list of all words that appear in the vocabulary practice ("Vokabeltraining").
- *My words ("Meine Vokabeln")* - the user can choose, add, practice and rearrange words on his own.
- *My card boxes ("Meine Karteikästen")* - The interactive index card method is an easy way to systematically learn new words and review old ones. The words are repeated systematically until they have been firmly rooted in long-term memory.

8 Interactivity

The interactivity in software systems means that the user is given the possibility to set some parameters and, as a consequence of these settings, the software system will act in the way defined by the user. For example, the user can set how much time he would like to spend on each lesson making the system adapt the program according to the user's expectations. Interactivity means also that the learning systems are expected to give feedback to nearly all actions of the user. In the learning systems, even a negative feedback should have a positive meaning. This means that for example if the student did not solve some problem correctly, the system should formulate the feedback in the constructive and motivating way. The aim is to motivate and show the weak points rather then to criticise [21].

8.1 Importance of Interactivity

In general, many authors and scientists agree that high level of interactivity is essential for successful learning process [22, 23]. The quality of the usability of an e-learning program increases usually with the level of interactivity.

However, the interactivity may be misunderstood. A large number of applications seem to be interactive, even though the interactivity level of these applications is actually very low. It happens sometimes that the feature of interactivity is given to applications for being only online applications.

The low level of interactivity, or an improperly designed interactive system can even disappoint the user, which can discourage him from further using of an e-learning application.

8.2 Levels of Interactivity

In the eighties, there were first tries to define the term interactivity. However, nowadays a strict definition of interactivity is not given. It is rather described as a propertythat can have various scale strengths. As a result, virtually every computer program possesses some interactivity features. However, it is decisive for and e-learning application which level of interactivity has been reached. The interactivity level can extend from the very primitive to advanced and intelligent forms.

For example, Bartolome [24] suggests levels of interactivity that are criteria for accessing the information in e-learning. The suggested main five criteria are presented below.

- *Level 0* - there is only one path, the same for every user, linear.
- *Level 1* - there are several paths for different users, branching.
- *Level 2* - the user selects the information to receive, branching by menus or direct access to different information packages.
- *Level 3* - the user not only selects the information but also the system of symbols.
- *Level 4* - the user selects also the source of information, he can access external sources of information.

Although there are more classifications of interactivity grades that focus on various types of activity [25] (like for instance reactive, proactive etc.), the author suggests that the aforementioned leveling can be used for the description of interactivity of an e-learning program.

8.3 Interactivity in Features

Metzger and Schulmeister have defined classification of program features in the context of interactivity. There are four main features where interactivity is used [25]; they are briefly described below.

- *Graphical navigation* - Direct navigation by icons, menus and graphical browsers. These elements should allow the user to select learning materials and learning methods. The user should be given the possibility to choose between many interactive elements like tables, diagrams, text or graphics.

- *Clickables* - Elements like: tables, charts, diagrams and graphics should be active, i.e. the user can click on some of this elements in order to get some more detailed information of this element. It can be for example some extra text, some explanation of the element's meaning or just a full-size graphics.

- *Simulations* - Learning programs should support the learning process with simulations. Simulations are helping to understand more complex problems by means of visualisation. To simulate real-life situations, the laboratories are recommended, therefore the simulation of laboratories in e-learning programs is also desired.

- *Feedback Signals* - Exercises should be constructed in such a way, that the user gets full feedback from the program with the information about the results. The system should indicate exactly where the mistake was made. The feedback should be immediate, and easily connectable to the subject.

9 Guidelines for Interactivity

Probably the most distinctive property of the e-learning is the interactivity. In comparison to the traditional learning materials like books, audio and video courses, the e-learning tries to fulfil the needs of the users. However, interactivity is often misunderstood as, for instance, only hyper-linking or simple clickables. Surely, such simple interactive features would not result in an effective e-learning environment. The guidelines for interactivity in learning programs were given in the work of Pohl and Schmalzl [26]

This chapter describes which elements are obligatory to create a user friendly program, where the user can enjoy its interactivity. A chart that visualises all of the essential interactivity features is given in Figure 19.

9.1 Immediate Feedback

As soon as the user feeds information into the learning system the immediate feedback should be given. The user should have the impression that all actions that he has made cause some reaction on the side of the system. The feedback should be possibly positive and motivating also in case of negative answers.

9.2 Introduction to System

Users need to be introduced into all interactive learning materials, in order to know how to deal with the interactive elements and how to obtain the most important information for them. Applications that are interactive offer flexible learning, and they should not be used like traditional books.

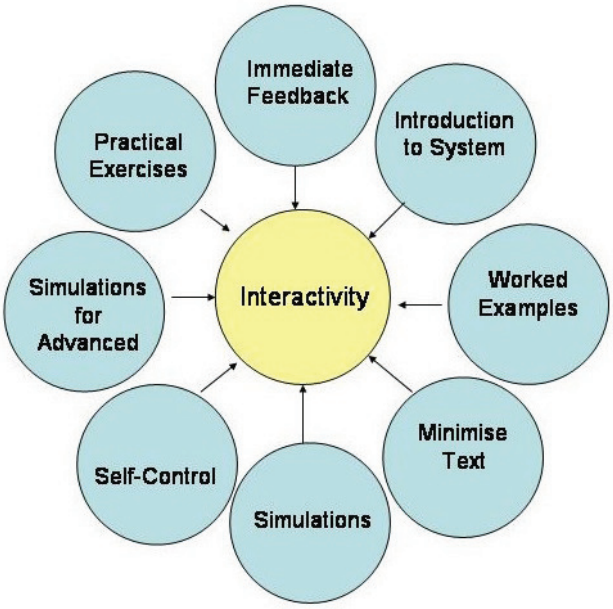

Figure 19: Features that make interactivity

9.3 Self-Control

The user should have the possibility to make self-control tests which can be used spontaneously. Therefore, the recent advances in the course can be followed. The user can measure his progress every time to notice how far he advanced in the learning material.

9.4 Practical Exercises

Practical exercises are considered to be the best way to position some knowledge in the long-term memory. Using this kind of exercises, students repeat some learned subjects and try to understand it in a real context. In the book of Clark and Mayer [2], many examples indicate that practical exercises are the best method to learn. In e-learning programs, practical exercises are used in a form of questions, drag and drop exercises or simulations.

9.4.1 Connection to Real Content

Practical exercises should not only check the learned knowledge but also show the connection between the real usability and the subjects. For example they should show, how to use learned skills at work or how to speak in some specific situation [2].

9.4.2 Time Management

Obviously, a greater number of performed exercises results in the acquaintance with more material. The only limit in this case is the time that student would like to invest in learning. The form of exercises should be well constructed to optimise the required time that is needed to learn. The exercises should be executed not only at the end of the learning material, but also between small chapters. This supports saving of the knowledge to the long-term memory and makes the student learn more easily.

9.4.3 Transparent Lesson Design

The exercises should be programmed in a sensible way. It is essential that the introductive material and parts of exercises can be easily distinguished from each other. These two areas should be separated. However, the answers to the exercises should appear exactly in the same application window where the user performed his exercise. The student should be given the possibility to easily compare his work with the feedback from the computer.

9.5 Worked Examples

Worked examples show step by step how a certain task can be solved. This type of the presentation of a task makes it more transparent and easier to understand. There are different kinds of worked examples. A detailed description how to make an exercise can

be in a form of a step-by-step explanation by an animation, a video with some experts performing this exercise or similar.

9.5.1 Worked Examples First

In case of beginners, practical examples should be replaced by worked examples. Basically all practical examples could be changed into worked exercises. For students being on an advanced level, worked exercises are not recommended. It is likely that many of them would skip this kind of examples. On the other hand, it is an excellent exercise for the beginners that shows how to apply correctly the newly learned material. It is important that worked examples are integrated before the practical exercises. Another possibility is to make an interactive exercise in which the worked examples can be changed with a one click into an exercise that the student would do on his own.

9.5.2 Frequency of Worked Examples

All the worked examples need to be based on the real usability and be useful in various contexts. In some cases, only one example is enough to show how an exercise should be done. It happens usually when the learned procedure is made always in the same way. In other complex cases multiple repetitions of worked examples are needed. Good example for an easy worked exercise is the instruction to start a vacuum cleaner. In contrast a complicated task, that would require more worked examples, is to clean an vacuum cleaner. Such process is split into more actions that can be done also in different order. Therefore all of the possibilities should be shown to the user.

9.6 Simulations

Simulations can help to build the knowledge and, based on this knowledge, to form some questions and to create some hypotheses. In successful e-learning processes, one

of the most important elements is systematic learning. Simulations support students in the systematic research and in collecting of the information. Additionally, simulations are considered to be a good motivation tool. The use of simulations as an e-learning method should be done in the proper way. It happens often that the simulation process is not fully understood by the students. Presentation of the planned tasks should be the first step in the process simulation. Afterwards the student should obtain instructions that indicate how to use the simulation and how to select, collect and save the provided information. Those steps are necessary to avoid situations when the students will play with the simulation without understanding it. After some time, when the user knows how to use the simulation, it is recommended to hide the instructions.

9.7 Simulations for Advanced

Students that have already some basic knowledge will find it easier to use simulations, than the students that are starting to learn a subject. Preferably, the simulations should be applied to rather more advanced students. It is not recommended to use the simulation for beginners. The beginners may find the simulation confusing as they focus on the way of working with simulation rather than on the learning material.

9.8 Minimise Text

Students using e-learning systems usually expect interactivity. An application that consists of many textual explanations and general text will demotivate the student. In case of the longer texts it is suggested to create PDF files and add it as a link.

10 Evaluation of e-Learning Software

In this work, an e-learning language course has been evaluated to determine some basic and also more detailed view of the e-learning software. The software evaluation generally consists of three main steps: data collection, data analysis and based upon the obtained results - answering the questions about the program. Typically, at the beginning of the evaluation the expectations for the investigated program should be defined. Subsequently, the expectations (requirements) are translated into clearly defined questions. Having prepared the questions, the collection of the data can be performed. The next step includes the data analysis that should explain firstly if the program fulfils the defined requirements and secondly determine the grade of the requirement coverage.

This work will consider the aspect of interactivity in e-learning software. To have an overview over a more complex evaluation, a short analysis of an evaluation made by Alarcom [27] will be presented.

10.1 Evaluation Criteria

Alarcom [27] suggested that the evaluation of the e-learning language course can be split into four main criteria:

- Neurological and psychological fundamentals
- Constructivism in the learning theory
- Constructive multimedia learning
- Pragmatic software components

10.1.1 Neurological and the Psychological Fundamentals

To verify if the neurological and psychological fundamentals of a foreign language learning process are realised well the following aspects are investigated:

- *General aspects* - the learning software should support emotional and psychic balance of the learning process as well as the aspects like cognitive learning, active and individual learning. The software should also be able to inspire the creativity of the student and additionally it must offer help and support in the appropriate moments.

- *Pedagogical an didactic aspects* - the learning system should be responsive to the students actions. The feedback should refer to the actual situation as well as to the learning method that is applied. Also the presentation of the learning materials should be presented in a interesting way and if possible the context of the exercise should be realistic.

- *Neuropsychological aspects* - the student should be considered as an individual. The learning software should motivate the student on variety of ways and levels. The learning motivation should be versatile, depend on the student age, individual and also should activate the memory connected with many disciplines. The software is expected to focus the attention of the student using the stimulation of the brain functions.

- *Neurobiopsychological aspects* - the software should allow the student to follow the language learning process that is individually adjusted to his profile and adapted to his age. The student should be supported by the verification of the language hypothesis with many exercises and training possibilities together with error correction.

10.1.2 Constructivism in Learning Theory

Based on the constructivism learning theory the following requirements for the learning software are verified:

- *Principles of the knowledge structure* - learning is an individual and active process. Therefore the learning methods and techniques as also the learning materials and content should be customised. The student should be able to learn by cognitive-active observation and by interactively cooperating with the software.

- *Conditions for constructive lessons* - in the constructive lessons the strategy of learning is less authoritarian and the presentation of the learning materials is flexible and adapted to the students needs. The learning itself is expected to be interactive and multidisciplinary. The student should learn: complex skills and strategies, team work and also how to transfer the learned knowledge to other contexts. The lessons should be multidisciplinary, related to reality, reasonable and motivating. It should be also possible to adjust the lesson to the student needs and expectations. In order to achieve successful learning process the impulse to study should be driven by the student himself.

- *Properties of constructive learning environment* - the student must be prepared for the learning material. The start point of the learning process should be a task or problem that is related to the realistic situation or experience. The task should achieve the following criteria: it must be interesting, complex, correct an presented in social context. The learning environment should allow the student to explore and control the approach. All the actions should lead to the reflexion about the student point of view and the learning situation.

Table 5: Criteria map for the software evaluation

neurological and the psychological fundamentals	pedagogical and methodical didacticism	based on profession	media didactic methods
construction of the knowledge	learning concept and learning method	language theory and neuro-psychological aspects	multimedial features
individual learning process	learning materials	correctness and being up-to-date	interactivity
autonomic learning	task definition and feedback	subject- and situation-oriented help	accessibility and availability
active learning	management of the activities and diagnostics		navigation
adaptive learning	user interface		innovation
	help		
	motivation		

10.1.3 Constructive Multimedia Learning

The criteria for the constructive multimedia learning that are verified in the evaluation process are presented below:

- *Fundamental conditions* - the learning features and abilities of a software are limited by the computer capacity. The software must offer the user the reasonable constructive learning process using possibly all of the computer resources. Additionally the user should be able to customise software to his individual needs. The fundamental requirement in constructive multimedia learning is the strong own motivation of the user.

- *Learning theory and didactic characteristics* - the software should be flexible, dynamic and contain interactive learning materials. The learning scope as also the usability of the application should be clearly stated. The construction of the knowledge in the software should develop self-learning skills of the user. The user should be also able to control his learning process by himself. Alternatively a selection of a tutorial way of learning should be available.

- *Pedagogical and media-didactic characteristics* - the selection of audio, video, text, animations and graphics used in the learning software should be based on didactic recommendations. The user should be also able to decide which elements appear during the learning course. Also the quality of the resources should be adequate in order not to interrupt the learning process. The user should be able to access all of the learning resources without any problems at every time. To reach the optimal learning results, the interaction with the application should be possible. It should noticed that the software should act motivating and the given feedback must be correct and reasonable.

10.1.4 Common Criteria for Software Evaluation

It can be easily noticed that some criteria are repeating in the aforementioned sections. It is understandable that some of them are equally important for one criteria groups as for the other. It can be observed that generally the common criteria for the evaluation of the e-learning software in the investigated work are:

- interactivity,

- learning motivation,

- content of the lessons.

In order to show clearly the differences between the three previously presented criteria Alarcom [27] has eliminated the not-unique criteria and has created summary of the unique criteria for each of the groups: neurological and the psychological fundamentals, constructivism in the learning theory and constructive multimedia learning. The most important criteria for each of the investigated groups are listed as follows:

Requirements for neurological and the psychological fundamentals are:

- student oriented learning,
- individual learning,
- self-governed learning (without control of a tutor).

Requirements for pedagogical and methodical didacticism are:

- learning concept (learning method),
- learning content (task creation),
- support offered,
- learning motivation.

Requirements based on media didactic methods are:

- orientation on multimedia,
- interactivity,
- customised features,
- accessibility,
- innovation.

10.1.5 Pragmatic Components

Eventually, the fourth part of the requirements, so called pragmatic components, can be created basing on the criteria that are presented below.

- *Check-list for the learning software* - suggested by Thome [28]. If used in the short version it contains the absolutely necessary components. The requirements in the list are a combination of didactic, pedagogic, theory of learning and also media didactic components and are split into three main groups: product description, assessment of the user inputs and statements, construction of the user interface.

- *BIG-Gütesiegel criteria (Bildungswege in der Informationsgesellschaft)* - used to verify if the software that is present on the market offers the content and media elements of high quality. The criteria that are taken under consideration are the structure of the software as also the offered function and usability, software construction according to the available hardware and eventually pedagogical preparation.

- *Software Documentation and Information System (SODIS)* - this is a system that is used for collecting of the large amounts of data about language learning software that is available on the market. The following criteria are considered to be the main branches of the software analysed in SODIS: technical aspects, didactic aspects and media-didactic aspects.

- *digita-award* - the award (German learning software award) given for the learning software that was analysed based on pedagogical, didactic and software technical aspects.

In order to create the catalogue with questions for the evaluation all criteria from the three previously described branches were compared, analysed and optimised. To avoid the repetition of the questions the categories have been reorganised so that all of them were unique. The criteria that were not relevant for the evaluation were removed. In Table 5 the map with the actualised criteria is presented.

11 Investigation Design and Testing Group

The software evaluation that is performed in this work, is done by the evaluation designer and a testing group. This means that a testing group have verified if and how far the evaluated application fulfils the defined criteria for interactivity.

In this section, some general definitions of the design of the investigations and testing group are presented. The basic theoretical background is necessary to construct a successful approach for a software evaluation. The investigation based on the presented theory and methods will be used later in the evaluation of the e-learning program in the context of interactivity.

11.1 General Guidelines for Testing Group

The selection of testing group deals with rules and operations that define how to approach the proper choice of the testing members. The bulk of investigating group is usually generated using a simple random method. However, the testing group may not be chosen accidentally. The group must be analysed and considered according to the investigation requirements. Here are presented the main criteria that should be considered during the design of the testing group:

- The test group should be goal oriented. This means that the selection of the testing group should be accomplished according to the investigation objectives. The number of details characterising a testing group should not be exaggerated.

- The requirements defined for investigation should be clearly defined but an excessively detailed requirements can lead to an inferior coverage of the research objectives.

- The economical/financial aspects should be considered during the investigation

design. The goal is to fulfill the investigation objectives with the minimal effort and cost.

11.2 Investigation Design for Software Evaluation

As far as the construction of investigation is concerned, the following aspects should be mentioned (according to [29] and [30]):

1. At the very beginning of the investigation design the detailed planning is required. Probably, it is the most important part of the investigation that should be performed with caution. Rules and definitions that are created during this stage will be the basis for the whole investigation.

2. The second stage is to conduct research according to the definitions made in the first stage.

3. The next stage is to analyse the investigation result and rework the data from the observations.

4. The fourth stage is to create the report that will answer the questions of the investigation.

5. The final stage is the publication of the report.

11.3 Investigation Planning in Details

11.3.1 Investigation Goals

The detailed investigation planning should not be disregarded. The final results depend largely on the exact and clear definition of the rules. The investigation construction begins usually with the formulation of the questions (or group of questions). Moreover,

in this point, the order of the questions and the structure of the investigation should be considered. This is required for higher transparency and conciseness of the results. For this purpose some knowledge about the construction of investigation is required. It is not only the way of the formulation of the questions itself but also the rules on how the questions or groups of questions should be measured that needs to be considered in detail.

11.3.2 Testing Group

After the goals of investigation are defined there is the turn to define the investigating test group. Investigating group can be understood as a group of units (individuals, elements) which helps to evaluate some software application. In order to describe well the testing group, following information needs to be given:

- *Content* - for example a group of students.
- *Units* - for example student of computer science.
- *Extent* - for example city of Vienna .
- *Time* - for example January 2010.

This information will help to understand how the variety of individuals influence the software understanding and judgment. There are some factors that may negatively affect the investigation results:

- *Pre-testing* - the investigating units that have already experience with some kind of interviews and also some knowledge about the subject can change the investigation result of the current evaluation. Typically, pre-testing units are yielding different results than the units that have not previous experience with the subject. In this situation to avoid the misunderstanding of investigation results it shall be

mentioned which member have had already experience with similar kind of investigation.

- *Testing situation* - the way how the testing group is acting during the investigation depends on the situation in which the interview is performed. The known problem is that the subjects that recognise that they are being observed may react totally different than those in a situation without observation. Additionally the fact that the testing units work in a group or individually may also have influence on final results. Typically the results obtained in the group are biased in comparison to those obtained while working individually.

11.4 Interviews

Interview is a research instrument that is used to collect data from respondents. The goals of the software investigation are processed and presented in the form of questions, which are enclosed in interviews. In a successful investigation the goals are covered by the questions; this is probably the most critical aspect during the design of a interviews. The next essential aspect is the order of questions. Frequently it influences the results of a interview. When the questions are ordered in a chaotic way, it can happen that such interviews will not fulfill the investigation objectives. Therefore, the order of the questions has a strong impact on the interview results. The flow of the questions should be organised in a logical way changing gradually from one aspect to the other.

To reach the best response rate the questions' order should be designed according to the following suggestions:

- from the least sensitive (emotionally) to the most sensitive questions.
- from the factual and behavioural to the attitudinal questions.

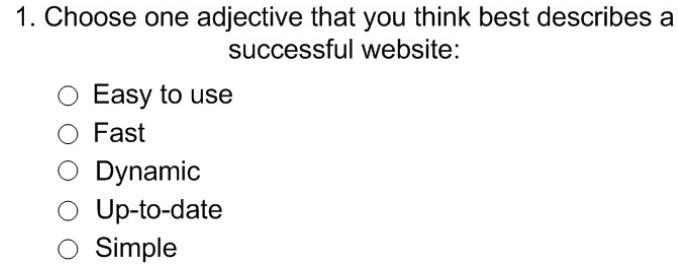

Figure 20: An example for a question with a single answer possible

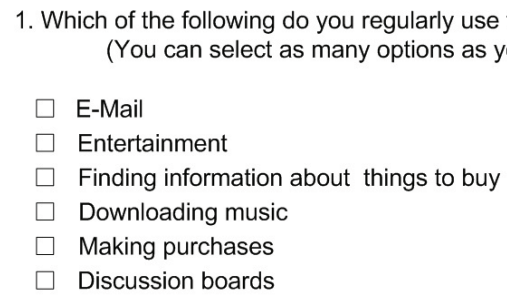

Figure 21: An example for a question with multiple answers possible

- from the general to the more specific questions.

The first common type of the interviews is the design when the respondent answers the questions by himself. The second method is when the pollster asks the respondent and puts down the answers. Sometimes the combination of these two designs can be met; some of the questions can be filled in by the respondent an other ones by the pollster.

There interviews can be grouped according to the form of the questions that are included:

- *open-ended questions* - here, there are no pre-defined answers and the respondent can arbitrary form an answer to the questions. For such form of questions, it is easier for the respondent to give his opinion to question. In contrast, for the pollster it is usually more complicated to code the answers owing to the high variety of the answers that can appear. The open-ended questions are applied to

investigate issues where not enough information is available to create a set with a few possible and accurate answers. The answers given to open-ended questions can point out issues that were not concerned by the interviews design or were omitted for example because of low importance of such answer. On the other hand, the point of view of a respondent that is shown by the open-ended questions can lead to new conclusions.

- *closed-ended questions* - the closed-ended questions can be split into two main types: the single choice questions and the multiple choice questions. As opposed to the open-ended questions, here the answers are pre-defined. During creation of the interviews, there must be enough information available on the investigated subject, as a result precise, concise and valued questions can be created. The answers to choose are given to the respondent. This confines the creativity of the respondent. He must adjust his or her opinions to the suggested answers. However, for the pollster the closed-ended questions are easy to analyse and code. A benefit when using closed-ended questions is the reduction of the time and cost of the survey.

According to the answers to the asked question, the following group of interviews can be specified:

- *questions with possible single answer* - these are questions from the closed-ended category, where the answers are pre-defined and the responded can select one and only one from the set of the answers. An example for this type of question can be seen in Figure 20.

- *questions with possible multiple answers* - similarly as the questions with a single answer, the multiple answers questions are from the closed-ended category,

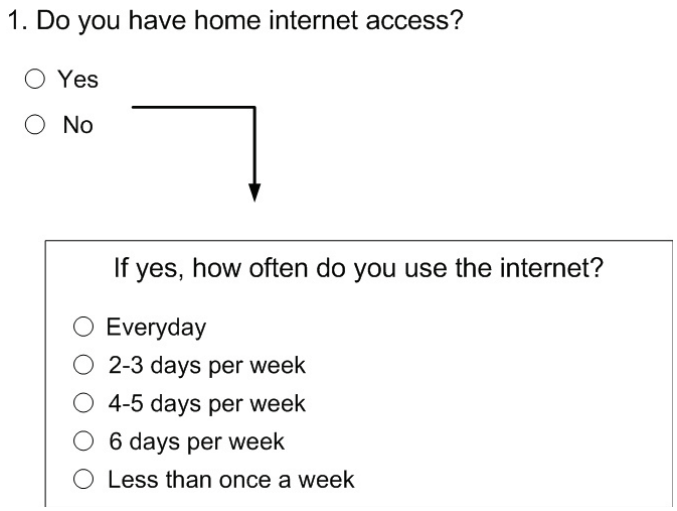

Figure 22: An example for a filtering question

however here the respondent can choose more that one answer. An example for this type of question can be seen in Figure 21.

- *empty questions* - the questions with no content that are the part of the interviews to verify the reaction of a respondent. The act of asking the empty questions where actually there are no right answers is a way to verify the credibility of the respondent. However, if the respondent notices that an empty questions is asked, it may lead to the demotivation and suspicion towards the pollster and the survey itself. Therefore the empty questions should be asked with care and not too frequently.

- *filtering questions* - they are used usually as a rules to move from a section of the interviews to the other. These movement depends on the answer that is given. The filtering question can be of the open-ended type as also of the closed-ended type. The main function of the filtering question is to lead to the next set questions. These questions depend on and are applicable to the scenario or situation that was associated with the given answer to the filtered question. An example for this type

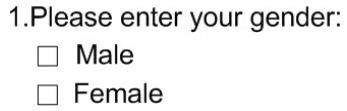

Figure 23: An example for a metric and scaling question

of question can be seen in Figure 22.

- *scaling questions and metric question* - in a interviews there can exist also a block of questions that provide factual information rather than assumptions and opinions of a respondent. The questions asked in this sections are verifying the sociological and demographical characteristic of the interviewed person. The usual verified information in this block of questions is for instance age, sex, education or profession. The collected informations are used to define the structure of the interviewed person. This should help to use the statistical methods for finding the dependences between the characteristic of the respondent and his opinions and believes that ware given by him in the interviews. An example for this type of question can be seen in Figure 23.

12 Software Evaluation

Presently, the e-learning software is considered to be interesting and successful provided that it is interactive. Therefore, in this work, e-learning software has been analysed and investigated in the context of interactivity. The software evaluation should answer following questions:

- What is the level of the interactivity that is realised in the software (Section 8.2)?
- Are the widely known interactivity features that are mentioned in Section 8.3 realised in the e-learning application?
- Does the e-learning software fulfill the guidelines for interactivity that are presented in Section 9?

To analyse the aforementioned aspects, an investigation was performed. In the investigation, a list of detailed questions was prepared. The actual topic of the interview is oscillating between the interactivity and its technical realisation. To evaluate this application a group of people was asked to use/test the application and to answer the questions.

The testing group is characterised by:

- Age: 25-33
- Education: students and alumni
- Sex: both
- Number of testers: 7
- Skills in using computer: users with intermediate and advanced skills
- Previous experience in evaluation of e-learning software: no

- Skills in German language: at least intermediate

In order to have clear overview on the evaluation results, preconditions and circumstances of the interviews are discussed below. Firstly, each of the testing group member was informed about the goal of the software evaluation. Next, all available materials attached to the e-learning German course were presented to the testers. They were asked to study the materials thoroughly as if they would like to make the complete course on their own in a real situation. Subsequently, the learning software was started from DVD and each user calibrated the microphone. In order to provide exactly the same testing environment, all testers used exactly the same PC and software. Testers of the software were given by the author of this work indications to use the same types of exercises and nearly the same topics. The users were given approximately one hour to get acquainted with the application. After the students had got familiar with the software, they have answered the evaluations' questions that are defined below. The answering to these questions was performed with assistance and support of the author of this work. The interview with each user took approximately thirty minutes. In addition, all of the remarks of the testers dedicated to the interactivity were noticed and analysed.

12.1 Investigation questions

1. Gender:

   □ female

   □ male

2. Questions concerning level of interactivity in the application:

   (a) How many learning paths are provided in the application?

   □ one

□ multiple

comments: .....

(b) Is it possible to use the application as a different user and choose a different learning path?

□ yes

□ no

comments: .....

(c) Is it possible to switch directly between different learning packages and subjects?

□ yes

□ no

comments: .....

(d) Is it possible to customise the graphical user interface?

□ yes

□ no

comments: .....

(e) Is it possible to select the preferred source of the learning materials (e.g. books, internet or other media)?

□ yes

□ no

comments: .....

3. Questions concerning the guidelines for interactivity:

(a) Does the system give you an immediate feedback to your actions?

□ yes

□ no

□ sometimes

comments: .....

(b) Is it possible to make some exams or tests spontaneously during the planned learning path?

□ yes

□ no

□ sometimes

comments: .....

(c) Is the introduction in the learning application, which is based upon available document and electronic help, sufficient?

□ yes

□ no

comments: .....

(d) Does the application offer practical exercises?

□ yes

□ no

comments: .....

(e) Do the offered exercises relate to real-life situations?

□ yes

□ no

comments: .....

(f) Is it possible to manage or plan the time that you would like to spend on learning in the course?

□ yes

□ no

comments: .....

(g) Are the introduction to the lesson and lesson's exercises clearly split?

□ yes

□ no

comments: .....

(h) Does the system offer you learning materials in the form of already solved examples?

□ yes

□ no

comments: .....

(i) Does the system offer you the possibility of practicing the learned material in the form of simulations?

□ yes

□ no

comments: .....

(j) Can you find in the applications some minimised or hidden text?

□ yes

□ no

comments: .....

4. Questions concerning the interactivity in features

(a) Does the system allow navigation over graphical elements like icons or menus?

□ yes

□ no

comments: .....

(b) Does the system offer interactive tables, diagrams, text or graphics?

□ yes

□ no

comments: .....

(c) Does the system offer some additional features after you click on some elements, text or other objects in the graphical user interface (e.g. context help or resize a picture)?

□ yes

□ no

comments: .....

(d) Does the system provide laboratories in form of simulation to practice acquainted knowledge?

□ yes

□ no

comments: .....

(e) Does the system give you complete feedback to the whole test that you have done?

□ yes

□ no

comments: .....

(f) In case you solve exercise incorrectly does the system point out exactly where the mistake was made?

□ yes

□ no

comments: .....

12.2 Analysis of Results

12.2.1 Analysis of Interactivity Level

In order to verify the level of interactivity described in Section 8.2, five question were asked. In this part, the testers responded to the questions in almost the same way. This is visualised in Figure (24). To the question *"How many learning paths are provided in the application?"*, every responder agreed that the program offers multiple paths of learning. Therefore, the interactivity level is above the "level 0".

The next question *"Is it possible to use the application as a different user and choose a different learning path"* the responders answered *"no"*. This means that the user branching is not realised in this application.

In the question *"Is it possible to switch directly between different learning packages and subjects?"*, almost all testers confirmed the possibility of the switching between information packages. One of the testers was confused and not sure if he was changing to other package or remaining still in the same one. This means that for certain users the system does not provide enough feedback that signals about changing learning packages. However, in general, it can be postulated that information branching and direct access to different information packages is provided by the system.

As far as the question *"Is it possible to customise the graphical user interface?"* is concerned, all users gave negative answer. It was not possible to select or define the system of used symbols. GUI is predefined and cannot be changed. Therefore, the "level 3" of interactivity is not implemented in the application.

The next question was *"Is it possible to select the preferred source of the learning materials (e.g. books, internet or other media)?"*. The testing group was able to find alternative or supportive sources of information in addition to the information provided at the DVD. The sources are the text book, internet classrooms and also some iPod®-

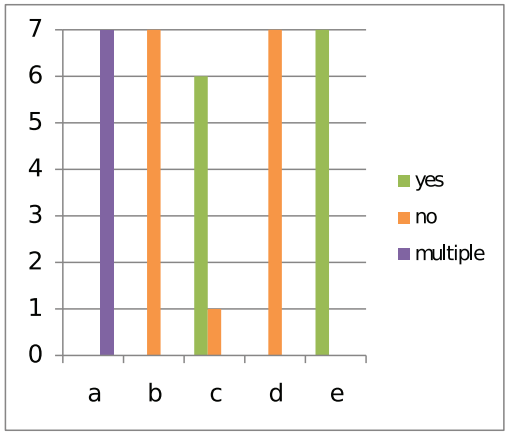

Figure 24: Application evaluation results concerning the interactivity level

environment lessons.

In the interview section concerning the levels of interactivity, it can be concluded that the application is not supporting multiusers as also does not allow to customize the GUI. The information branching, and the multiple learning material sources are provided. Hence, it follows that interactivity ”level 1” and interactivity ”level 3” are not implemented, but interactivity ”level 2” and interactivity ”level 4” are available.

12.2.2 Analysis of Guidelines for Interactivity

Subsequently, it was considered if the guidelines for interactivity defined in Section 9 are realised in the e-learning application. From the investigation results, it could be observed that the testing group did not share the same opinion about the realistation of the guidelines for interactivity. The distribution of opinions is presented in Figure (25).

To the question *”Does the system give you an immediate feedback to your actions?”* five testers said ”yes”, one of the responders said ”no”. The need for an additional action like clicking on the button ”correction” to obtain the feedback to an exercise from the system was a reason for this tester to postulate that the system’s feedback is not immediate. Another respondent chose the answer ”sometimes”, in his opinion the

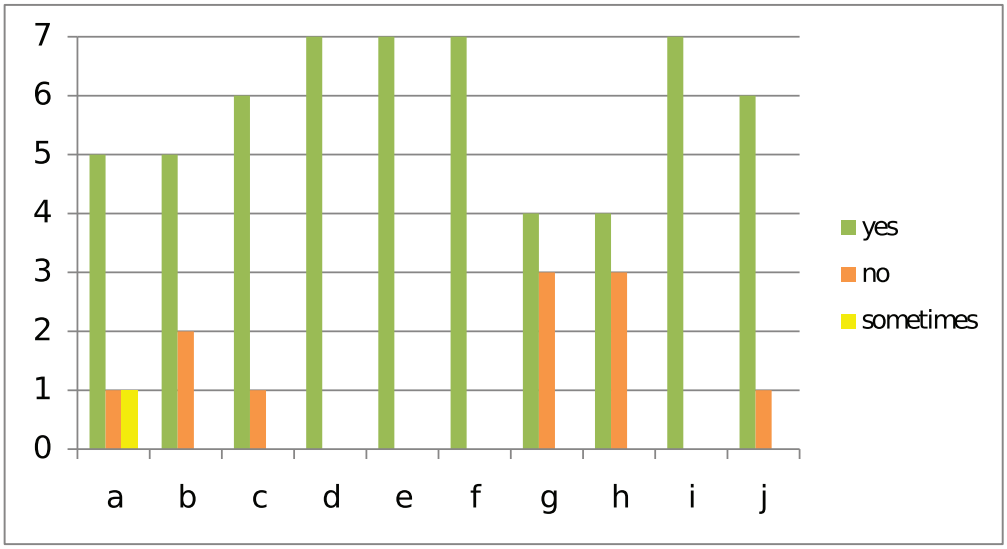

Figure 25: Application evaluation results concerning the guidelines for interactivity

immediate feedback is given only in some exercises. The different opinions about the immediate feedback are caused by the different expectations of the testers. Most of the responders are content with the system's feedback even if they must execute some additional actions after they finished the exercise in order to get a system response. In the evaluated application, in some exercises, it was necessary to press button correction to get the feedback. In conversation exercises the feedback was immediate. However, in certain cases the system feedback of the conversation exercises was not executed because the software did not recognise the tester voice and did not provide any feedback as long as the sentence was not captured by the system. In this example, it is visible that the current students expect the application to be more intelligent and predict user preferences on the feedback type. Some of the student would prefer a system to know when the exercise is finished and give the automatic feedback. Summarising, in the opinion of most testers, the evaluated application is giving enough immediate feedback.

To the question *"Is it possible to make some exams or tests spontaneously during the planned learning path?"*, the five tester answered "yes" and two answered negatively.

In the application, the self-control exercise is placed not at the end of each lessons but realised as a separate section. Not each tester was able to identify this separate exercise section because they found an access to this section not clear. It is apparent that the navigation over the application is not transparent enough. The changing from one section to the other and from one exercise to another one, and back, is visualised in a clear way. In general the tested application offers self-control possibilities, which are however limited to some extent by the usability.

Almost all testers (six out of seven) in the answering to the question *"Is the introduction in the learning application, which is based upon available document and electronic help, sufficient?"* chose the answer "yes". They were pleased with the introduction to system. The tester found the introduction to the technical usability (simply how to use the software) as also the general description of application structure to be good enough. According to the additional comments that were provided by the testers to the author of this work, there was no clear distinction between lessons (i.e. the end and begin of a lesson was not signalised). The offered materials are good enough to operate the application, but additional information about the flow of the lessons would be advisable.

To the question *"Does the application offer practical exercises?"*, all responders gave positive answer. Based upon the responders' answers, it can be postulated that practical exercises are the core of application. Also, to the next question *"Do the offered exercises relate to real-life situations?"* all of the responders answered "yes". This means that the application is seen by the testers as a one that offers not only practical exercises, but also exercises that are dedicated to real-life. All testers liked the content of the exercises.

All respondents answered "yes" to the question *"Is it possible to manage or plan the time that you would like to spend on learning in the course?"*. The course provides an exercise type where it is possible to plan the time and content of the lessons. This is only

a part of the course, and the time planning cannot be done for all learning paths (like for example ”systematic learning”). Time management is available for one learning path but not for the whole application.

The question about the transparency of the learning design *”Are the introduction to the lesson and lesson's exercises clearly split?”* was answered half-positively-half-negatively. The system provides some information on how to solve an exercise and in case of grammatical exercises it describes grammatical rules. However, the introduction concerns only how the exercise can be solved (i.e. technical pressing buttons, filling in gaps etc.). Other information, for example grammar, is continuously shown in the exercise window.

To the question *”Does the system offer you learning materials in the form of already solved examples?”*, the opinions are also split. It is interesting why there are differences in the testers' understanding of solved examples; some users understood worked examples as completing the exercise by the computer. Other testers would expect some additional explanation why an exercise is solved in this and not in other way. In this application worked examples are provided and realised as solving of exercise by the system when the user wishes to see the correct solution.

All testers answered positively to the question *”Does the system offer you the possibility of practicing the learned material in the form of simulations?”*. Basing on the respondents' opinions, it can be stated that the system offers the learning by using simulations to the users. The simulations were seen by the testers as a very positive and interactive aspect of the evaluated application. The possibility to navigate the conversation simulation with the voice have impressed the respondents.

The application offers minimised texts as a context help to the users. Almost all testers were able to find the minimised text in the application. Hence, to the question *”Can you find in the applications some minimised or hidden text?”*, six out of seven

testers answered ”yes”.

In the evaluated application, the guidelines for the interactivity are realised. However, it should be mentioned that not every type of the exercise contains all of the interactivity features. The interactivity guidelines were implemented only in case they could be reasonably used.

12.2.3 Analysis of Interactivity in Features

In this chapter the features of interactivity described in Section 8.3 are evaluated. The description of the opinions is presented in Figure (26).

To the questions *”Does the system allow navigation over graphical elements like icons or menus?”* and *”Does the system offer interactive tables, diagrams, text or graphics?”* all responders answered ”yes”. Both questions were dedicated to the graphical navigation. On the account of positive answers it can be postulated that the graphical navigation of the tested application is well-realised.

The next considered feature of interactivity is so called ”clickability”. To the question *”Does the system offer some additional features after you click on some elements, text or other objects in the graphical user interface (e.g. context help or resize a picture)?”* six out of seven responders answered ”yes”. They were able to find active tables and graphics in the application and click on the to trigger some action. Hence, this application can be considered to have the feature of ”clickability”. It seems that the single person that answered negatively did not read the introduction to the program thoroughly.

Feature of simulation was analysed in the question *”Does the system provide laboratories in form of simulation to practice acquainted knowledge?”*. All responders sheared the same opinion that simulation are well-realised in the investigated application.

The next questions are about the feedback signals in the application. To the question

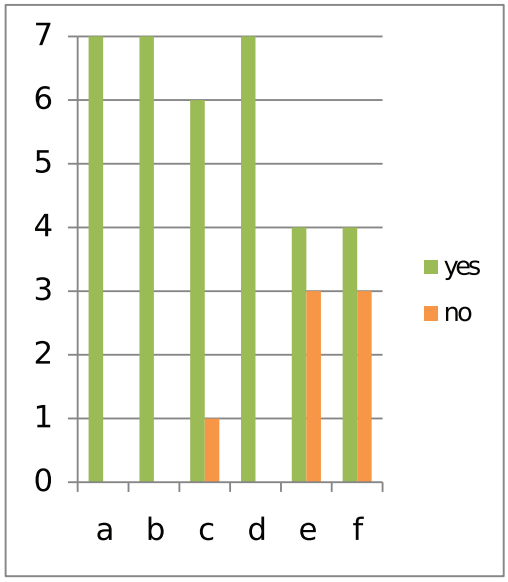

Figure 26: Application evaluation results concerning the features of interactivity

"Does the system give you complete feedback to the whole test that you have done?" four responders answered "yes" and three of them "no". From the communication with the responders, it can be identified that the system gives a feedback to the actually solved exercise, however the feedback to the whole lesson is not provided directly after a single exercise was solved. The results for executed exercises are provided in a separate table somewhere in the application. This table gives a general overview of user activities.

To the question *"In case you solve exercise incorrectly does the system point out exactly where the mistake was made?"* four out of seven users answered "yes". The differences in the opinions are attributed to the differences in the former users' experiences. Some students spend more time on testing of certain part of program like for example simulations or grammatic exercises, because they had problems with completing exercises which is due to usability issues. The feedback is implemented in a different way for each type of the exercise. Conversation exercises give a feedback that is less exact than the feedback in the grammar exercises. All this caused the divergence in the opinions given to this question.

In general, the testers would expect complete feedback in every type of exercise. From its definition, a complete feedback should clearly identify mistakes and explain why the answer is wrong. It should not be forgotten that the machine cannot completely replace the human being intelligence, which is necessary for this type of feedback analysis. The application provides relatively good solution for computer aided assessment.

Basically, features like graphical navigation, ”clickability” and simulations are well-realised in the application. The feedback signals are also provided in the applications, but, according to the observations of the testers' opinions, could be more optimised.

13 Conclusions

In the current world, success is associated with knowledge. Continuous extending of knowledge horizon in various domains is preferable. Simultaneously, globalisation leads to the creation of multicultural society. Therefore, language skills are one of the most important elements that are indispensable for the successful functioning in this society. Dynamic lifestyle causes that free time is limited and therefore it is complicated to find plenty of it for learning. E-learning offers a solution for this problem. Flexible, time and place independent e-learning meets people's expectations.

On the market there is plenty of e-learning language courses available. In order to find out which of them fulfils the predefined expectations, software evaluations can be performed. In this work, an evaluation of an e-learning application for the German language was performed in terms of its interactivity. The author of this work assumes that the interactivity is an indispensable part of every e-learning program for foreign language. In order to determine if the investigated application is interactive, level of interactivity, guidelines for interactivity and features of interactivity were verified. The conclusion of this evaluation are as follows. Although the level of interactivity was assessed to be rather low, the features of interactivity were realised in a great extent. As far as guidelines for interactivity are concerned, majority of them were realised as defined and expected. It should be mentioned that not every guideline for interactivity and feature of interactivity is realised in every single point of the investigated language course. It is evident that full implementation of guidelines for interactivity and features of interactivity is not always reasonable. It can be postulated that the tested application in general as a whole realises the interactivity requirements, but its single components realise this requirements only partly.

In the times of heavily interactive applications in internet or in portable devices like

mobile phones, users expect similar interactivity design for each application. Therefore, in the next future, the level of interactivity in e-learning applications as also usability are expected to continuously grow and improve. Expectations of users are directed towards more intelligent systems, with which the interaction would be easier.

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