e-Learning Theories in Practice: A Comparison of three Methods

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Abstract: As e-learning and distance learning tend to get more and more important for all kind of organisations, researchers and practitioners are becoming aware of the fact that a simple technology-focussed approach does not guarantee successful teaching and learning. Thus, a shift to pedagogy-based initiatives can be observed within the field of e-learning. This paper examines the implications of commonly known learning theories on online courses. Therefore, a case study was carried out within the field of adult education aiming at the implementation of different e-learning strategies with respect to the behaviouristic, cognitive, and constructivistic school of learning. Furthermore, these instructional approaches are compared with each other in order to examine aspects such as the effort for the teacher and the students, the effectiveness of each method, the students' workload or collaborative and social aspects of e-learning.

Keywords: e-learning; learning theories; behaviourism; cognitivism; constructivism; case study, Moodle.

Categories: **TH.**TH, **TH.**EV, **TO.**14, **TO.**18, **TO.**20, **TO.**27

1 Introduction

E-learning is identified as one of the emerging areas as shown by means of concrete numbers in [Brennan 2003] and has turned out to be important for educational institutions as well as for companies as highlighted by concrete application scenarios in [Dietinger 2003]. Nevertheless, various problematic aspects such as higher costs and political influences [Noble 2001], the focusing on technology and the negligence of pedagogical principles [Park et al. 1987], usability problems of e-learning systems, etc. were reported. According to [Gunawardena & McIsaac 2004], a shift from technology- to pedagogy-based research can be observed within the field of distance learning. Educators have become more interested in examining pedagogical themes and strategies within online courses instead of experimenting with new technologies.

Against this background, the need for realising distance learning phases was recognised at the Campus02, University of Applied Sciences, Graz, Austria [Campus02 2005]. Thus, an internal project which aimed to support lecturers with implementing their distance learning strategy was initiated. The study dealt with in this paper is one result of this project's outcomes and was initiated in order to examine and compare different e-learning methods. Therefore, three online courses were implemented with the intention to follow the ideas of commonly known learning theories summarised in section 2. Afterwards, a detailed description of the e-learning study, the didactical strategy and the implemented courses is given in section 3.

Thereafter, the three methods are compared to each other and findings are pointed out in section 4.

As this paper discusses different approaches for realising online courses, the following assumptions about didactical aspects of e-learning were made by the author:

- It is possible to implement an e-learning course on a certain topic in different ways, and each of these methods is realisable in the area of adult education.
- E-learning courses implementing different pedagogical strategies may vary in the preparation, implementation, or concluding stage.
- The behaviouristic and the constructivistic approach may not be that effective and popular due to the disadvantages of these two learning theories.
- Group tasks may be more effective and popular than tasks for individuals.

With respect to [Oblinger & Hawkins 2005], the term "e-learning" is currently used for different educational scenarios in literature. Therefore, at this point, the term has to be defined by describing the character of the case study: The study deals with the scenario of running three online courses entirely virtually over a period of two month. Each course aims at mediating a set of competencies given by objectives, materials, and instructions. All interactions between the learners (students) and the instructor (teacher) are accomplished online utilising an e-learning system. The three courses differ with respect to instructional design, which means that each course is determined by another set of tasks. The learning objectives as well as the learning content are equal for each course.

2   E-Learning Theories

Implementing e-learning courses can be seen as a complex process going beyond systematically executing steps within an instructional design model. Among a large number of critical aspects, [McLeod 2003] suggests instructors to consider principles of learning by means of historically grown learning theories. Thus, it is possible to reuse certain procedures, for instance pre-defined instructional components as stated in [Merrill 2001]. Within the e-learning situation, three learning theories – the Behaviourism, the Cognitivism, and the Constructivism – are of importance as shown in [Cooper 1993], [Dietinger 2003], etc.. In the following, these three theories are described in short, and implications for realising online courses are derived.

2.1   Behaviourism

The behaviourist school of thought, influenced by researchers like Watson, Thorndike, Pavlov, and Skinner who postulates that "*learning is a chance in observable behaviour caused by external stimuli in environment*" [Skinner 1974]. Behaviourists see the mind as a "black box", in the sense that a response to a stimulus can be observed quantitatively, totally ignoring the effect of thought processes occurring in mind. [Atkins 1993] highlights four aspects relevant for realising online courses with respect to the behaviourist school:

- The learning material should be broken down into small **instructional steps** being presented in a deductive way by means of starting with a rule, category, principle, formula or definition, giving positive examples to reinforce understanding, and showing negative examples to establish conceptual boundaries;
- Course designers have to define **sequences of instructions** using conditional or unconditional branching to other instructional units and pre-determining choices within the course. Normally, activities are sequenced for increasing difficulty or complexity. The sequence and pacing through the materials are usually beyond learner control;
- To maximise learning efficiency, learners may be routed to miss or repeat certain sections based on the performance on diagnostic tests, or on tests within the sequence of learning activities. Nevertheless, the instructional designer may also allow a learner to choose the next instruction out of a set of activities, giving the learner more **control over the learning process**;
- The behaviouristic approach for **learning** suggests to demonstrate the required operation, procedure or skill, and to break it down into its parts with appropriate explanation before learners are expected to copy the desired behaviour. Learners are supposed to build proficiency from frequent review or revision with check tests at strategic points or repeat practice with feedback. Instructional design emphasises low error rate and the usage of remedial loops back through material if necessary. Furthermore, reinforcement messages should be used to maintain motivation.

Overall, behaviourists recommend a structured, deductive approach to design an online course, so that basic concepts, skills, and factual information can rapidly be acquired by the learners. Further implications on online learning can be summarised by the concept of drill and practice, portioning materials and assessing learner's achievement levels, and giving external feedback. However, the effectiveness of behavioural design approaches for higher-order learning tasks or for transfer of learning is as yet unproven.

2.2   Cognitivism

Cognitivists consider learning as an internal process that involves memory, thinking, reflection, abstraction, motivation, and meta-cognition as outlined by [Ally 2004]. Cognitive psychology comprises the learning process from an information processing point of view, where information is received in the sensory store through different senses and, further, transferred to the short-term and the long-term memory through different cognitive processes.

Furthermore, the cognitive school recognises the importance of individual differences and of including a variety of learning strategies to accommodate those differences. Thus, different learning styles [Kolb 1984], [Myers 1978], etc. refer to how a learner perceives, interacts with, and responds to learning material. In addition, cognitive styles as addressed e.g. in [Witkin et al. 1977] describe learner's preferred way of processing information, that is a person's typical mode of thinking, remembering, or problem solving.

Besides, the individual cognitive trend derived from Piaget's theory, [Deubel 2003] states that the learning process also includes socio-cultural perspectives emphasising socially and culturally situated contexts of cognition as expressed by Vygotsky (see [Duffy & Cunningham 1996]). Instructional designers have to consider the following aspects for realising online courses:

- The teaching strategy should **enhance the learning process** by facilitating all sensors, focussing the learner's attention by highlighting important and critical information, reasoning each instruction, and matching the cognitive level of the learner;

- The instructional designer should **tie up to new information with existing information** from long-term memory using advanced organisers to activate exiting cognitive structures or to incorporate the details of the lesson, providing conceptual models to enable the learner to retrieve existing mental models, using pre-instructional questions to set expectations and to activate the learner's existing knowledge structure, and using prerequisite test questions to activate the prerequisite knowledge structure required for new materials;

- The learning content should be chunked to **prevent cognitive overload**. Exceeding a number of five to nine items to learn, linear, hierarchical, or spider-shaped information maps should be provided;

- Strategies requiring the learner to apply, analyse, synthesise, and evaluate should be used to promote **deep processing of information** and higher-level learning;

- Online learning materials should include activities for the **different learning and cognitive styles**. Furthermore, it is necessary to provide adequate and the right type of support for students with different types of learners;

- With respect to **dual-coding theory** [Paivio 1990], information should be presented in different modes to accommodate individual differences in processing and to facilitate transfer to long-term memory;

- Students need to be motivated to learn by means of learning strategies addressing the intrinsic **motivation** (driven from within the learner) and the extrinsic motivation (instructor or performance driven). Therefore, methods such as Keller's ARCS model – the abbreviation for attention, relevance, confidence, and satisfaction [Keller & Suzuki 1988] – could be applied by the instructor;

- With respect to [Meyer 1998], the teaching strategy should enforce learners to use their **meta-cognitive skills** by reflecting on what they learn, collaborating with other learners or checking their progress;

- Finally, the teaching strategy should connect learning content with different real-life situations, so that the learners can **tie up to own experiences** and, therefore, memorise things better. Furthermore, a transfer to real-life situations could support the development of personal meaning and contextualisation of the information.

To sum up this subsection, cognitive psychology focuses on learners' receiving and processing of information to transfer it into long-term memory for storage. Therefore, instructional designers have to consider different aspects beginning from chunking the

learning content into smaller parts and supporting different learning styles up to higher concepts such as motivation, collaboration or meta-cognition. Although the cognitive-focused approach is well suited for reaching higher-level objectives, a major weakness can be identified, if a learner lacks of relevant prerequisite knowledge. To account this, a course designer has to ensure that the instructions are appropriate for all skill levels and experiences, which is evidently costly and time-consuming.

2.3   Constructivism

The constructivist school of learning suggests that learners construct personal knowledge from the learning experience itself as stated in [McLeod 2003]. Thus, learning can be seen as an active process, and knowledge cannot be received from outside or from someone else. According to [Duffy & Cunningham 1996], learners should be allowed to construct knowledge rather than being given knowledge through instructions. Furthermore, constructivists emphasise situated learning, which sees learning as contextual and suggests strategies promoting multi-contextual learning to make sure that learners can apply the information broadly.

With respect to [Boethel & Dimock 1999], the following assumptions can be made up on this learning theory: Learning is an adaptive activity and situated in the context where it occurs. Knowledge is constructed by the learner who also deals with resistance to change. Experiences and social interactions play a role in the learning process. By deriving implications for creating instructions for online learning, the following statements have to be made up:

- Learning should be an **active process** by means of keeping learners active doing high-level activities such as asking learners to apply information in practical situations, facilitating personal interpretation of learning content, discussing topics within a group, and so forth;
- To enforce learners constructing their own knowledge, instructors have to provide **good interactive online instructions**, since the students have to take the initiative to learn and interact with other students and the instructor and since the learning agenda is controlled by students [Murphy & Cifuentes 2001]. In contrary to traditional lecture where instructors contextualise and personalise information to meet their own needs, students have to experience the learning content at first-hand;
- As stated e.g. in [Hooper & Hannafin 1991], **collaborative and cooperative learning** should be encouraged to facilitate constructivist learning. Working with other learners gives students real-life experience and allows them to use and improve their meta-cognitive skills. When assigning learners for a group work, membership should be based on the expertise level and learning style, so that team members can benefit from one another's strengths;
- Learners should be given **control of the learning process**. Besides, there should be a form of guided discovery where learners can make their decision on learning goals, but can also use some guidance from the instructor;
- When learning online, students should be given **time and opportunity to reflect** the learning content. Embedded questions on the content can be used

            throughout the lesson to encourage reflection and processing of the information;

- Learning should be made meaningful and illustrative for learners by including **examples and use cases for theoretical information**. Besides, activities should enforce learners to apply and personalise the learning content offered;
- Instructors should focus on **interactive learning activities** to promote higher-level learning and social presence and to help develop personal meaning. As learning focuses on developing new knowledge, skills, and attitudes, e-learning faces the problem that psychomotor, affective and higher-level objectives are hard to reach within virtual learning phases. Therefore, [Mödritscher & Sindler 2005] suggest providing other ways – such as social or interactive activities, context-based learning, assessment through open-ended questions, etc. – to realise such didactical aspects.

Examples of constructivist learning can be found within the scope of experiential learning, self-directed learning, context-aware learning, and reflective practice. Despite a variety of advantages of Constructivism, like the presentation of content from multiple perspectives, the active knowledge construction, the development of meta-cognitive strategies, this learning theory also faces a few disadvantages, such as problems in adequately evaluating the learning process, lack of instructional resources to respond to the multitude of student interests or higher effort to create context-based learning content, restrictions on driving the learning process to a certain direction given e.g. by science, higher drop-out rate due to a lack of extrinsic motivation for students with low capabilities on self-directed learning, etc..

These three commonly known learning theories are of central relevance for the implementation of different e-learning strategies as shown in the case study described in the next two sections.

3   Realisation of the Courses regarding the Learning Theories

The following study was accomplished within the scope of an e-learning project at Campus02 [Sindler 2005] and dealt with an online course on the topic "document formats". Although the instructional unit can be considered as a lecture on the basics of information technology, attempts were made towards reaching the whole range of competencies and some higher-level objectives to cover and examine a broad range of didactical aspects. Characterising the course with reference to [Bloom 1956], the educational objectives mainly dealt with imparting knowledge on the students, but included also two skills and one affective goal as shown in Table 1.

Table 1: Statistics of the course's educational object

Domains according to Bloom Taxonomy	Level 1	Level 2	Level 3
Cognitive Domain	5	4	2
Psychomotor Domain	0	0	2
Affective Domain	0	0	1

When planning this study, the lecture was implemented in three different online courses, each one realising the didactical strategy related to one learning theory described in the last section. Therefore, the 38 students were split up into three groups according to the students' performance on a previous lecture related to the topic and assigned to the courses. Subsequently, a customised version of the open source platform Moodle was used to launch the courses which, then, were successfully running over a two month's period. The online courses dealt with the same learning content and, in addition, tried to achieve the same objectives depicted in Table 1. Hence, each course applied different didactical activities as shown in the following subsections.

3.1   Course A – the Behaviouristic Approach

Course A was planned with respect to Behaviourism, whereat learning objectives and materials were portioned into three modules by the teacher and each of the 14 students had to study each module and finish it within a certain period of time. The sequence of the instructional portions as well as the schedule was given by the teacher. The students' achievement levels were measured with online examination. Furthermore, this course included some playful activities, such as the possibility of several attempts in the exam, an increasing difficulty level on later modules, one task to gain a bonus, etc., to keep the learners motivated. The learning process was assessed by typical behaviouristic elements like multiple-choice questions, assignment tasks or short answers. To examine the high-level objectives of the psychomotor and affective domain, ITS methods were simulated by the teacher, e.g. by manually evaluating submitted strings encoded by Huffman or LZW compression.

3.2   Course B – the Cognitive Approach

Course B attended by 12 students was implemented according to the ideas of Cognitivism. Therefore, its tasks can be characterised by classical cognitive elements, such as repeating learning content in different ways, working out parts of the course within a group work or re-structuring the content. Different learning styles were covered by providing different kind of instructional support using various learning activities of Moodle. Motivational aspects were realised by fast responsiveness of the teacher as well as by a bonus system. Further, meta-cognitive skills of students were reflected or even enhanced by enforcing students to work in groups. Finally, the students' tasks were focussed on including own experiences within their work.

Overall, this course was divided into two phases. Firstly, three groups consisting of four students each had to work out a part of the course's objectives. In the second phase, the groups were reassembled to four groups with three members, while each

group had to restructure the results of the first phase using a WIKI environment. To motivate the groups, the best work of the second phase was awarded with a bonus. To assess the learning process, the results of each phase were graded by the teacher based on the quality and quantity of the students' work within the group. WIKI enables the reproduction of the student's part within the group.

3.3   Course C – the Constructivistic Approach

Course C comprises the idea of constructivism enforcing each of the 12 participating students to work actively on the tasks within a group of three members. Further, all kind of interactive elements such as chat, discussion group, tasks, etc. were provided within the Moodle system, and the students were also allowed to collaborate outside the e-learning platform. Thus, students held full control over the learning process and were able to manage the schedule on their own. The approach was realised by giving the four groups all materials and the task to create a document for mediating the course's learning objectives to colleagues. In the second phase, the three members of each group had to compare the works of the other groups, evaluate them by distributing a certain amount of points and reason this distribution. Again, the group with the best work received a bonus. The group assignment work was graded by the teacher on basis of the students' peer reviews.

While the e-learning phase was in process, students of the courses were instructed to document certain aspects, such as the effort for learning, a self-assessment on reaching the objectives, etc.. Furthermore, an unannounced and challenging examination as well as a post-questionnaire was carried out in the course of the lecture held after the e-learning experiment. Based on the whole amount of data retrieved from this study, the next section summarises the experiences gained about the different e-learning strategies comparing them to each other.

4   Comparison of the three e-Learning Strategies

To evaluate the different e-learning methods following the learning theories dealt with in section 2, the three courses are compared to each other with respect to different aspects such as the effort for the teacher or the students, the effectiveness, and so forth. In the following subsections each stage of the study is examined closer.

4.1   Preparation Stage

First of all, the preparation stage for the study took the lecturer approximately 15.5 hours distributed as shown in Table 2. As materials had existed already, there was not much effort for preparing the online materials, which were the same in each course.

Table 2: Characteristics of the three courses for the preparation stage

Teacher's activities and effort (* all courses alike)	A	B	C
1. Determining organisational parameters	1*	1*	1*
2. Defining the learning objectives	1*	1*	1*
3. Preparing the existing materials	2*	2*	2*
4. Assigning students to the three courses	½*	½*	½*
5. Creating instruction for the ongoing evaluation	½*	½*	½*
6. Creating instructions and activities for the course	5 ½	1 ½	1 ½
7. Preparing concluding tests and post-questionnaire	2*	2*	2*
Teacher's overall effort [in hours]	*12 ½*	*8 ½*	*8 ½*

Including the effort of seven hours for course-independent activities, the teacher spent more time to create course A than to prepare the courses B or C. These differences can mainly be reasoned by the high effort for creating questions with the Moodle system. Nevertheless, the quizzes created allowed for quick grading and can be reused for other online courses on this topic.

4.2   Running the Online Courses

Secondly, the implementation of the three courses required an amount of 11.5 hours of work from the teacher. An overview on the teacher's activities and efforts for carrying out each course is given in Table 3. In addition, students of course A meant to master most of the 14 learning objectives, while students of course C slightly doubted about it, and students of course B were very pessimistic about the achievement of the defined competencies. Moreover, student groups of course A and C declared to work on the tasks separately most of the time, while the participants of course B quoted to work with other students at least for 30% of the time.

Table 3: Characteristics of the three courses for the implementation stage

Teacher's activities and effort (* all courses alike)	A	B	C
1. Introducing the online course in the lecture	1*	1*	1*
2. Weekly mail to inform and motivate students	2	1	1
3. Supervising the group tasks	-	1 ½	½
4. Individual feedback on students and group tasks	2	1	½
Teacher's overall effort [in hours]	*5*	*4 ½*	*3*
Further Characteristics			
Students' self-assessment of effort [in hours]	12.2	9.4	7.6
Students' self-assessment of mastering objectives	92.9%	46.8%	74.3%
Students' self-assessment of learning alone	96.9%	69.2%	98.8%
Number of teacher's activities	3278	3712	1773
Number of students' activities	2969	8037	3162

An interesting aspect in this stage is the distribution of online activities of the teacher and the students in the e-learning platform Moodle. Although the online activities are only a part of the teaching and learning process itself, the distribution of the clicks

over the period of the e-learning phase might give some interesting interpretations on different aspects of the course.

Analysing the number of activities in the three courses, course A is characterised by the fact that the teacher had more activities than the 14 students altogether (3278 vs. 2969 activities). Interpreting Figure 1, it is obvious that the number of activities amounts up to 500 activities right before each module ended, because the students had to pass the examination until these deadlines. As shown in the chart, these peaks can be found before the deadlines (21st April, 19th May and 2nd June 2005), while the activities at the other events, as for example the intensive and course-independent discussion at the beginning of the e-learning phase, are significantly lower.
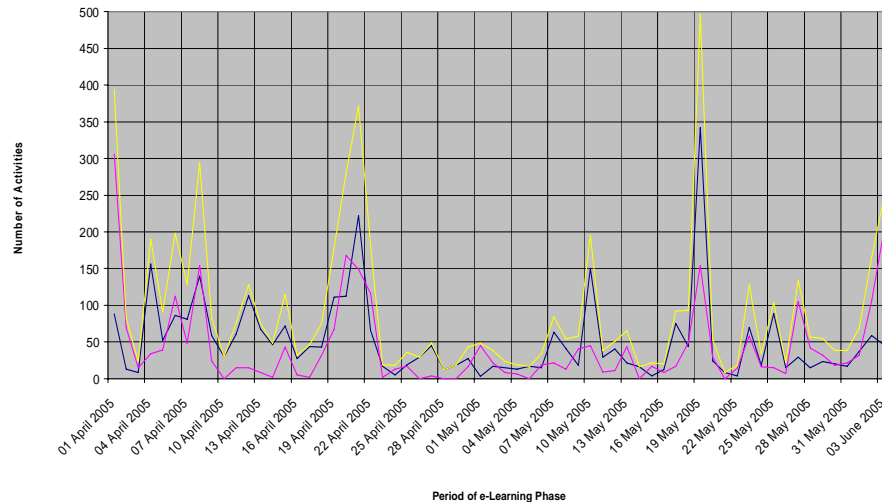

Figure 1: Distribution of teacher's (blue), students' (pink) and overall (yellow) activities for course A

Contrary to course A, the 12 students of course B had to act more than twice as much as the teacher (3712 vs. 8037 activities) due to the usage of the WIKI module.
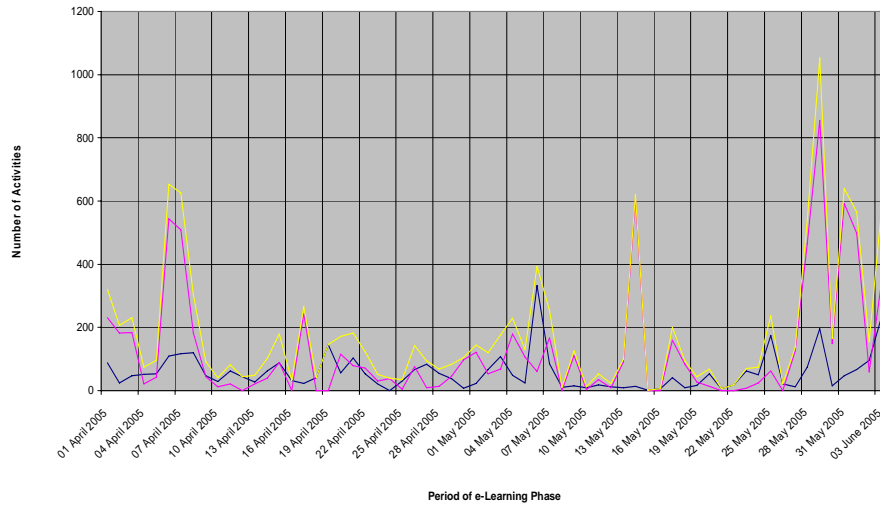
Figure 2: Distribution of teacher's (blue), students' (pink) and overall (yellow) activities for course B

Furthermore, the deadlines for the two phases (6th May and 2nd June 2005) are not clearly recognisable. The peaks of activity numbers (up to 1000) can be identified in the second phase as shown in Figure 2. This could be seen as an indicator that the first phase was too long, or the workload in the second phase was too high. Nevertheless, in this course each student had to work with the Moodle system, which was guaranteed by the tasks and the version-control feature of the WIKI environment.
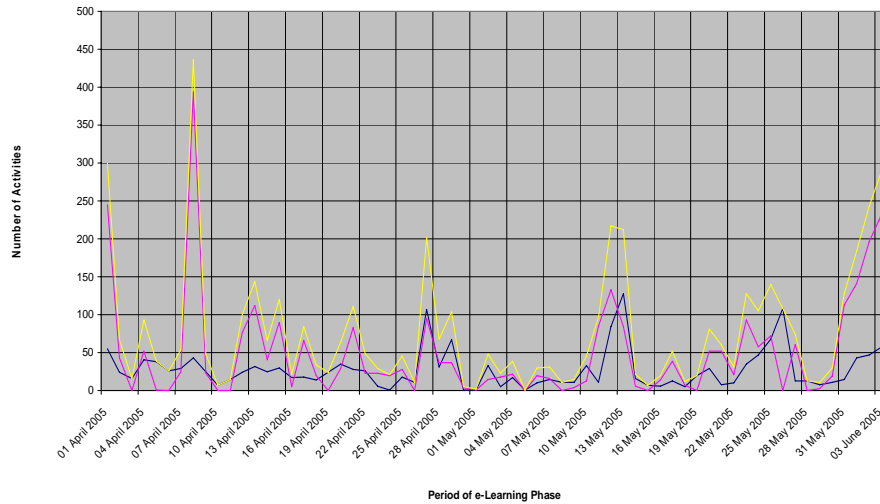

Figure 3: Distribution of teacher's (blue), students' (pink) and overall (yellow) activities for course C

In course C, the teacher's activities were about half of the ones carried out by the 12 students (1773 vs. 3162 activities). Having a look on the distribution of the activities in this course (see Figure 3), the peaks of the activities are distributed over the whole course, and the deadlines (13th May and 2nd June 2005) cannot be clearly identified. Other events such as an extensive usage of the discussion group or course announcements caused more activity in the course than the deadlines. Furthermore, in this course the possibility was offered that only one of the three group members posted the results of the first phase, while the other work was done offline.

Summarising the distribution of activities over the period of the e-learning phase, the following statements can be put forward:

- The behaviouristic approach is characterised by a high degree of online learning and teaching as well as clearly recognisable deadlines, as it is obvious that most students prefer to finish a module as late as possible;
- The cognitive approach (including the usage of the WIKI module to enforce students to work online) seems to cause a lot of work load for the students as well as harder effort for the teacher;
- In contrast, the constructivistic approach is characterised by a fewer effort for both the students and the teacher. The activities seem to be distributed equally over the whole period;
- Generally, group works can be characterised by a better distributions of activities. Besides, unbalanced workload can be identified much better if students work in teams.

4.3 Concluding the Study

Finally, the concluding stage of the e-learning phase took the teacher about 5.5 hours, which is distributed as shown in Table 4. The results of the ongoing assessment were rather equal in each course due to a very moderate grading to keep the students motivated. In fact, the results of the unannounced and demanding concluding exam carried out in the classroom are more reliable and allow evaluating the effectiveness of each course, which is strongly related to the students' self-assessment of being able to master the objectives (Table 3).

Table 4: Characteristics of the three courses for the concluding stage

Teacher's activities and effort ([*] all courses alike)	A	B	C
1. Assessment of learning process and grading	½	2	1
2. Concluding exam and post-questionnaire	2[*]	2[*]	2[*]
Teacher's overall effort	*2 ½*	*4*	*3*
Further Characteristics			
Results of the running courses' assessment	78.1%	78.9%	79.9%
Results of the concluding exam	54.8%	37.4%	43.2%

Considering the effort for each course, it has to be stated that the most time-consuming course for both the teacher and the students was course A. The teacher had much more preparation effort, while the students had to invest a lot of time due to the fact that they had to master the course on their own. Besides, only the teacher's

grading was fast and easy in this course due to the usage of Moodle's quizzes module. Course B demanded a fewer effort from both the teacher and students, even though the grading was more complex. Since the students of this course spent a great amount of time on the tasks, it was obviously not very effective to use the WIKI module for extensive group works – the students considered themselves to be more concentrated on the tool than on the learning content. Course C is characterised by the lowest effort for all aspects except the grading of the group works. In contrary to course B, the peer review task supported the teacher in grading.

Drawing conclusions from the students' self-assessment of their effort (Table 3), their online activities (Figures 1 to 3) and the results of the concluding exam (Table 4), the students' workload concerning the course's topic seemed to be at a high level in course A and at a medium level in course C. Although the students meant to spend a lot of time on the tasks and had to use the platform more intensively in course B, the achievement levels as well as the self-assessment of mastering the learning objectives was relatively low. As a consequence, the overall educational strategy of this course proved to be inefficient. Although the workload of the group tasks was certainly high, the students focused too much on the system usage than on the learning content.

Summarising the questionnaire students had to fill out, course A was rated neutral, but both positive remarks like "a good extension for a course" as well as negative statements such as "missing explanations for more complex content" or "disappointment about the online course" can be found. In contrary, course B was pounced due to the usage of the WIKI module. Students of course C were neutral about the e-learning phase, but gave a few negative remarks, such as "doubt on the didactical model", "hard effort" or "tasks too low-level". It has to be said that this course was less time-consuming for learners than the other two. The learning materials were rated as neutral, while the e-learning platform was largely accepted by the students. In particular, the usability of the system's features (except the WIKI module) was highlighted as good.

5   Conclusions

To sum up this study, the four assumptions made in the introduction of the paper can be commented on in the following way:

- First of all, it is possible to implement an online course on a certain topic in different ways, e.g. by following principles of the three learning theories. All of these e-learning strategies can be considered as realisable in the area of adult education;
- Secondly, each of the three courses varied in several aspects (such as the effort, the effectiveness, the teaching and learning behaviours, the acceptance, and so forth) within the stages of preparation, implementation and conclusion for both the teacher and the students;
- Thirdly, the behaviouristic and the constructivistic approach showed better results on effectiveness in teaching and earned a better rating from the students;

- Finally, this study showed that the best efficiency of knowledge transfer measured by the students' achievement can be obtained through those tasks that students have to complete on their own. It has to be noted that, although the first phase of the constructivistic approach was intended to be a group task, most members of the groups decided to work separately on parts of the task and merge their results afterwards.

As a result of this study, the following advice can be given to instructional designers of online courses. It is important to choose the appropriate e-learning strategy for implementing an online course, e.g. by reusing a pre-defined didactical component following a commonly-know learning theory. Within the scope of adult education, the three e-learning strategies dealt with in this paper are realisable for a lecture which mainly tries to address the cognitive domain. Nevertheless, important learning objectives should be achieved by applying certain tasks which students have to master on their own. From the didactical point of view, some kind of assessment is necessary to enforce learning. Yet, it is not important whether the assessment is done by the teacher or by the students themselves. Altogether, this study can be seen as a positive example for implementing e-learning in the area of adult education.

Acknowledgements

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