

EVALUATION OF AN E-LEARNING COURSE IN MOODLE IN COMPARISON TO A TRADITIONAL LESSON

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Abstract

A Moodle course was used in an e-learning unit to compare undergraduate students' outcomes to those in a traditional lesson. A traditional teaching unit was presented for a parallel control group. After the lessons, the students performed the same exercises. Afterwards, the learning success of the students was compared. In addition to the quiz assessment, the students were asked about their personal impressions in a questionnaire.

The result of the quiz was that the group with the traditional lesson achieved results that were slightly better than those of the e-learning group. The evaluation revealed that the students' opinions about the e-learning course differ more than the opinions about the traditional unit.

Keywords: E-Learning, Motivation, Evaluation, Comparison, Moodle Course, Knowledge Management, Knowledge Modeling and Description Language

1. Motivation and Project Background

Sponsored by the STAEDTLER Foundation, a project to support underrepresented groups in STEM (Science, Technology, Engineering and Math) subjects is being carried out at the Department of Computer Science at the Technical University of Nuremberg Georg Simon Ohm (TU GSO). The project includes "people from non-academic families, those who come from a migrant background and women have been underrepresented in STEM subjects at universities" (Schötteler & Brockmann, 2019, p. 3100). This project intends to counteract the shortage of specialists in the STEM occupations by supporting underrepresented student groups (i.e., students with a migration background, from non-academic households, female students) before, during and after their studies. To this end, digitization measures in STEM studies should be evaluated and carried out at the TU GSO Nuremberg. The entire life cycle plays a decisive role, starting with the choice of the students' course of study, through university or college study to entry into the labor market, and is included in this research project. Specific digital prototypes will be developed as supporting measures. One question within this project is: Can e-learning be a useful instrument to explain complex topics? Self-reliantly learning with electronic media is an essential qualification for students' future working-life (Schuhbauer, 2018, p.

2724). Maybe e-learning has an additional value, especially for students who cannot attend the lessons. It allows them to repeat the units. This may be necessary for students who have to work or to take care of children or elderly or handicapped persons. E-learning supports repeating the material and preparing for tests.

In this paper, first the advantages and disadvantages of e-learning are described briefly. Afterwards, the research field is specified. Then the characterization of the traditional unit and the e-learning unit that were developed for this project follows. The test and the evaluation after the units are described in sections six and seven. The paper ends with a perspective on future work.

2. Advantages and Disadvantages of E-Learning

In this paper, I define e-learning as the support of teaching and learning processes through digital media or tools. The most common advantages of e-learning are the independence from time and place, the unlimited number of participating students, the ability to repeat the lesson, standardized contents and the possibility to offer different media. On the other hand, e-learning demands self-discipline of the students; it offers fewer possibilities to ask personal questions; and the teacher does not get feedback from the students. Working on a computer screen can be tiring. Some related works point out the advantages and disadvantages of e-learning (Radovic-Marcovic, 2010; Arkorful & Abaidoo, 2015).

Rivera and McAlister (2001) worked out a similar research study. They randomly divided students of the course "Management Information Systems" into three groups. Forty-one students received a traditional lecture. Forty students were divided into a hybrid section in which the course was also held as a lecture. In addition, course materials were made available online and included in the course. For the third group of fifty-three students, the course was largely only offered on the web. Subsequent examinations did not reveal any significant differences in the performance of the participants in the three groups. In contrast, in a survey of student satisfaction, there were differences. The web-based course scored particularly poorly, regardless of the same performance of the students in the test. The low level of satisfaction was associated with problems in providing the online platform and course materials. Overall, it was noted that concerns about the use of e-learning courses were more related to student satisfaction than to learning success. However, this study is more than eighteen years old. This could be a clue that the results found are no longer valid today.

Dondorf, Breuer & Nacken (2016) carried out a similar comparison. The traditional student group achieved significantly better performance results than the e-learning group. The satisfaction of the e-learning course was also surveyed. Three quarters of the students believed that they had learned more in a traditional course. Motivation is cited as an important factor for the poorer performance of the e-learning group.

The WICHE Cooperative for Educational Technologies (WCET) lists some studies at their website “no significant difference” (WCET, 2019) which compares the students’ outcomes using alternate modes of education delivery. In addition to these studies, the aim of our project is to find out the usability of e-learning especially for complex topics.

3. Research Field

The subject “knowledge management” is part of the bachelor's program in information systems during the 4th semester. Students should learn the contents of knowledge management. They should understand the requirements of knowledge management in companies. At the end, they should be able to design solutions for knowledge management. They should be able to think, to analyze, to classify problems, and to identify solutions of knowledge management.

Knowledge Modeling and Description Language (KMDL) is a complex topic in this field. KMDL describes knowledge flows and conversions “along and between business processes. The KMDL enables the formalization of knowledge intensive processes with a focus on certain knowledge-specific characteristics” (Gronau, 2012, p. 1). This description language for knowledge-intensive processes contains three levels. The students should know the description symbols for each level. They should be able to read and interpret process descriptions at all levels. They should be able to model small processes themselves.

In the summer semester of 2019, one comparison group attended a traditional teaching unit about KMDL; a second group took an e-learning course about the subject. The e-learning course was not designed an asynchronous, online course. The students were progressing through the material in a self-paced manner in a classroom environment, with the instructor present. The participants of both groups attended the course Knowledge Management in the summer semester of 2019 and had a comparable level of pre-existing knowledge. Figure 1 shows the process of the study.

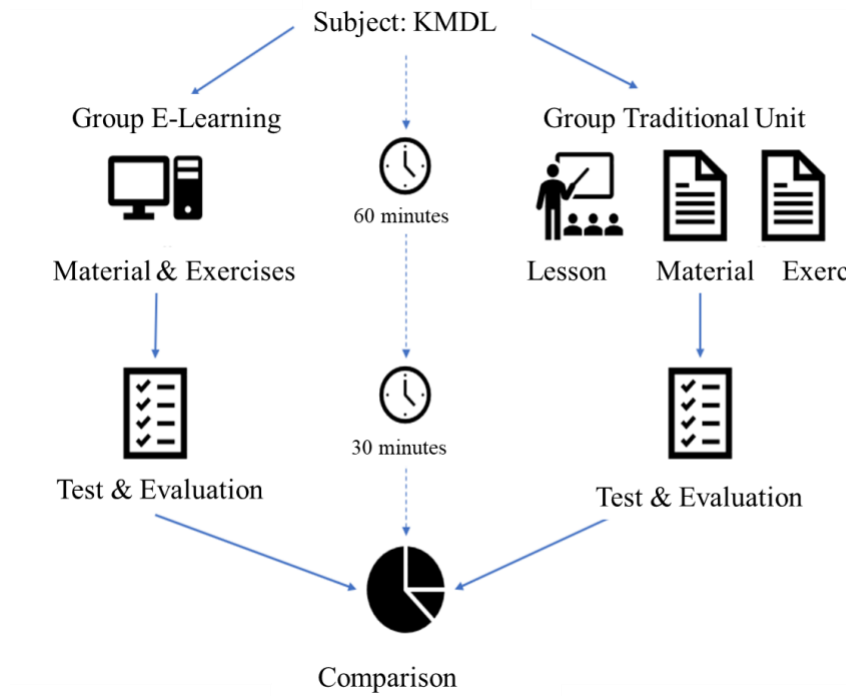


Figure 1. Process of the study.

4. The Traditional Unit

The traditional unit consists of a lesson and exercises. This in-class unit was about sixty minutes. The second group had also sixty minutes for their e-learning course. First, twenty participants listened to a presentation about KMDL. This teaching unit consists of a complete lesson about all three of the KMDL description levels. An instructor explained visuals. Figure 2 shows a slide of this presentation. The students had the chance to ask comprehension questions.

Modellierung von Wissenskonzersionen in der Aktivitätssicht

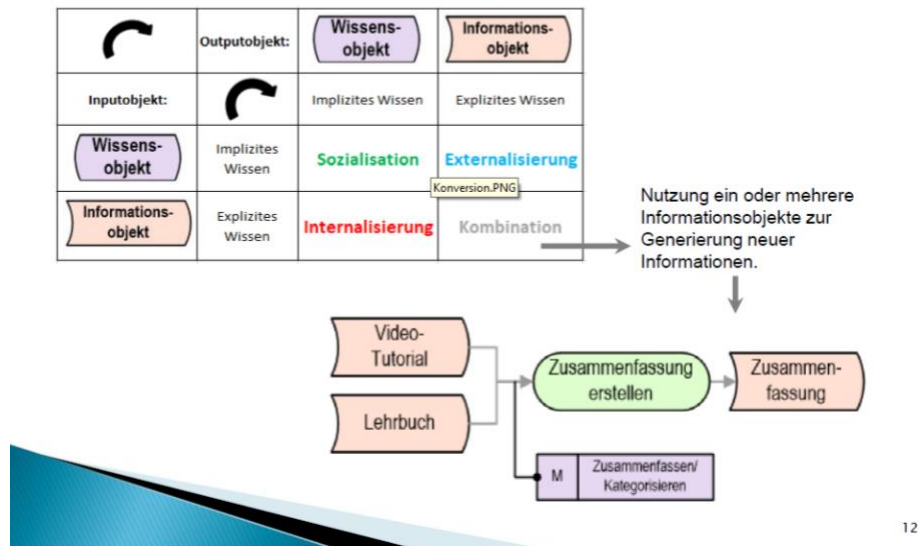


Figure 2. Slide of the traditional unit.

After the presentation, the students got exercises to solve. They had to solve several tasks by themselves. The professor and an assistant looked at their work and were ready to help and answer questions. Figure 3 shows one of these tasks.

3. Fallstudie zur Kommunikationssicht

Am 15. März um 13:00 Uhr verabreden sich Angela und Bernd in der Cafeteria, um ihre Semesterpläne zu vergleichen und evtl. weitere offene Fragen zu klären. In der Cafeteria diskutieren die beiden Studenten darüber, welche Voraussetzungen die Studierenden erfüllt haben sollten, damit sie die Module aus dem letzten Semester belegen dürfen. Angela behauptet, dass die Belegung der Module nur nach dem erfolgreichen Abschluss des Praxissemesters möglich ist. Bernd ist sich unsicher und recherchiert darüber in der SPO. Da er die Information darüber nicht findet, ruft er einen Mitarbeiter vom Studienbüro an. Die Information von Angela wird ihm vom Mitarbeiter bestätigt.

Modellieren Sie den Ablauf der Kommunikation zwischen den beteiligten Personen mit Hilfe der KMDL-Kommunikationssicht.

Hilfstabelle:

Person	Ebene	Person	Kommunikationsmittel	Zeit und Ort	Geplant/ ungeplant		
Angela	Cafeteria	Bernd	Gespräch	gleiche Zeit, gleicher Ort	geplant	2h	Frage klären

Figure 3. Task of the traditional unit.

5. The E-Learning Unit

Moodle is an open-source learning management system (Moodle, 2019). In Moodle, the learning content, such as text passages, images or videos, is available in a digital course room. This content can be enriched with various gamification elements. Levels can be created, which are a requirement for progressing to the next level. Self-control options can also be incorporated, for example as a quiz. All students of the Technical University of Nuremberg are provided with a Moodle account at the beginning of their studies. The students of the Technical University of Nuremberg are familiar with the software.

In advance, a project team of four students developed a Moodle course for the KMDL unit. For this study, twenty students took the course at the university. To get comparable results, they had also sixty minutes time for their unit. A professor and an assistant were present and advised the students. Time and place were fixed for the event. This means that the advantage of independence from date and time does not exist here. In return, the students had the possibility to ask for advice.

The subjects of the traditional unit and the e-learning unit were the same. The e-learning unit consists of several small lessons. After every lesson, exercises are provided. Figure 4 shows the start of the e-learning unit.

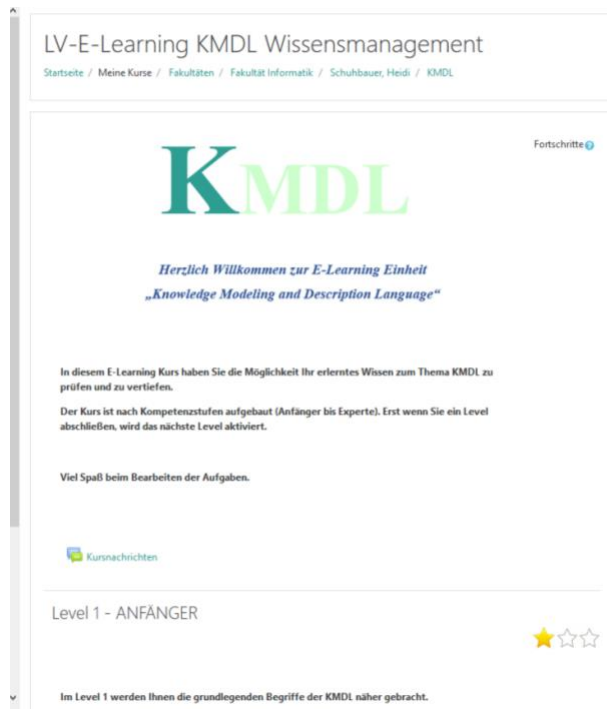


Figure 4. Start of the e-learning unit.

Figure 5 shows one of the exercises the students had to perform. This example is an assignment task. It is a drag-and-drop activity. The students had to assign knowledge objects to the category “explicit knowledge” or “implicit knowledge”.

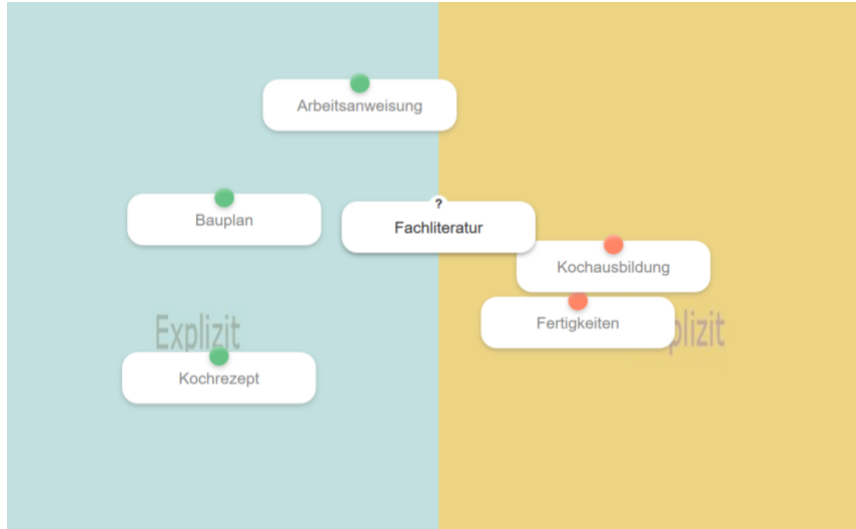


Figure 5. Task of the e-learning unit.

6. The Test

Next, the learning success of the students was assessed. A small quiz had to be taken by the students immediately after the e-learning or practice unit. It was not graded and could be handed in anonymously. It was only used to compare which group understood the material better. For this purpose, a quiz was developed which the students had to take. This test was the same for both groups. It consists of short questions referring to the complete learning material. Afterwards, it was checked at which questions significant differences occur.

As shown in Table 1, the result of the quiz was that the group with the traditional lesson achieved results that were slightly better than the e-learning group. However, these results are not statistically significant because of the small group sizes. The null hypothesis for the two-sample t-test was that the average test results of the e-learning group and the traditional taught group did not differ. Since t is not in the critical range at a significance level of 5% ($t=1.2783$; Range -0.2024 to 0.2024), the null hypothesis is confirmed. Therefore, from these results we cannot draw the conclusion that the traditional unit imparts learning content better than an e-learning unit. On the other hand, we can assume that there are no major differences in the amount of learning effort required when attending a traditional unit or an e-learning course.

Table 1

Comparison of the test results of both groups

	Group E-Learning	Group Traditional Unit
Number	20	20
Average	15	16.5
Standard Deviation	2.85	2.84
t	1.2783	
Range	-0.2024 to 0.2024	

7. Evaluation

In the next step, the students were asked how they assess their lessons. They assessed whether and how well they liked the unit presented, what they liked and disliked, and which learning kind they would prefer. Parts of this questionnaire were:

- Personal information about the students, such as their qualifications and their progress in their studies
- Questions about the contents of their lessons, such as the quality and amount of the exercises and examples and the level of the material
- Questions about the teaching method, such as comprehensibility, motivation, and assistance
- Questions about the acceptance of their unit, such as personal motivation, personal assessment of the lessons' quality.

Table 2 shows an overview of statements that compare acceptance and satisfaction with the courses. The students rated how much they agree with the statements listed in the table. While the average satisfaction with the course, the type of information provided or the type of teaching hardly differs for most questions, there are sometimes differences in the standard deviation. Excluding the first question, there was a dispersion of student opinions in the e-learning course.

Table 2

Comparison of the evaluation results of both groups

Question		Average	Standard Deviation
The unit was motivating.	E-Learning	72.6%	19.2
	Traditional	67.5%	21.6

The unit was comprehensible.	E-Learning	78.6%	21.3
	Traditional	77.6%	14.2
The presentation was appropriate.	E-Learning	78.8%	23.3
	Traditional	78.8%	14.7
I am content with the unit.	E-Learning	82.5%	20
	Traditional	81.3%	13.8
I prefer this kind of lesson.	E-Learning	76.2%	27.9
	Traditional	82.5%	14.2

8. Future work

The number of the participants in the test was not high enough to achieve statistically significant results. Building the two groups, the different levels of the students were not considered. To confirm whether the results achieved in this project are valid, the experiment will be repeated during the following summer semesters. More test groups could improve the project results achieved.

For the interpretation of the results, it is necessary to know that they depend on the quality of the teaching units evaluated. Results of the traditional unit depend on the quality of the teacher. Results of the e-learning unit depend on the quality of the e-learning course. In conclusion, it will remain difficult to explain whether one teaching unit is better than the other. However, some statements about the learning efforts and about the students' preferences could potentially be validated.

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