ANALYSIS OF LEARNING OBJECTS FOR OPTIMIZATION AND DIGITAL TRANSFER REPORT OF INTERMEDIATE RESULTS ON LEARNING PATH IDEAS – FIRST SURVEY

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ABSTRACT

This paper is a progress report about a project that consists of five stages starting with an analysis of the current state of application of higher educational learning material with regards to structural format and media didactics. The aim of this analysis has been accomplished through an initial survey with the motivation to analyze didactic and digital aspects of final study competencies as well as individual learning styles. The next stages include a digitalization process and an upcoming evaluation section. The results of the initial survey show that key competence goals that are formulated by teachers are not always comprehended and accepted by students. Students sometimes do not understand the purpose of the teachers' learning path ideas and, thus, do not accept some subjects and intermediate goals. These lacks of acceptance provide a fundamental basis of refining teaching courses. This report summarizes an approach to optimize learning goals and digital transfer so that precise evaluation helps finding these misconceptions and therefore both course structure and learning materials can be improved. Furthermore, it advices teachers to focus on teaching relevant topics not only for exam purposes but also for future professional competencies. Finally, this paper serves an example for teachers, especially of higher education level, to find weaknesses in a teaching objective and how to prioritize optimization, thereby clarify the learning path to students. This increases motivation and improves digital transfer.

KEYWORDS

E-Learning, Distance Education, Higher Education, Scientific Survey, Didactic, Competence Learning, COVID-19.

1. INTRODUCTION

Covid-19 has led to a rise in digitalization of teaching objective in global education due to the closure of many schools (Statista 2020). Since then, digitalization has become essential with new challenges to tackle. Institutions and experts advise higher education materials to be open access and call for wider cooperation (DAAD/DIE, 2018). Consequently, a project between six high schools in North-Rhine-Westphalia has been started promoting digital OER[1]-learning materials for public use and discussion. In this project, six universities, namely TU Dortmund University, Dortmund University of Applied Sciences, Bochum University of Applied Sciences, South Westphalia University of Applied Sciences, Hamm-Lippstadt University of Applied Sciences and University of Wuppertal, revise the learning materials used in higher education. Through surveys, didactic and digital aspects of study competences and individual learning styles were analyzed. Altogether, this paper evaluates the initial situation including the first survey, while the digitalization process is still going on. A second survey will follow in early 2023.

Previously, the course Technical Drawing, a basic module of higher education for engineers, has been restructured in terms of didactics to aim for competency-based learning. Here, constructive alignment ensures that learning objectives, success contributions, and teaching/learning activities are aligned (Biggs, J. & Tang, C., 2011). Then, a digitalization project was launched to offer OER-material (open educational resources) for the higher education platform of North-Rhine-Westphalia (ORCA.nrw). To obtain knowledge about the needs of students and lecturers, questionnaires have been prepared. The focus of this survey is to find out which competences are important to reach certain learning goals/objectives. Both the students and the lecturers' thoughts on the acquirement of these competences are considered. A majority of students in higher semesters

were surveyed. The students have predominantly participated in the exam at the end of the course, so that they are able to answer with a much broader knowledge in terms of competences needed for their future study. This article is structured as follow: at first, the project cycle is shown to understand the purpose of the report. Then, the structure of the questionnaire is depicted and the inspected parameters of the first survey are presented. Next, the results are analyzed by comparing the answers of the students with the expectations of the lecturers and are discussed. Finally, a conclusion regarding the presented optimization process is given.

2. PROJECT CYCLE

Before the teaching module is digitalized, an initial survey is applied to analyze both the students' and teachers' opinion on how learning materials should be provided to reach competence goals (Figure 1). The first questionnaire was handed out at the beginning of the Covid-19 pandemic in 2020 and the second one will be introduced in February 2023 in order to indicate possible changes. They should reveal the student's assessment of educational goals and whether these competences needed for further studies are attained. For this reason, mostly students of higher semesters were consulted.

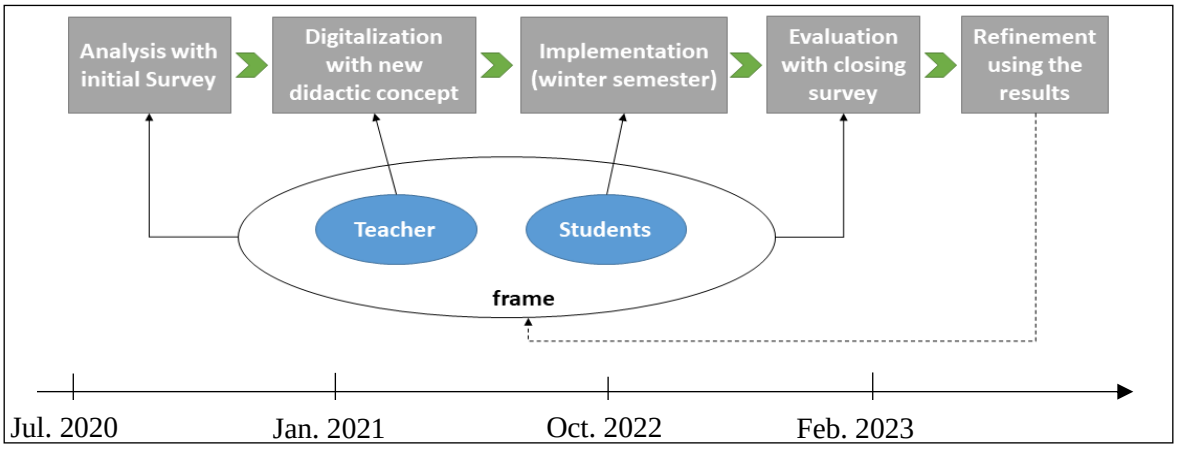

Figure 1. Project cycle with timetable

At the moment, new digital materials with innovative and interactive characters are generated. To reach learners' full motivation, as suggested by Shabbir et al., providing personalized intervention will be considered (Shabbir et al. 2020). After the completion of this stage, the new proposal will be offered locally at the universities that are participating in the project by implementing it in teaching courses. At the end of the trial, the evaluation with the second survey will be executed. The results will be analyzed afterwards and the digital course offer will be passed through a refinement process. Last but not least, the final results will be published in a full paper. The upcoming paper will analyze the sufficiency of the measures presented in this paper and will also conclude the acceptance of digital OER-material using modern didactics backtracking. Moreover, the digital learning materials will be published at the online portal of North-Rhine-Westphalia.

2.1 Questionnaire Structure

The questionnaire is provided digitally to the students, which makes it easier to automate the evaluation. It consists of eight questions that are to be answered within five minutes. These questions target specific facets such as the gained skill level or the importance of the gained knowledge for their further study that is displayed in further detail in table 1. In order to determine the degree of agreement regarding the questions, the Likert scale, developed by Rensis Likert (1931), from one to five (strongly agree-strongly disagree) is implemented. It is used in various sciences using questionnaires (e.g. Croasmun JT & Ostrom L. 2011; Gay, L. et. al., 2009). The questions also provide the assessment of their own skill level. It is convenient to link these self-assessments to the competence goals written down in the module manual. On the other hand, the survey delivers not only direct topics and ideas that are very suitable to refine, but also reveals lacks of skill or competence that should be addressed to fill a desideratum.

Table 1. Construction of questionnaire

Dimension	Facet	Option
exam	skill level/experience	Yes/no
extent	perception	1-5
complexity	previous knowledge	1-5
Media usage	digital media-savvy	1-5
topics	Importance for further study	1-5
topics	Suited for digitalization	1-5
Skill level	Gained in course	1-5
digitalization	Innovative ideas	Open response

3. SURVEY RESULTS AND DISCUSSION

259 people from the six universities mentioned above participated in the survey. The majority of the participants (95 %) relate to a semester greater than two. 89 % of the students have also participated in the course exam, so that they are able to assess their exam grade, which is correlated to the competence level obtained in the course. The results show that the extent of the course is estimated as reasonable.

Based on the following Figure 2, it can be seen that the students do not entirely agree to whether the media used to contribute better understanding. This circumstance could have two reasons. First, this could relate to different learning styles in general or the degree of proficiency. Hence, the skill level of first semester engineer students differs tremendously due to individual internships before studying and possible vocational training completed in advance. Secondly, the knowledge of innovative media available and technological possibilities is different among the students.

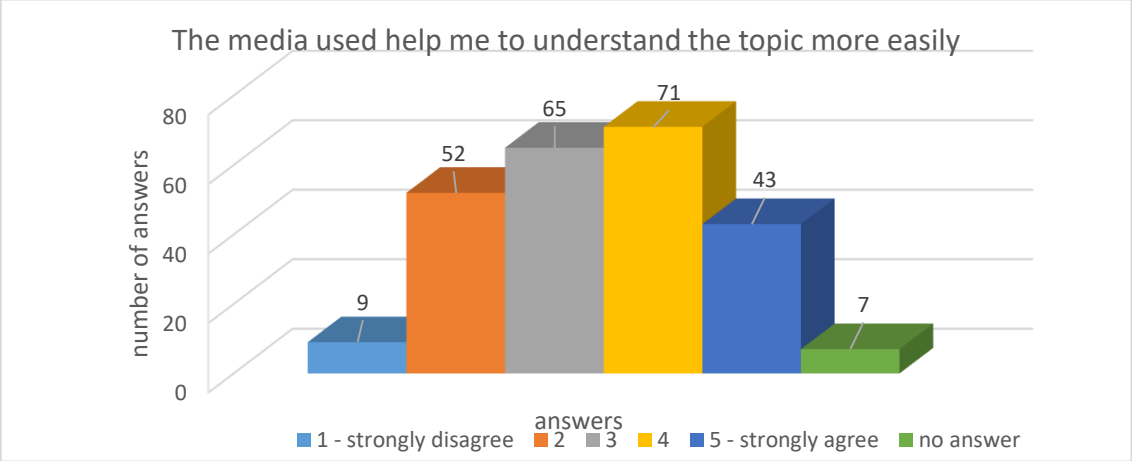

Figure 2. Opinions on media usage

Furthermore, it is asked whether the skills gained could and should be applied in their study. The answers correlate directly to the next question, which topic should be focused on in a broader way related to competences needed for studying and jobs in the future. The results relating to the question about the suitability of topics for digitization with a virtual teaching approach in particular are coherent in terms of the lecturer's expectation on the student's answers.

The last question targets ideas for both technical and didactic digitalization solutions to offer new innovative learning and teaching materials. There is one interesting point where teachers and students contradict each other. Drawings made by hand are considered unimportant by students and the focus should be more on CAD (computer aided design) drawings, because technical drawings made by hand will not be needed any more in the future. The teachers strongly disagree on this point, because it does not only help them to learn effectively with simple examples, but it is also a basic comprehensive competence needed in many engineering situations like a strategy department meeting to sketch ideas or examples by hand, so that the communication between engineers is simplified.

4. CONCLUSION

The survey points out which topics should be focused on when creating new digital learning objectives. It shows where learning objectives are presented poorly, for example the strong disagreement on drawings by hand. It leads teachers to where and how misconceptions are to be processed. The first idea that comes into mind is to outline important competences in a motivation section to show important skills that are urgent for future tasks to come. Moreover, it locates possible weaknesses in teaching courses that can be tackled through didactic approaches for example through gamification improving student's and teacher's satisfaction.

In general, students prefer videos as digital preparation especially to be able to learn independent of time and place, also mentioned in LinkedIn (2019). Nevertheless, there is also a fraction of students that need a schedule that is set up by the lecturer for motivation and organization purpose. These different opinions also prevail over students in terms of teaching in presence vs. teaching digitally. These results suggest that hybrid learning or blended learning is a reasonable model that is able to fulfill everyone's needs. It should be mentioned that these models should provide both options (physical and virtual presence) simultaneously.

E-learning with digital media is able to set up a learning environment that is much more effective, but also bears more risks that need to be tackled. On the one hand, some students lose their motivation quickly while studying at home (Islam, S et al., 2018). On the other hand, time saved through higher efficiency can be used elsewhere, for example to close the gaps mentioned above. These measures lead to the establishment of a better basic understanding for both teachers and students. By applying those changes mentioned in the article, it is expected that the misconceptions between teachers and students decrease and the formulated competence targets coincide. This thesis will be researched after the second survey in early 2023.

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