Digital Mindset as the Most Important Prerequisite for Learning and Teaching in the Future

Further development of student digital literacy: An interdisciplinary perspective

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Abstract

In order to successfully integrate new, digital teaching and learning formats into university teaching, not only technical, financial, and structural prerequisites must be created, but also competence-related prerequisites that enable students to deal with the new formats. In an interdisciplinary project, we derive 64 relevant digital competencies from interviews and a questionnaire study, considering the perspectives of teachers and students. As a result, a pronounced digital mindset emerges as the most important component.

In order to successfully integrate new, digital teaching and learning formats into university teaching, not only technical, financial, and structural prerequisites must be created, but also competence-related prerequisites that enable students to deal with the new formats. In an interdisciplinary project, we derive 64 relevant digital competencies from interviews and a questionnaire study, considering the perspectives of teachers and students. As a result, a distinctive digital mindset emerges as the most important component.

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1. Motivation

What digital skills do students need when dealing with new, digital teaching/learning formats? This question is being researched in the sub-project "sTUDents - student-oriented digital learning and teaching", one of a total of eight sub-projects in the interdisciplinary joint project "virTUos - virtual teaching and learning at the TU Dresden in an open source context", in which innovative teaching/learning formats are being developed using gamification, VR technology and robotics, among other things, in order to be introduced into everyday university life after a successful trial phase.

To this end, agile and interdisciplinary innovation teams from the departments of medicine, mechanical engineering, economics, and humanities will initially test the novel virtual and hybrid teaching/learning scenarios and then disseminate them to other departments. The central goal is the development of a common strategy for digitally supported learning and teaching at the TU Dresden. For this purpose, all prerequisites that are necessary for the successful establishment of the new formats in the university context are analyzed, including technical, financial and structural prerequisites. sTUDents approaches the objective from a further perspective and examines the competence-oriented prerequisites that are necessary on the part of the students in order to be able to benefit maximally from the new formats in the learning process.

In recent years, the training of digital skills in the university context has become increasingly important in order to prepare learners for the future challenges in everyday working life, so that universities are increasingly creating corresponding offerings [1,2]. This process was accelerated by the pandemic in order to be able to continue to use the digitalization efforts that have been initiated in the long term. Within the framework of virTUos, we want to contribute to researching the current need for student digital competencies in order to enable learners and teachers to perceive digitally supported teaching as an opportunity and not as a hurdle in the long term.

In this context, it is also important to delineate which competencies are actually digital competencies. Digital competencies are "... Skills that enable people to navigate and actively participate in a digitized environment" as defined by the Stifterverband [3]. The European Reference Framework for Digital Competences (DigComp) 2017 describes digital competences as "understanding information and data; communication and collaboration; creating digital content; security of devices, personal data and the environment when using digital technologies; problem solving strategies" [4]. However, according to Kerres (2017), these are not additional competencies, but pervasive skills of the previous learning world [5]. Consequently, "digital competence[s] ... are the ability[s] to use digital media, to develop them in a productive way, to use them for one's own life, and to understand reflectively, critically, and analytically their mode of action in relation to the individual and society as a whole, as well as knowledge about the potentials and limitations of digital media and their modes of action." [6].

In the context of the project, we take the definitional approaches listed here as a basis for exploring the competencies needed by students in the university environment of the future.

The question of the necessary digital competencies is inevitably followed by the question of their concrete training and further development. Since this is significantly influenced by the needs of students as the central target group, it is essential to involve students already in the development of the competence development formats.

2. Procedure

In order to approach the question of the necessary digital competencies, interviews were conducted with academic and student employees from all subprojects to collect the digital competencies that are considered necessary for the successful integration of the developed formats into everyday teaching. In the next step, the results were critically reflected on the basis of the above-mentioned definitions and those competencies that cannot be specifically classified as digital competencies as well as duplications were removed. In this way, the total of 90 mentions was reduced to 64 items. In order to be able to struc-

ture the future offerings for competence transfer thematically in a meaningful way, the items were finally clustered and classified into the four categories: "Digital Mindset and Reflection", "Technical Knowledge", "Digital Teaching", and "Virtual Communication and Collaboration", whereby there is no claim to selectivity between the individual categories.

For capacity reasons, the remaining high number of 64 items necessitated prioritization, which will be used to guide the successive development of the competency development formats in the future. To this end, project staff were invited to select from all the digital competencies identified up to this point those that are relevant in their individual project con-

texts. In contrast to the first survey, which was carried out on a subproject-specific basis, it was now also possible to consider responses from other subprojects. After quantitative evaluation of the feedback, a ranking was finally produced. An overview of the methodological procedure is shown again in Figure 1.

The core of the sTUDents subproject then begins by involving students from the outset in the development of the innovative formats as well as the formats for the necessary competence development in accordance with the "Students as Partners" approach, in addition to teachers and university didacticians, and thus creating offers that are suitable for the target group [7].
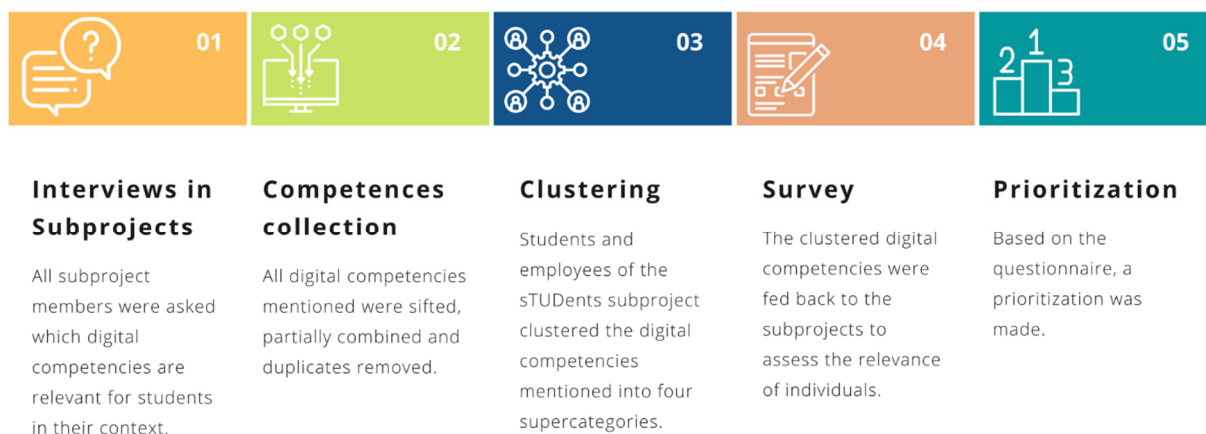

01	02	03	04	05
Interviews in Subprojects	**Competences collection**	**Clustering**	**Survey**	**Prioritization**
All subproject members were asked which digital competencies are relevant for students in their context.	All digital competencies mentioned were sifted, partially combined and duplicates removed.	Students and employees of the sTUDents subproject clustered the digital competencies mentioned into four supercategories.	The clustered digital competencies were fed back to the subprojects to assess the relevance of individuals.	Based on the questionnaire, a prioritization was made.

Fig. 1: Methodical procedure

3. Results

First of all, the interviews revealed how diverse and complex the field of digital competencies is and how they differ from those competencies that do not relate specifically to digital aspects. While proficient use of a learning platform or mastery of a programming language can be clearly assigned to digital competencies, self-organization, communication skills, and conflict management are competencies that were already important in traditional learning settings but are increasingly shifting to the digital realm.

In the in-depth analysis of digital skills, it becomes clear that about two-thirds are soft skills and about one-third are hard skills.

Quantitatively, the majority of the mentions from the interviews could be assigned to the category "Digital Mindset and Reflection" (see Fig. 2) and were confirmed once again by the contributors to the subprojects as the most relevant aspects in their areas of expertise during the questionnaire study.

This category includes competencies such as "acceptance of digital formats", "self-efficacy in digital learning processes" and "media resilience". The explicit naming of these competencies is surprising, as they are common to the so-called "digital natives," a generation, who has grown up in a digital world are often ascribed as a matter of course [8,9].

Based on the surveys in the departments and fields of action of virTUos, it can be deduced that a digital mindset and reflection competencies in their entirety are regarded as the core competencies in future everyday learning and work.
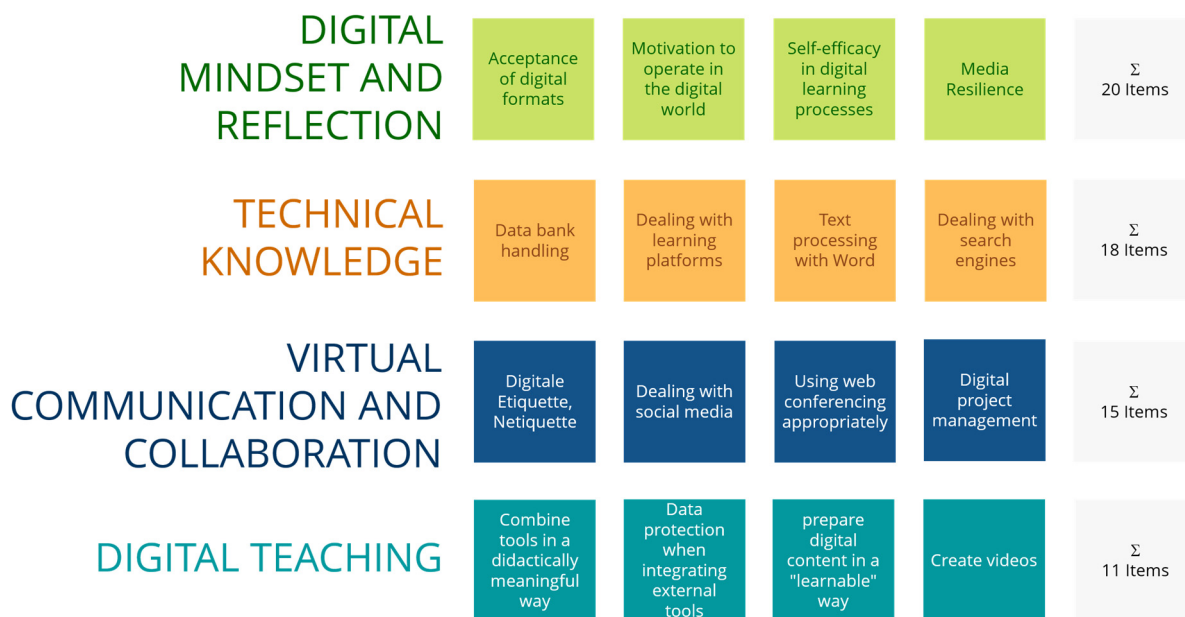
DIGITAL MINDSET AND REFLECTION	Acceptance of digital formats	Motivation to operate in the digital world	Self-efficacy in digital learning processes	Media Resilience	Σ 20 Items
TECHNICAL KNOWLEDGE	Data bank handling	Dealing with learning platforms	Text processing with Word	Dealing with search engines	Σ 18 Items
VIRTUAL COMMUNICATION AND COLLABORATION	Digitale Etiquette, Netiquette	Dealing with social media	Using web conferencing appropriately	Digital project management	Σ 15 Items
DIGITAL TEACHING	Combine tools in a didactically meaningful way	Data protection when integrating external tools	prepare digital content in a "learnable" way	Create videos	Σ 11 Items

Fig. 2: Categorization of digital competencies

4. Implications

From the insights gained, we derive the mission to support students in particular in developing a digital and reflective mindset. It can be assumed that students who have competencies such as flexibility and openness in dealing with digital innovations will find it easier to access more specific competencies. The digital transformation imperatively requires the acquisition of new technological skills, for which an open-minded inner attitude and the perception of new possibilities of digitalization are fundamental. Companies increasingly need professionals who understand digital technologies, use digital tools to solve problems and act flexibly. In the next few years cultivating a digital mindset will continue to be a major challenge, but one that holds a lot of potential: students benefit from acquiring transferable skills when they enter the workforce. In addition to higher productivity and satisfaction, studies highlight the positive impact on resilience [10]. Individuals with a strong digital mind set are less responsive to technological stressors, reducing the risk of reduced work and learning performance, lower job satisfaction, and higher dropout rates [11]. As current research findings show, forming the digital mindset is a top-down process [12].

Accordingly, university administrators and teachers should set a good example by acting sustainably and reflectively with digital media and enriching their teaching methods with open science and open education efforts.

For these reasons and the expected positive effects, the sTUDents subproject is taking on the challenge of equipping learners and, as a consequence, teachers with an open digital mindset and motivating them to actively participate in the digitization of university teaching and to act as role models in order to jointly achieve efficient ways of working with the support of digital media. For this purpose, existing artifacts will be collected as well as new artifacts will be created that address and educate this mindset. In doing so, we initially focus on the needs and priorities of the subprojects and increasingly expand them to other subject areas. The developed formats will be succes-

sively compiled in the OPAL course "Driver's License Digital Competencies" as well as addressed to students in workshops and subsequently made available for sustainable use as OER. The entire development process is largely shaped by students themselves and is based on studies on teaching/learning formats that have been proven to be conducive to learning or preferred by students in the context of university teaching [13,14].

Acknowledgement

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