Change and adoption of digital learning formats during the COVID-19 pandemic. A trend study from Germany

Tom K. Schaal
Faculty of Health and Healthcare Science
University of Applied Sciences Zwickau, Zwickau, Saxony, Germany

Maria A. Marchwacka
Faculty of Nursing Science
VinzenzPallotti University, Vallendar, Rhineland
Palatinate, Germany

Daniel Tolks
Faculty of Health Sciences
Medical School Hamburg, Hamburg, Hamburg, Germany

Joachim Kugler
Institute and Polyclinic for Occupational and Social Medicine, Faculty of Medicine,
Technical University of Dresden, Dresden, Saxony, Germany

Background: With the COVID-19 pandemic, lecturers in Germany faced the challenge of emergency remote teaching. The widespread formats of frontal teaching in lecture halls had to be transferred ad hoc to existing digital structures and expanded to include digital and didactic skills. Challenges existed in particular in the technical infrastructure. Aim: The goal of the trend study was to assess digital teaching and capture the change that has largely or entirely replaced face-to-face teaching as a result of the COVID-19 pandemic from the perspective of public health, medical, and nursing faculty. Methods: The cross-sectional surveys took place online from June to August 2020 and June to July 2021, respectively, and data were collected via www.soscisurvey.de. The online survey was conducted among members of various professional societies for public health, nursing science, and medical sociology in Germany. The standardized survey with predominantly closed questions collected data on the use and application of digital technologies in teaching, tools for digital teaching, digital teaching-learning concepts, experiences and attitudes of teachers, challenges in digital teaching, and evaluation concepts and data protection. Results: Technical equipment improved between the two surveys at the universities (3.2 to 2.8). Whereas 54.8% of respondents were critical of data protection with regard to webinars or chats in 2020, the figure was 38.5% in 2021. It could be determined that digital teaching and learning offerings promote the attractiveness of the university and improve learning outcomes from the perspective of the teachers. In contrast, the format makes individual learning more difficult and involves more effort. Among all participants, a stronger integration of online voting tools was found. While Cisco Webex and Zoom experienced the strongest growth in demand, Adobe Connect and Amboss were displaced the most. The percentage of online teaching that instructors would like to maintain in their teaching in the future was quantified at 42.5%. Discussion: During the first and third semesters in the midst of the pandemic, an improvement in digital learning formats was noted. Future challenges continue to be legal issues as well as digital infrastructure of universities and lack of didactic support indicated. New technology is mainly used for knowledge transfer, rarely for activating students and redesigning learning tasks and processes. The centers for higher education didactics have partially responded to this challenge with the "Digital Change Agent" continuing education program.

Keywords – higher education, digital teaching, competence achievement, technological resources, data protection/security

I. INTRODUCTION

The COVID-19 pandemic impacted education systems worldwide and contributed to the temporary closure of universities and colleges. By August 2020, it was estimated that 1.6 billion students had been affected by pandemic-related closures. To overcome this problem, UNESCO recommended the use of distance learning environments [1-2]. At the beginning of the summer semester 2020, it was decided throughout Germany to implement the semester exclusively with digital teaching offerings due to the COVID-19 pandemic. Instructors at universities were under high pressure to deliver digital courses in the shortest possible time and without significant support. The support measures for teachers had not grown in a linear relationship to the demand from one day to the next. This situation can therefore be interpreted as a unique crisis-related field experiment. This crisis-related form of "digitization in higher education" must be clearly distinguished from systematic and long-term planning, development and implementation of online teaching, such as is familiar in the context of part-time courses, at distance learning universities or as international offerings with distributed target groups [3]. The term e-learning is a relatively new term that has emerged as information and communication technologies have developed and advanced. E-learning is considered a broad term that describes the asynchronous or simultaneous delivery of knowledge to learners through electronic systems. The historical origin of the term e-learning is not precisely known. However, it has begun to develop with the use of the Internet and personal computers [4-5]. Even before the COVID-19 pandemic, there were good developments in digital learning and teaching [6-7]. Evidence exists in basic research that has highlighted the benefits of the targeted use of digital teaching [8-9]. In particular, blended learning formats showed higher effect sizes on learning outcomes compared to the traditional lecture [10]. In higher education didactics of health professions courses, emphasis was placed on blended learning scenarios as well as the use of virtual patients [11], simulations [12], and game-based approaches [13]. Ferri et al. highlighted open challenges at the technological and pedagogical levels. First-named were access to infrastructure such as technological devices and an Internet connection, lack of teacher skills in using technology, and the need for training and guidelines for teachers and students. Second-named were the need for instructional materials in the form of interactive multimedia (images, animations, educational games) to keep students motivated and a lack of student feedback and assessment systems [14]. Initial findings as part of the survey of public health, medical, and nursing faculty described below found that response systems were used in digital teaching by 29%, digital games by 9%, and videos by 67% of respondents. Consultations via email were most common within digital teaching and study activities, computer simulations the least common [15]. The focus in university teaching should not be on "what is technically feasible" but on "what is didactically desirable", because as soon as digitization efforts "leave the field to the technologies", "digital scenarios will be little more than those of a 'framework' for content" [16].

The purpose of this study was to assess digital teaching and to capture changes between the first and third semesters during the COVID-19 pandemic from the perspective of the lecturers. The focus was on the use of different forms of teaching and learning as well as the assessment of digital teaching in the study programs Public Health, Medicine and Nursing.

II. Methods

Two independent online surveys were conducted in the period June-August 2020 and June-July 2021. The second survey's questionnaire was expanded and adapted. The first survey's questionnaire contained largely closed questions and was based on the Bertelsmann Stiftung's "Digital Education Monitor" [15, 17]. A pretest was conducted in each case for functional and linguistic verification and adaptation. Questions related, among other things, to the application of digital technologies in teaching, to the experiences and attitudes of teachers and to challenges in digital teaching, as well as to evaluation concepts and data protection. The online survey was conducted among members of various professional societies for public health, nursing science, and medical sociology in Germany. To keep the dropout rate low, questions in the online questionnaire could be bypassed and not mandatorily answered. The invitation to participate in the survey was sent out via the newsletters of the respective professional societies; personalized participation links were therefore not possible. The survey was hosted at https://www.soscisurvey.de. It was estimated that 1,700 teachers were reached. On the landing page of the survey, the objectives were explained and reference was made to the voluntary nature of participation and anonymous data processing. A link led to the comprehensive data privacy concept if interested. At the end of the landing page, participants had to agree to data processing, otherwise they were taken to the end of the survey. Current guidelines for ensuring good scientific practice were taken into account [18]. The convenience sample included 100 participants in the first survey and 138 participants in the second survey. It was not possible to link participants between the two surveys. Data analysis was performed using IBM SPSS Statistics(version 29).

III. RESULT

Women were 60% (men 38%, diverse 2%) in the first survey and 63.8% (men 36.2%) in the second survey. The age groups 40-49 and 50-59 were represented collectively by 59% in the first survey and 56.5% in the second survey. The majority of respondents had been lecturers for 11-20 years (29% and 31.2%, respectively). Among all respondents, 75% and 76.1% taught at universities, respectively, with the remaining percentage at colleges and other types of higher education institutions. With reference to the status group, 47% and 50% of the participants were research assistants 32% and 27.5% professors and 21% and 22.5% lecturers and others, respectively. Respondents belonged to different disciplines (Figure 1).
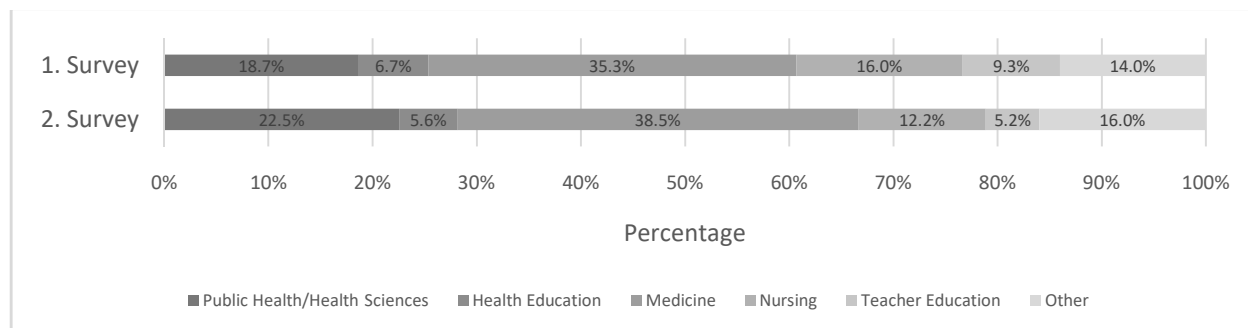

Figure 1. Overview of represented teaching disciplines (multiple answers possible)

On a six-point scale (1 completely adequate - 6 completely inadequate), respondents rated the technical equipment for digital learning at their university an average of 3.2 (SD±1,4) in the first survey and 2.8 (SD±1,2) in the second survey. It was found that tools in digital teaching were used to different degrees between the first and second surveys (Figure 2).
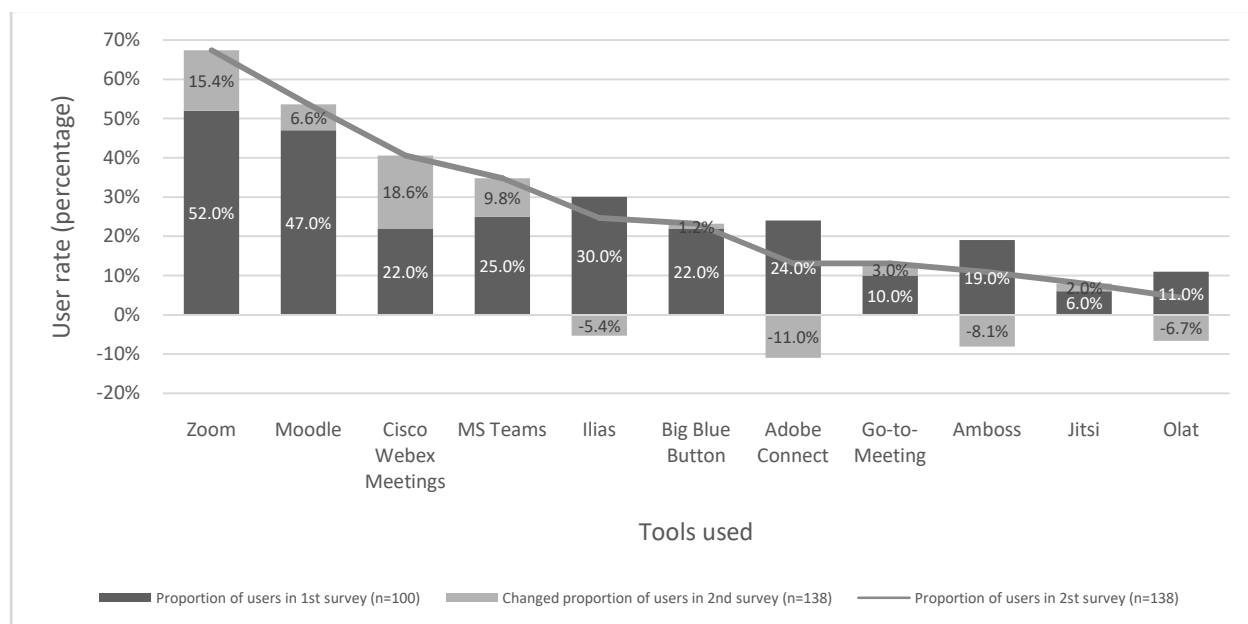

Figure 2. Change in the use of tools in digital teaching

While 54.8% of participants were critical of data protection with regard to webinars, chats, etc. in the first survey, this figure was 38.5% in the second survey. The question of whether teachers create videos themselves was answered in the affirmative by 53% in the first survey and 63.8% in the second survey. Saving webinars, e.g. for asynchronous participation in lectures, was answered in the negative by 59% in the first survey and by 47.1% in the second survey. With the exception of Tweedback, a higher degree of use was recorded in the second survey for all online voting tools queried (Figure 3).
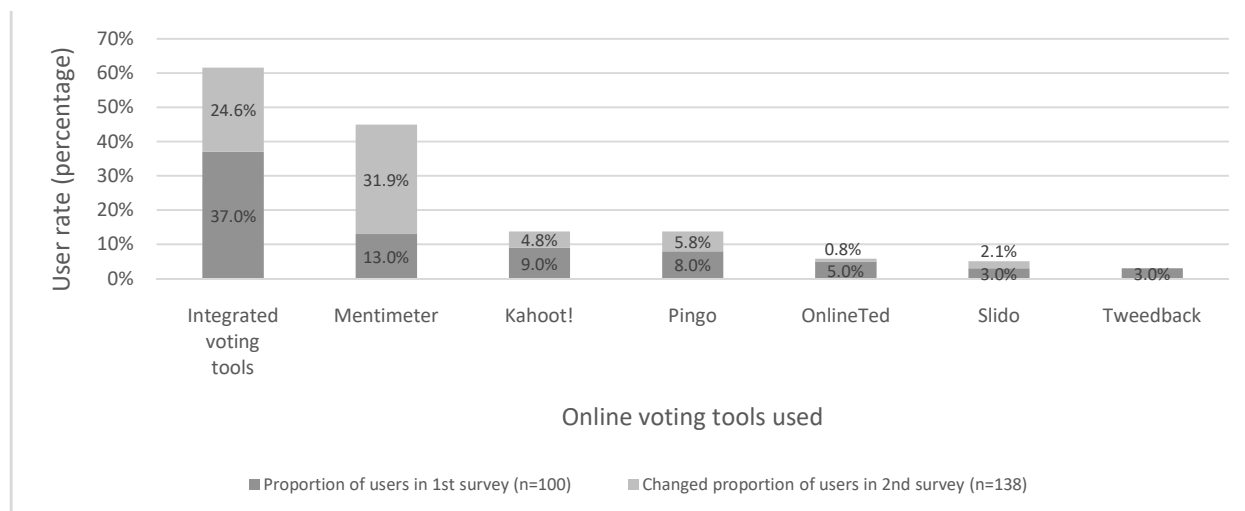
Figure 3. Change in the use of online voting tools in digital teaching

Based on their experience, participants were asked to rate how well different digital learning concepts had worked. On a six-point rating scale, the second survey showed a better rating in three cases (Figure 4).
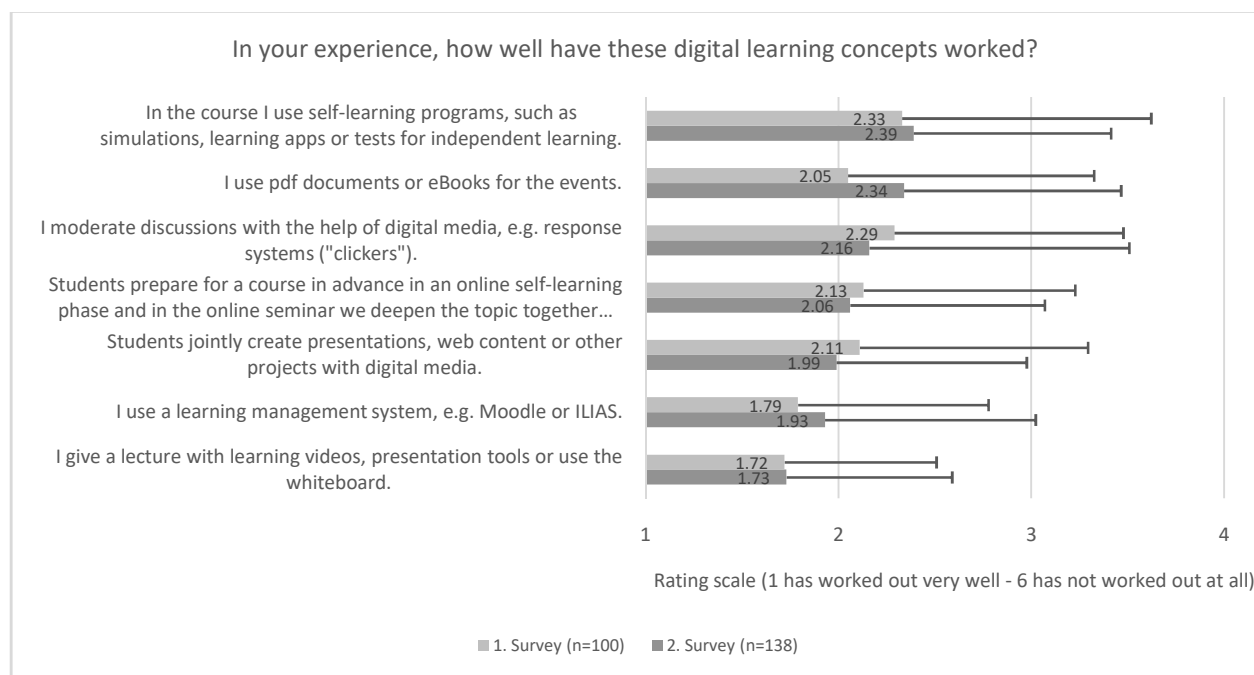

Figure 4. Average rating of digital learning concepts used (mean and standard deviation)

In both surveys, participants were asked which learning or study activity they use in online teaching. Possible response options were I use frequently, I use occasionally, I never use, and I don't know. For clarity, the first two categories were combined and the change between the two surveys was shown (Figure 5). In the first survey, 55.6% of the participants stated that evaluation concepts adapted for online teaching exist at their university. In the second survey, the value was 61.6%. Participants in the first survey rated their satisfaction with the implementation of digitally supported teaching on a six-point rating scale (1 not at all satisfied - 6 extremely satisfied) at 3.9 (SD±1.4) and in the second survey at 4.2 (SD±1.3). Along the same scale, the implementation of teaching from the home office was rated at 3.8 (SD±1.6) and 4.2 (SD±1.4), respectively. In contrast, the didactic support of the university was rated at 3.3 (SD±1.6) and 3.7 (SD±1.3), respectively. Only in the second survey were participants asked what proportion of online teaching they would like to maintain in their teaching in the future. The range of answers was from 0% to 100% (M:42.5%; Q1: 30%; Q2: 40%; Q3: 50%).
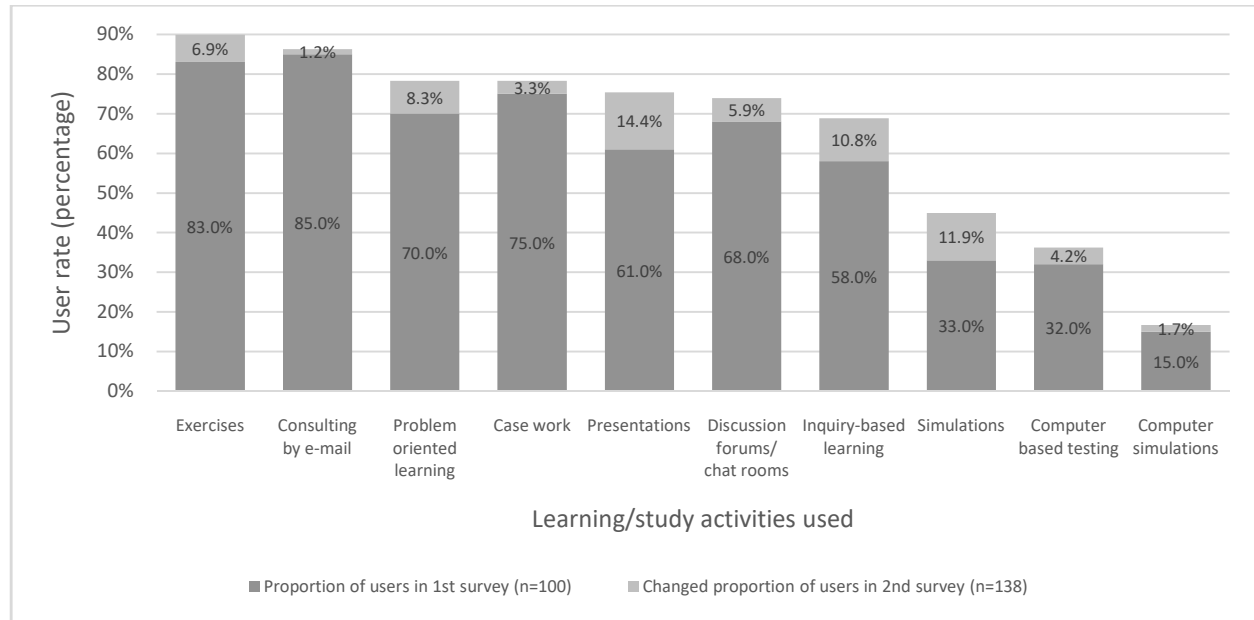
Figure 5. Overview of used learning/study activities

IV.CONCLUSION

The results show limitations due to the small sample sizes and the convenience sample approach of recruiting participants based on their affiliation to selected professional societies. Thus, representative conclusions about lecturers from all science disciplines are not possible. Since it was not possible to merge cases between the first and second survey and the prerequisites of an unconnected sample were equally not met, results were evaluated exclusively descriptively. A potential bias of the results due to non-response cannot be excluded due to the high number of members in the professional societies and the achieved participation. Since largely the same group of persons was considered for participation in both surveys, the results are nevertheless suitable in the sense of a trend study to show changes in the queried parameters between the first and third semester during the COVID-19 pandemic.

Between the two surveys, a largely more positive assessment of the tools used and of learning and study activities was found. The change in demand for various web conferencing systems can be seen in the fact that, at the beginning of the pandemic, lecturers resorted to well-known or readily available systems without these being structurally located in the respective university landscape. For example, Adobe Connect could be used free of charge via the German Research Network. Due to the COVID-19 related increase in usage, the system was overloaded at times and required an extension to other systems [19]. Lischka and Gelberg [20] conclude that it is not expertise in individual tools that counts, but openness to the use of different tools. Accompanying the situationally appropriate application are always organizational policies that are relevant at different levels and have an influence on the provided web conferencing system at the university level.How the demand for video conferencing applications will develop in the future is open. Viewed in terms of market growth, the survey results suggest a decline in market share and thus user demand for Zoom by competitors such as Microsoft Teams and Google Meet [21]. The present results support the findings of Kononowicz et al. [11] of the increased use of blended learning scenarios. It was shown that the use of online self-learning phases and immersion in online seminars were better evaluated in the second survey. The proportion of computer simulations used was also higher in the second survey [12]. It can be seen that lecturers are proportionately interested in retaining digital elements in post-pandemic teaching. In order to move from the crisis-related form of "digitization in higher education" to systematic and long-term planning, development, and implementation of online teaching, instructors need to be provided with knowledge about multiple uses of synchronous and asynchronous online teaching. The expansion of media, didactic and methodological competence should be in the first place. The goal here is not "large-scale" university strategies for digitization, but rather specific aspects of individual subjects and subject cultures. Digitization in medicine or the humanities differs enormously from the natural sciences. A "bottom-up" implementation based on subject-specific teaching content should be the target, not a strategy for more digitization [3, 22]. The Center for Higher Education Didactics in Saxony, one of 16

states in Germany, meets this requirement in the project "Digitization in Disciplines Participative Implementation :: Competencies Connected (D2C2)" with a duration of 36 months. In subject-specific Professional Learning Communities (psychology, health and social sciences, computer science, engineering, art and design), ten Saxon universities are working together, subject-specifically, to promote innovations in digital teaching and their participatory implementation. The focus is on the design of suitable teaching-learning scenarios, their evaluation and adaptation [23]. Now in its third cohort, lecturers at the Center for Higher Education Didactics in Saxony are being qualified as "digital change agents" in an 18-month continuing education program. These are to act as multipliers within the university, advising and supporting colleagues and the university management in a structured manner in the introduction of new, digital structures and processes. The current transformation in university teaching creates a need for further research, and in the future students and their needs should be increasingly included in the process of digital change.

REFERENCES

[1]　United Nations (2020). Policy brief: Education during COVID-19 and beyond. New York. https://unsdg.un.org/sites/default/files/2020-08/sg_policy_brief_covid-19_and_education_august_2020.pdf. Accessed 24 November 2022

[2]　UNESCO (2020). Education: From disruption to recovery. https://www.unesco.org/en/covid-19/education-response. Accessed 24 November 2022

[3]　Reimann G, Bohndick C, Lübcke E, et al. (2020). Emergency Remote Teaching im Sommersemester 2020. Universität Hamburg, Hamburg

[4]　Sweileh WM (2021). Global Research Activity on E-Learning in Health Sciences Education: a Bibliometric Analysis. Medical Science Educator 31:765-775

[5]　Wang ZY, Zhang LJ, Liu YH et al. (2021) Process evaluation of E-learning in continuing medical education: evidence from the China-Gates Foundation Tuberculosis Control Program. Infectious Diseases of Poverty Mar 10:23

[6]　Erpenbeck J, Sauter S, Sauter W (2015) E-Learning und Blended Learning: Selbstgesteuerte Lernprozesse zum Wissensaufbau und zur Qualifizierung. Springer Gabler, Wiesbaden

[7]　Riplinger T, Schiefner-Rohs M (2017) Medieneinsatz in der Hochschullehre. Akademische Lehr- Lernkonzepte zwischen Zumutung und Zu-Mutung. https://omp.ub.rub.de/index.php/RUB/catalog/view/105/94/586. Accessed 24 November 2022

[8]　Vaona A,Banzi R,Kwag KH et al. (2018). E-learning for health professionals. Cochrane Database Syst Rev. http://doi.wiley.com/10.1002/14651858.CD011736.pub2

[9]　Fontaine G, Cossette S, Maheu-Cadotte MA et al. (2019). Efficacy of adaptive e-learning for health professionals and students: a systematic review and meta-analysis. BMJ Open 9:e25252

[10]　Chen F, Lui AM, Martinelli SM (2017). A systematic review of the effectiveness of flipped classrooms in medical education. Med Educ 51:585-597

[11]　Kononowicz AA, Woodham LA, Edelbring S et al. (2019). Virtual patient simulations in health professions education: systematic review and meta-analysis by the digital health education collaboration. J Med Internet Res 21:e1467

[12]　Cook DA, Hatala R, Brydges R et al. (2011). Technology-enhanced simulation for health professions education: a systematic review and meta-analysis. JAMA 306:978-988

[13]　Tolks D, Lampert C, Dadaczynski K et al. (2020). Game-based approaches to prevention and health promotion: serious games and gamification. Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz 63:698-707

[14]　Ferri F, Grifoni P, Guzzo T. (2020). Online Learning and Emergency Remote Teching: Opportunities and Challenges in Emergency Situtaions. Societies 10:86

[15]　Marchwacka MA, Kugler J, Schaal T, Tolks D (2022). Digital higher education in the first COVID-19 semester. A survey of teachers in public health, medicine and nursing. Präv Gesundheitsf. https://doi.org/10.1007/s11553-022-00937-1

[16]　Handke J (2020). Handbuch Hochschullehre Digital: Leitfaden für eine moderne und mediengerechte Lehre. Tectum, Baden-Baden

[17]　Müller-Eiselt R (2017). Materialsammlung Monitor Digitale Bildung. https://www.bertelsmann-stiftung.de/de/unsere-projekte/teilhabe-in-einer-digitalisierten-welt/monitor/materialsammlung-monitor-digitale-bildung. Accessed 25 November 2022

[18]　DFG (2019). Kodex „Leitlinien zur Sicherung guter wissenschaftlicher Praxis". Deutsche Forschungsgemeinschaft, Bonn

[19]　Georg-August-Universität Goettingen (2020). Informationen zu Adobe Connect. https://www.uni-goettingen.de/en/informationen+zu+adobe+connect/604816.html Accessed 20 November 2022

[20]　Lischka A, Gelberg J (2021). Welche Kompetenzen benötigen virtuelle Teams? Wissensmanagement 3:44-45

[21]　Mausbach C (2021). Welche Krisengewinner Zukunft haben.Versicher Mag 68:60-62

[22]　Josten U, Uebernickel K, Cuno M (2022). Digitale Lehre. https://www.hochschulverband.de/subsites/hochschulconsult/beratungsleistungen/digitale-lehre. Accessed 30 November 2022

[23]　HDS (2022). Digitalisierung in Disziplinen partizipativ umsetzen :: Competencies Connected. https://www.hd-sachsen.de/projekte/d2c2. Accessed 29 November 2022