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IMPLEMENTING EDUCATIONAL DIGITAL GAMES INTO TEACHER-TRAINING PROGRAMMES: A CASE-STUDY BASED ON GERMAN EXPERIENCE

Сучасні засоби масової інформації, що представлені у вигляді книг, журналів, газет, фільмів, музики, відеоігор, телебачення, мобільних телефонів, різних видів програмного забезпечення й Інтернету, можна розглядати як важливу форму педагогічного впливу і соціалізації, оскільки вони не тільки поширюють інформацію, але формують наші культурні уявлення та поведінкові норми.

Нове «цифрове» покоління молоді сьогодні зростає в інтерактивному мережевому медіа-середовищі, повсюдних графічних зображеннях, системі миттєвих винагород. Невипадково, сучасну молодь характеризують як швидку при пошуках інформації, що легко сприймає образні моделі, ефективно працює з гіпертекстами, здатну виконувати декілька завдань одночасно.

Освітній ландшафт також спостерігає зміни, спрямовані на використання соціальних медіа і мобільних технологій для нової аудиторії навчаючихся та застосування засобів масової інформації на дошкільному, початковому, середньому та вищому рівнях освіти. Зараз дискусії ведуться і навколо цифрових ігор.

Результати наукових досліджень свідчать про здатність цифрових ігор підвищувати мотивацію, забезпечувати автентичний досвід навчання, сприяти системному мисленню, заохочувати до спільного проблемно-орієнтованого навчання та впливати на соціальну сферу. Всупереч цим перевагам, інтеграція цифрових ігор у формальний освітній контекст залишається обмеженою. Це частково пояснюється все ще поширеним сприйняттям відеоігор як частини дозвілля, низьким рівнем обізнаності викладачів щодо цифрових ігрових процесів навчання, широким спектром питань, що виникають при впровадженні цифрових ігор в освітній контекст.

Питання про переваги цифрових ігор як інструменту навчання, можливі сценарії інтеграції цифрових ігор у навчальний процес, якою є типова структура гри і як правильно підібрати гру для конкретного навчального контексту, як використати досвід, отриманий у процесі гри, для розвитку реальних життєвих навичок, де знайти підтримку при впровадженні та використанні цифрових ігор – це лише декілька з найбільш поширених питань.

Щоб подолати деякі з вищезазначених проблем, ми розробили та впровадили семінар «Освітні цифрові ігри: від теорії до практики», етапи якого, зміст та результати описані в даній статті з метою допомогти більшій кількості педагогів познайомитися з та застосовувати освітні ігри у своїй практиці.

Ключові слова: *освітні цифрові ігри, навчання через ігри, семінар, освітня наука, нові технології, методика навчання.*

Problem statement. Present-day global problems of climate change, population growth, natural resources scarcity, religious, ethnic and racial conflicts require new individual and collective efforts. Today, meta-skills come to the foreground, including collective intelligence, a variety of thinking styles and empathy. In recent years, when contemporary high-tech enterprises (e. g. Ciklum, Infopulse, N-iX Ukraine) require their employees to demonstrate a good level of mathematics, sciences, engineering, be computer literate and solve complex tasks creatively, the training of a new, competitive generation depends, primarily, on innovative technologies and teaching approaches that would enhance students' cognitive, motivational and social potential, skills of team-working, problem-solving, and critical thinking. Contemporary scholarly discourse and the new competencies dictate a revision of the very concept of "education".

Education now is being viewed as a process of individual development, life-long learning that involves interconnectedness and interdisciplinarity, encouragement of students' autonomy in the form of self-guided learning and self-guided education enhancement. It is based on problem and project tasks without fear of making mistakes; game / play-based learning, virtual augmented reality, and computer-mediated communication (CMC), which have come to the foreground in the context of COVID-19 lockdown and the after-pandemic period when pedagogies turned from in-personal to virtual instructions, distance learning and e-learning to maintain the barrier-free educational environment.

It is important for our research to emphasise that the young generation of today is growing in interactive media world. They favour high-speed information acquisition, graphic images and multi-tasking, expression through producing a content, collaborative problem-solving, and peer-to-peer activities. Digital pedagogy, playful learning, gamification and educational digital games or serious video games (SVGs) – built on game-based learning principles, containing basic elements of video games and used not for the entertainment – are gradually becoming a part of everyday toolkit of teachers on a global scale.

At the same time, our literature review revealed the following: many educators see video games as a leisure time activity with no pedagogic value; many educators are not familiar with the interface of games as well as the game-based learning concept and process; even those teachers, who do use video games face difficulty in the contextualization of the learned skills into real-world scenarios, which is confirmed by the statistics from the European Games Developer Federation that states that only 39.4% of teachers in Europe feel well or very well prepared for the use of digital technologies [European Games Developer Federation, 2020].

Analysis of the latest research and publications. Our in-depth literature review proves that the scope of scholarly works about video games is wide. For example, M. Prensky investigates D-generation and argues for a partnering pedagogy. Works of S. Arnab, et al., K. Becker discuss the formal design paradigm for serious games. P. Wouters, et al. present the analysis of motivational and cognitive effects of video games. Questions related to the game-based curriculum are analysed in articles of A. Alklind Taylor and B. Marklund [Prensky, 2010; Arnab, 2012; Becker, 2017; Wouters, 2013; Alklind Taylor, 2014; Marklund, 2015].

There are several projects that exemplify the gamification process and application of video games to different contexts, including the educational one. We can name "Beaconing" – Breaking Educational Barriers with Contextualised Pervasive and Gameful Learning (Horizon 2020, EU Program), "Nutriciencia" – a research project to increase the food and nutritional literacy of high-risk populations (the University of Porto, EEA Grants Program, Ministry of Health, Portugal, 2016), "Serious Games in Higher Education: Impacts, Experiences and Potential" (Research Center CIIE, the University of Porto, Portugal, 2016-2019), "KidCOG" – Prevention of Online Sexual Grooming of Children project (the University of Skövde, the Change Attitude Foundation, Sweden, 2016-2020), and Ukrainian project "Gamehub" within Erasmus+ Program, 2016-2019

[Beaconing, 2020; Nutriciencia, 2016; Research Center CIIE, 2016-2019; University of Skövde & Change Attitude Foundation, 2016-2020; Gamehub, 2016-2019].

There are studies suggesting that serious games support civic development and learning transferable skills as serious video games are contributory to making meaning out of human past and present, "heritage experiences", "re-enactment of events", have the power for "social dreaming" (to prototype better futures), consolidating democratic awareness and boosting willingness to become politically involved [Boyle, 2012; Chapman, 2016]. For example, such simulation games as "Quo Vadis, European Union?", "Bribania", "Kodori – Peace Talks", and "Quo Vadis Ukraine?" (Berlin CRISP studio) are conductive to civic education and civil conflict management. Experienced-based learning, risk-free environment, cooperation, intercultural and intersectoral learning, empathy for different opinions, self-reflection stimulation processes, and critical thinking promotion – all these features make these games a powerful tool that transforms participants into stakeholders and let them experience the roots and dynamics of a given situation [CRISP, 2021].

Ukrainian studies aimed at understanding the experiences and attitudes of Ukrainian educators to gamified learning applications (GLAs) revealed that the advantages of GLAs in education are as follows: the capability to develop skills of cooperation – 62.5% of the asked respondents; they develop skills of mutual decision-taking – 45.8%; they develop skills of problem-solving – 41.7%; they develop memory – 33.3%; they develop skill of self-control – 29.2%; they develop skills of planning – 25%; they develop skills of understanding other people – 25%; they develop negotiation skills – 20.8% [Tokarieva, Chyzhykova, 2022].

Interesting statistics is also provided by the Germans Games Industry Association: 81% of Germans think that "the World Class Games" are understood all over the world; 62% of Germans see games as the medium of our time; and 68% of Germans see games as a global cultural phenomenon.

As game-studies are gathering momentum in theory and practice, our literature review, gamification and analysis of SVGs' projects helped understand that the path of digital games to formal educational context requires a complex approach that will affect the administration, IT departments, educators, students, parents, community and is accompanied by many preliminary arrangements, starting from the analysis of the target organization to the choice of the most appropriate scenario of a game's application. The key figure in the process of transforming a game into a meaningful activity is an educator. This demands a strong skillset of gaming literacy, technical skills, knowledge of the taught subject, pedagogy, psychology, etc., as in the process of digital game-based learning a teacher exercises different roles of a subject expert, a facilitator, a coach, an evaluator, a game moderator, tech support, a de-briefer, a co-player, and a co-designer. Teachers build up lesson plans, conduct the lesson and debriefing, follow the quickly changing market of digital games, and play games to be able to choose the right one for the class. At the same time, what prevents educators from applying SVGs and GLAs to their practice is not enough level of teachers' digital skills; the absence of necessary equipment; and the absence of accompanying teaching materials [Tokarieva, Chyzhykova, 2022].

The novelty of the study: Our idea (born in 2017 and developed in the research studies and publications within the recent years) to change the attitude and motivation of a teacher, to equip her/him with the understanding of the game-based learning "architecture", to show ways to apply and transfer the acquired in game-play process knowledge, to train teachers how to create their lesson plans around video games – has led us to the creation and implementation of the seminar: "Educational Digital Games: From Theory to Practice", which is selected as a case-study for the present article.

Therefore, **the purpose of the article** is to present the stages of the creation, the content of the seminar: "Educational Digital Games: From Theory to Practice" conducted by us in the University of Siegen, Germany in October-November 2024 as a part of a teacher-training programme and to discuss the results of it, including the ideas for further development.

Methodology. In order to achieve our aim, a complex of qualitative research methods, including synthesis, comparison and generalization of theoretical material was applied, which helped identify the main topics for the analysis. Theoretical analysis was in large part informed by the material related to pedagogical aspects and based on the study of such works as "Digi-

tal Games in Schools: A Handbook for Teachers", "Supporting Teachers in the Process of Adoption of Game Based Learning Pedagogy", "Learning with digital games", and "Poverty is not a Game: A Handbook for Teachers" [Emin-Martinez, 2013; Felicia, 2009; Kearney, 2010; Whitton, 2010].

We also base out work on a constructivist theory of learning that emphasises how games generate meaning and reflect broader social and cultural discourses and a participatory seminar organisation, based on the reflective exploration of games [Kolb, 2015].

Presentation of the main research material. The seminar was run in the University of Siegen, Germany in October-November 2024 (winter semester) in a group of students (35 students), majoring in primary school teaching, who are in an advanced phase of their training (90% – Bachelor level; 10% – Master level). At this point, they already have had basic pedagogical and didactic knowledge in the field of school and teaching. The examination of digital games as educational media and intercultural perspectives, therefore, took place at a crucial moment in their professionalization in the Module of Studies: "Erziehen, unterrichten, lernen" (educate, teach, learn). The duration of the seminar was 30 academic hours delivered in a block format.

The expected seminar' outcomes were: to increase students' understanding of how educational games can be used as a teaching / learning tool; to study theoretical fundamentals behind gamification and game-based learning, grounded in different theories of motivation; to develop practical skills of how to create an analogue game and how to build a lesson plan around a digital game; how to work with gamified learning platforms. The students' achievements within the seminar were measured by their engagement in interactive lectures and assignment completion.

The sequence of the seminars' themes and assignments was structured according to E. Rogers "Diffusion of Innovations" Theory [Rogers, 1983]. According to it, the process of adoption of new ideas in various fields follows the same five-stage pattern: the knowledge stage, the persuasion stage, the decision stage, the implementation stage, and the confirmation stage.

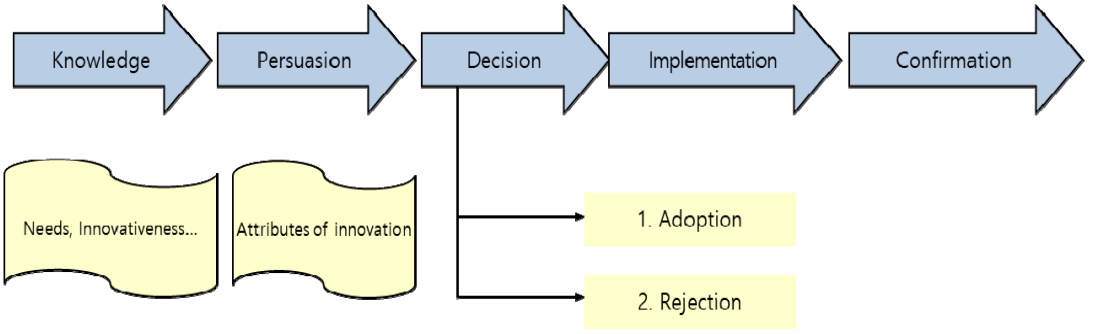


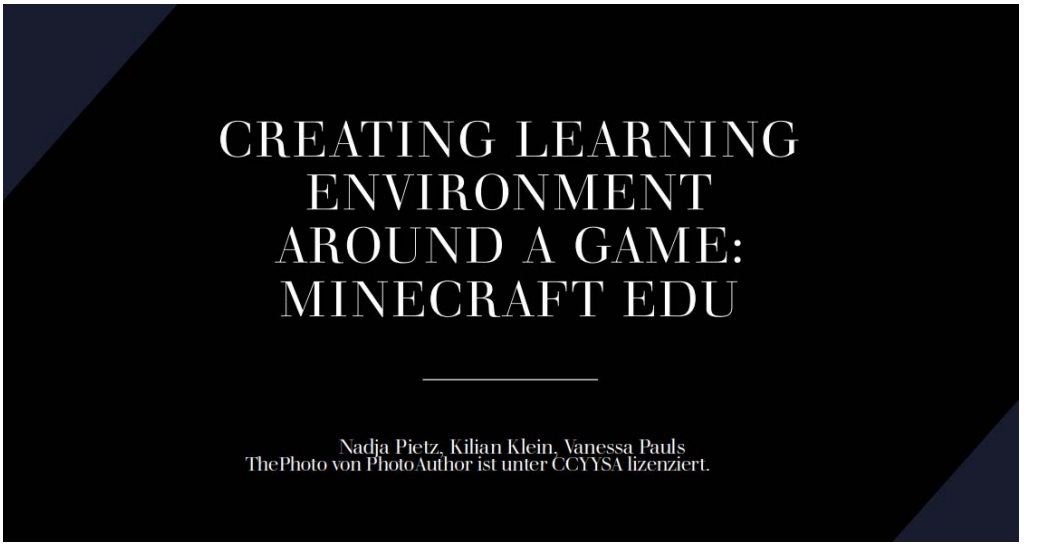
Fig. 1. Stages of the decision-making process for innovations by E. Rogers

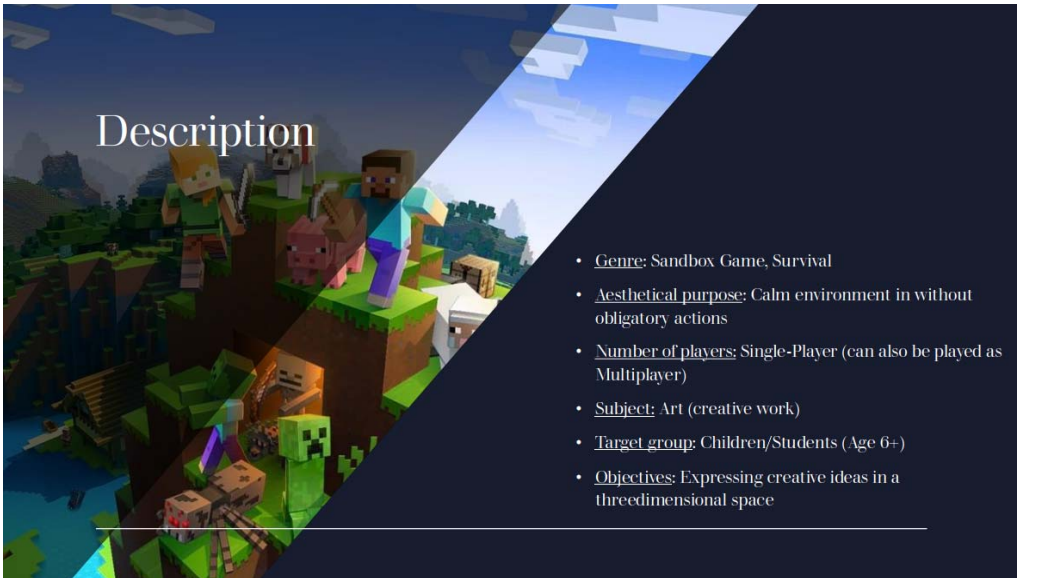
Thus, at the knowledge stage, an individual or a group becomes aware of existence of innovation without the purpose of its adoption. There are three types of knowledge – knowing about the existence of the innovation, knowing how it works, and knowing the underlying principles. At the persuasion stage, an individual or a group begins to think of the possibility to adopt innovation and start actively seeking additional information. A certain view is formed, which gives this stage an emotional character. The stage of decision occurs when an individual or a group is involved in active analysis, discussion, testing, in order to assess the advantages and disadvantages of innovation, which leads to making a decision. Implementation stage takes place with the introduction of innovation in everyday practice. It is accompanied by the analysis of positive and negative effects of the innovation and the assessment of its 'profitability'. Confirmation happens when an individual or a group receives data that reinforces their choice (for or against) [Rogers, 1983].

We present the stages of the seminar in parallel with the stages offered by E. Rogers:

Knowledge stage
At this stage, there was an introduction into the topic: video games in broad context; video games in educational space: brief historical journey, key terms, examples of projects; strengths and opportunities of digital games; challenges of digital games were discussed. The follow-up first assignment was an article summary, and students were asked to: 1. Work with the assigned (chosen) article (articles). 2. Summarize (in writing) the main ideas of the article (as you see them). 3. Share their discoveries with the group. The suggested articles were: a) Making Learning Fun: A Taxonomy of Intrinsic Motivations for Learning (by Thomas W. Malone, Mark R. Lepper); b) Can you Send me a Photo? (by Tarja Susi, Niklas Torstensson, Ulf Wilhelmson); c) Strategy for Germany as a Games Hub (by Federal Ministry of Transport and Digital Infrastructure); d) Educational Games – Are They Worth The Effort? A literature survey of the effectiveness of serious games (by Per Backlund, Maurice Hendrix).
Persuasion stage
At this stage, the following themes were discussed: Digital Game-Based Learning (what digital game-based learning is, the origin of digital game-based learning, its main characteristics, the difference between game-based learning and gamification). Educational Potential of Digital Games (the advantage of digital games, the definitions of “serious video games” and “educational digital games”, theories that describe the educational potential of digital games (including cognitive, motivational, and social aspects). The follow-up assignment was analysis of games (game-play): 1. Experiment with several offered games. 2. Analyse the games (or a game you liked most) using a SWOT (strengths, weaknesses, opportunities, threats) analysis. 3. Share your experience and ideas with the group.
Stage of decision
At this stage, the students studied the theme of Structural Characteristics of Digital Games (MDA model, game genres and corresponding skills, two main game-rating systems – ESRB and PEGI, what makes up a good educational game), and in assignment 3 they were asked to create an analogue game: 1. Split into mini-groups. 2. Each group should create its own game. For 2+ players; dice/card/ or board; set up: player experience goals; write down the rules; maximum playtime – 10 min. 3. Present your game to the class.
Implementation stage
At this stage, the students studied the themes of Building up Educational Digital Game-Based Environment (how digital games can be integrated into educational context, the creation of game-based learning environment, levels of decision-making related to integration of EduGames, possible scenarios of integration of EduGames into an educational context). Educational Digital Games in the Classroom (what a digital game-based lesson structure is, learning models and teaching styles, different teachers’ roles along with the accompanying instructional techniques in the digital game-based classroom, an example of a possible lesson plan template, other examples of how to plan a digital game-based lesson). Assignment 4: Creating learning environment around a game: 1. As a group – choose a game to work with. 2. Present your game by describing it (its genre, aesthetical purpose, number of players, subject, target group, objectives, etc.) 3. How would you implement the game into an educational environment? (Which scenario would you choose? Will you use briefing and de-briefing and when?) 4. How would you organize a game-play? What are your ideas of a lesson plan?

Fig. 2. Assignment 3: Creating an analogue game





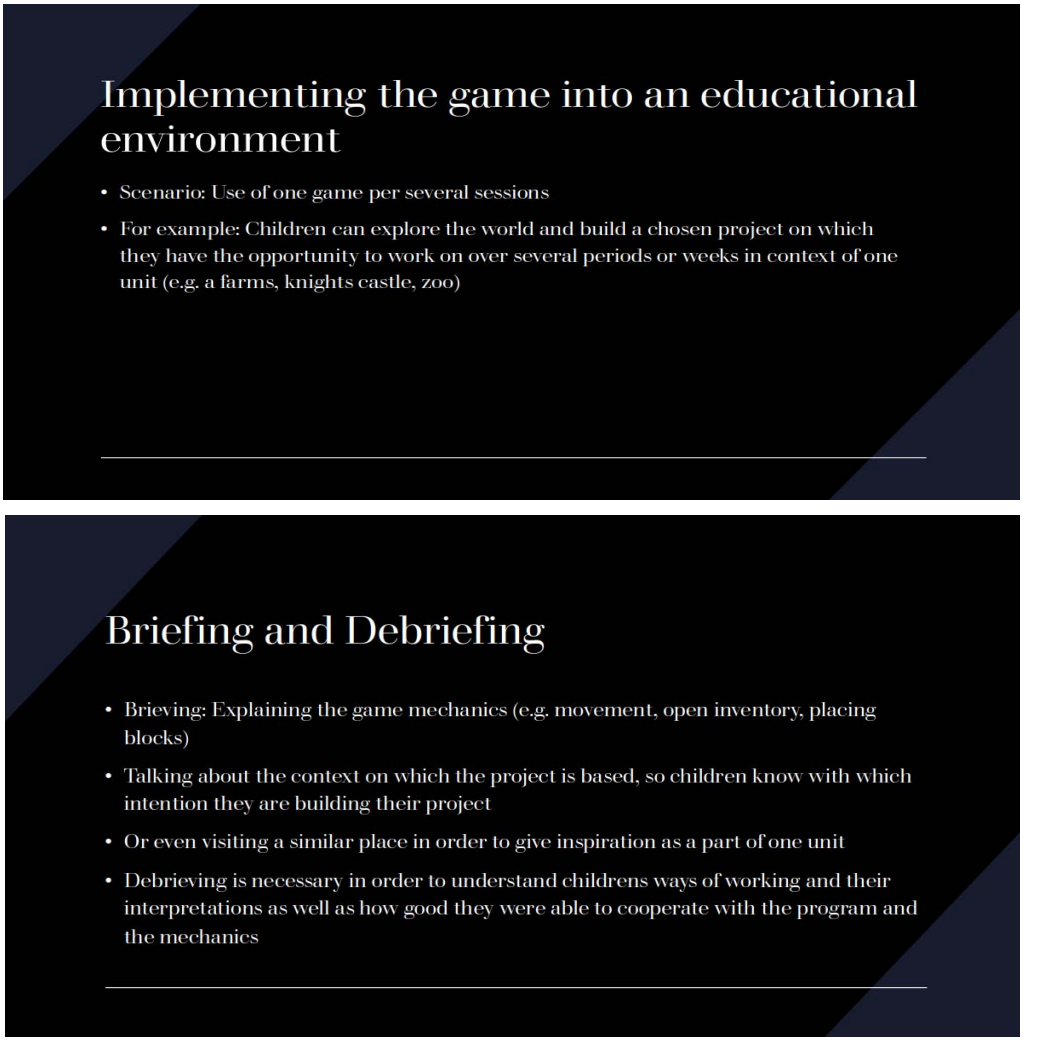


Fig. 3. Assignment 4: Creating learning environment around a game

Conclusions. The seminar was positively evaluated by the students, and this assessment was based on the questionnaire conducted in four weeks after the seminar's completion. 5-width scale was used as a measuring scale (with 1 – the highest and 5 – the lowest index).

Absolutely valuable were practical experiences when students worked in mini-groups with discussions of articles, game analysis (SWOT approach – marked by students as new and helpful), creation of analogue games and lesson planning.

In the course of the theoretical material discussion, the new themes appeared. Among them were: a) media literacy, media education, issues of cyberbullying, new literacies (AI); b) game mechanics: Loot Boxes, in-game gambling. The themes were added to the Moodle platform as the material for self-studying.

As our final evaluation, we may say that the implemented seminar has enriched the University's curriculum as the one that is rich in different theoretical and methodological approaches to studies on educational games, with a strong potential to advance students' professional development on the crossroads between Educational Science, New Technologies and Methodology of Teaching. It was perceived by students as fun and interesting. Theory was mixed with practical training. The content was new (particularly interesting was to know about game-based learning theories and how to create intrinsic motivation).

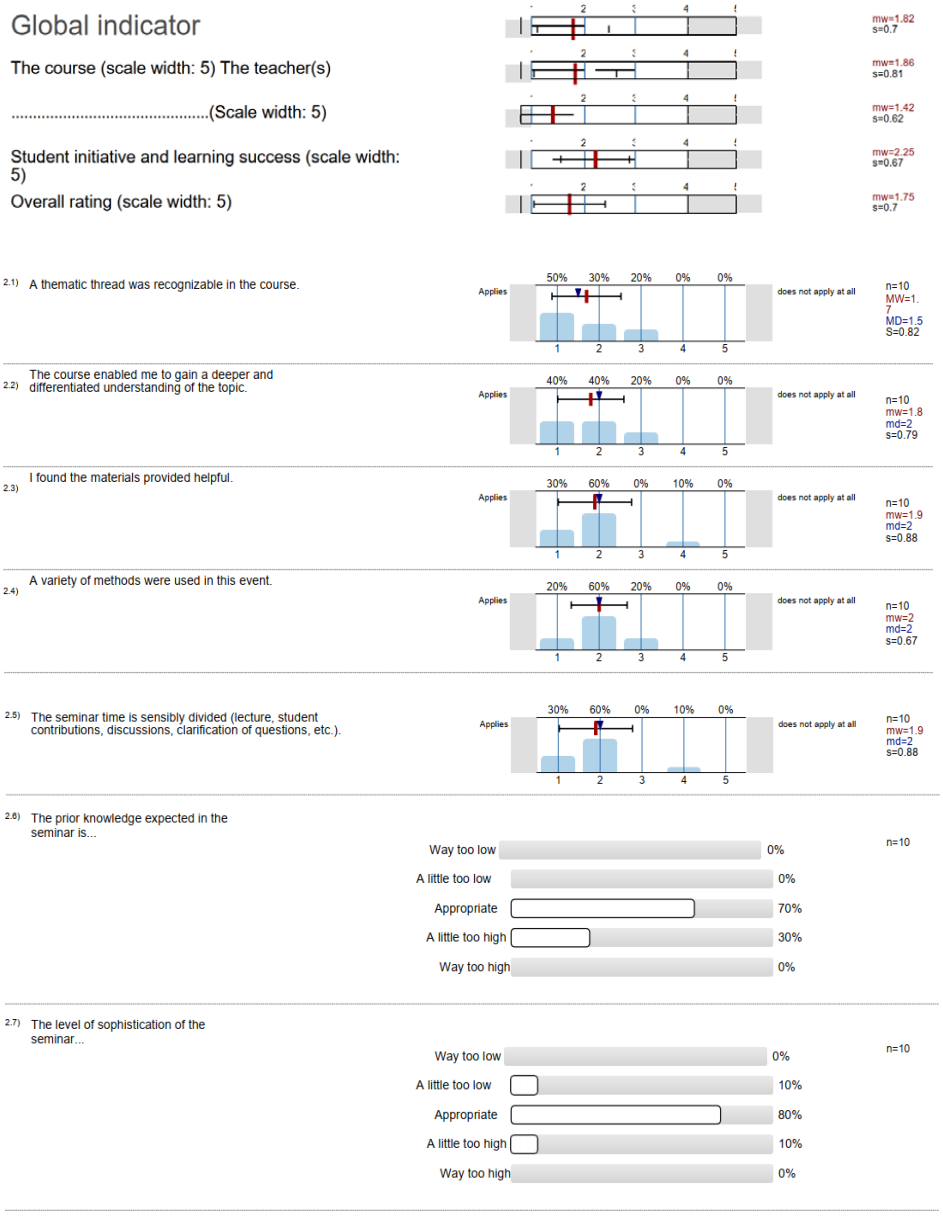


Fig. 4. Results of the questionnaire

As the area of growth and improvement, it was suggested to place more emphasis on how to implement games in schools, with the focus on primary school.

We conclude our present article with one more idea (and the prospect for further research and action) connected with the importance of “Education Design Laboratory” as an integrative part of a contemporary educational institution, the work of which can be streamed into “Contemporary Multimedia in Education”, “Teacher Training in Multimedia and EduGames”, “Technological Pedagogical Content Knowledge Design”, etc. This, as we see it, may help teachers gain and / or upgrade their competences and get support in implementing cutting-edge instructional tools, assist the administration in building up a contemporary technologically rich research model of an educational institution and students – to develop the 21st-century skills.

Adherence to Ethical Standards.

The use of the profile lines of the automated course evaluation EvaSys for the winter semester 2024/25 as a data material is acceptable and complies with the principles and rules of publication ethics of The Publishing Ethics Resource Kit (PERK) and does not contradict the principles of academic integrity established by the Committee on Publication Ethics (COPE). Using the data gathered from the automated course evaluation EvaSys adhered to the ethical guidelines of the University of Siegen that acknowledges the high importance of handling data in the sense of good practice. Here you can see the profile line of the course compared to the profile lines of all evaluated courses of the same type (lecture, seminar, tutorial) for the winter semester 2024/25.

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IMPLEMENTING EDUCATIONAL DIGITAL GAMES INTO TEACHER-TRAINING PROGRAMMES: A CASE-STUDY BASED ON GERMAN EXPERIENCE

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Keywords: *educational digital games; game-based learning; computer-mediated communication (CMC); gamified learning applications (GLAs); seminar; educational science; new technologies; methodology of teaching.*

Modern media that come in many different formats, including books, magazines, newspapers, television, movies, video games, music, cell phones, various kinds of software and Internet, can be viewed as an important form of pedagogic influence and socialization, as they not only spread information and knowledge but also form our cultural values and behavioural norms.

Following the above, educational landscape has been seeing changes directed at tapping social media and mobile technologies to reach new student audiences and to apply media as an educational tool on a

preschool, elementary, secondary, and higher educational levels with the aim to augment learning. Most recently, instructional designers have been examining how best to use digital games.

Integration of digital games into formal education is still scarce. This is partially attributed to a still prevalent image of video games as a leisure time activity with little or no pedagogic value, low familiarity with digital game-based learning and teaching processes, wide scope of issues to be addressed while implementing digital games into educational contexts.

***The aim** of the article is to present the stages, the content and the results of the seminar: "Educational Digital Games: From Theory to Practice" created to overcome some of the methodological challenges. The seminar was conducted in the University of Siegen, Germany in October-November 2024 as a part of a teacher-training programme.*

*A complex of qualitative research **methods**, including synthesis, comparison and generalization of theoretical material was applied, which helped identify the main topics for the analysis. The work is also based on a constructivist theory of learning that emphasises how games generate meaning and reflect broader social and cultural discourses and a participatory seminar organisation, based on the reflective exploration of games.*

The discussions within the seminar of such topics as "What digital game-based learning is?", "Educational potential of digital games", "Structural characteristics of digital games", "Building up educational digital game-based environment"; "Educational digital games in the classroom with the accompanying practical assignments 'Games' (game-play) analysis", "Creating an analogue game", "Creating learning environment around a game" contributed to students' knowledge extension, teaching repertoire enrichment and comparison of methodological and cultural perspectives (as the material of the seminar was based on Ukrainian, Swedish, Portuguese studies and international research analysis).

The sequence of the seminar themes and assignments was structured according to E. Rogers "Diffusion of Innovations" theory.

The seminar was positively evaluated by the students, and this assessment was based on the questionnaire conducted in four weeks after the completion of the seminar. 5-width scale was used as the measuring scale.

***Conclusion.** Absolutely valuable were practical experiences when students worked in mini-groups on discussion of articles, game analysis (SWOT approach – marked by students as new and helpful), creation of analogue games and lesson planning. In the course of the theoretical material discussion, the new themes appeared. Among them were: a) media literacy, media education, issues of cyberbullying, new literacies (AI); b) game mechanics: Loot Boxes, in-game gambling. As the area of growth and improvement, it was suggested to place more emphasis on how to implement games in schools, with the focus on primary school.*