

New Technologies and E-Assessment

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Introduction

Technology is developing day by day and it is integrated into many production lines. So much so that we are now in a period where human-robot integrated production is becoming widespread. In 2016, the concepts of Society 5.0 and Industry 5.0 were put forward in Japan and it became clear that this era is now the era of Industry 5.0. In addition, it has been officially stated by the European Commission that Industry 5.0 has started as of January 4, 2021. There are studies such as supply chain in the field of specialized logistics, the use of artificial intelligence in many areas, integrating virtual world studies into the real world, all online shopping and crypto money studies, internet of things, virtual reality and digital mapping. These studies are the new technologies. With Industry 5.0, (a) human-machine integration and technologies in this field, (b) renewable smart sensors that can be embedded in materials with biological technologies, (c) twin identity for modeling technological systems, simulations, (d) enabling advanced systems to work with data technologies that



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transmit, store and analyze, (e) artificial intelligence that can take action by solving the working principles in complex systems, (f) technologies for efficient energy resources and renewable-storable resources. The most interesting and assertive concept in this period is the concept of metaverse (Tekin et al., 2022). The concept of metaverse, which was used in 1992 by author Neal Stephenson in his book *Snow Crash*, is used to mean "beyond the universe". Although this concept has a fictional meaning, it is considered as a dimension such as "the future of the internet" or time. Metaverse is the precious version of real world life in the virtual environment in theory. It is estimated that the concept of metaverse will exist with its technological infrastructure and the universe it has created. The concepts of software, artificial intelligence, virtual reality, cloud, network, augmented reality and blockchain are related to the metaverse.

Education-based activations in the virtual world (vitamins, morpakampüs), cryptocurrencies and shopping with them, internet-integrated games and virtual concerts or meetings in this game, digital-based interactions such as building a virtual city or buying land, online shopping sites. It can be thought that a totality can be perceived as a metaverse. In other words, it is called the new concept formed as a result of the digital integration of these platforms in the virtual world. It is said that you can participate in the metaverse individually and live in this world by making your own digital face, that is, your avatar. To give a few examples; For those who want to do sports at home, having avatars of the same or different sports coaches at the same time, increasing the number of referees in football matches with avatars, relieving the pain of virtual reality during childbirth, being exposed to global warming in the digital environment and being sensitive to the environment and atmosphere in the real environment are some examples (Gülen et al., 2022). Apart from these examples, the use of technologies in the field of education and technology integration in education takes a new form. This form can be called metaeducation, like the metaverse.

There are many technologies that can be used in the field of education, and with the appropriate integration of these technologies, metaeducation can also be established in the field of education. There are also quite ambitious theories on this subject (Tekin et

al., 2022). It is known that technology can be used widely, especially in the dimension of student evaluations of education. Evaluations of students can be made with the help of technology. For this, teachers need to train themselves first. In this article, teachers' ability to make e-assessment with new technologies and examples of technologies used in this field are given.

E-Assessment in the Process of Distance Education

Today's teacher candidates enter higher education with the hope of getting an education according to the necessity of being a teacher in accordance with the requirements of the age. From the first day, these pre-service teachers should have experiences that activate and support students in the process, use technology effectively in their classrooms and integrate technology into the teaching process (Edwards, 2021). Academicians should provide pre-service teachers with experiences of technology integration in the classroom, so that pre-service teachers should increase their technological competence and help them to repeat these skills in their future classes (Slykhuis et al., 2020). In addition, for the purpose of 21st century education, the focus of teacher preparation programs should shift from a teacher-centered teaching to a cooperative learning-centered situation rather than competition among teacher candidates who integrate technology into the teaching process and use technology effectively (Edwards, 2021).

Teacher preparation programs should ensure technology integration throughout the breadth and depth of the program (Stokes-Beverley & Simoy, 2016). In recent years, technology has become a key component in the learning process (Rich et al., 2018). Teachers are now aware that technology is an important part of students' daily lives. For this reason, many researchers have recently explored how technology integration is experienced by teachers (Browne, 2019; Buenger, 2019). Batane and Ngwako (2017) stated that the 21st century teaching process requires teachers who have the skills to use technology. In addition, technology integration affects information, communication and cooperation variables in the classroom (Alenezi, 2017).

Information and communication technology (ICT) is technology, usually a computer system, used to store, retrieve, transmit and display data and information electronically. ICT can be a management system operated by a certain number of users that enables individuals and organizations to connect (Buabeng-Andoh, 2012). Examples of ICT include computers, technological devices, mobile devices, wireless networks, computer games, robotic devices, e-reading and smartphones. Increases in the use of ICT require computer-based literacy competencies for the workforce in the 21st century to acquire, process, evaluate, create and communicate information (Alenezi, 2017). Using technology for learning can help teachers in their formal evaluation and decision-making processes when creating instructions (Herzberg et al., 2017). ICT can be effective in five main areas for teachers: Analyzing student thoughts, understanding best practices for creating classroom models, planning instruction, analyzing instructional practices. Ellaway and Masters (2008) state that student success is greatly affected by technology, as it is related to understanding instructions (Brownell et al., 2017).

Learning using technological tools allows teachers to make the material they teach more visible, which helps them remember information and provide effective feedback to their students (Khatatneh & Teh, 2018). This is crucial to learning because the way students learn has changed drastically over the past century. In this century, teaching should benefit from technology integration that helps students acquire new knowledge and achieve better learning outcomes (Alenezi, 2017). Technologically Integrated learning systems allow students and teachers to participate in new learning experiences while continuing to meet the same level of quality in education (Johnson, 2022). Researchers have determined that computer learning also helps students develop their creative skills, participate in teamwork, and draw conclusions on their own (Khatatneh & Teh, 2018). Students who use technology in the classroom have the potential to gain a deeper understanding of the content they encounter.

Rich et al. (2018), 21st century learning has required technology and computer learning to be a part of the educational process. Technology has been used to assist users in improving their ability to identify, absorb, and respond to important

information in a variety of ways (Jension & Hebert, 2017). Increasingly, technology is now being applied to help develop learning standards that meet the needs of 21st century students. Batane and Ngwako (2017) argued that 21st century learning requires teachers to access technological resources that can be easily applied to their lessons. Technological developments and their simultaneous penetration into the educational process in the 21st century have made it a new way of assessing and providing feedback on student learning (Kundu et al., 2020).

Assessment is a fundamental activity at all levels of the teaching process. Identifying students' skills, knowledge, understanding and abilities is used to promote learning as well as to compare students' intended learning outcomes. Assessment strongly influences students' perceptions of the learning environment as well as their approach to learning and study (Thomson & Falchikov, 1998). Assessment is seen as a very important part of curricula aiming to both increase the quality of teaching and facilitate interaction among students (Stödborg, 2012). Assessment is at the heart of the learning experience: how students are assessed determines their progress and achievement of curricular goals. Recent developments in higher education, ICT has become even more important lately.

Technology can play an important role in this process because, if used appropriately, it can add value to any of the assessment-related activities. E-assessment is a natural partner of e-learning (Mackenzie, 2003), offering the harmonization of teaching and assessment methods (Ashton & Thomas 2006; Gipps 2005). In this way, it offers the opportunity to do a different variety and more authentic homework and provides assessment of skills that cannot be easily evaluated in other ways, through eportfolios, simulations and interactive games. The advancement of technology and e-learning systems has put e-assessment in high demand (Brink & Lautenbach, 2011). Crisp (2011) used the term e-assessment to refer to all assessment tasks conducted via a computer, a digital tool and/or the web.

Educational activities such as e-learning and technology assisted learning have become important elements providing new opportunities and approaches to teaching, learning and assessment in higher education. Evaluation using ICT is known as e-

assessment, which includes the entire evaluation process from designing assignments to storing results with the help of ICT. E-assessment, alternatively known as electronic assessment, computer-based assessment, digital assessment or online assessment, is the use of ICT in assessment. E-Assessment is the process of generating feedback and evaluation for formative, summative, diagnostic or self-assessment using digital technologies (Koçdar et al. (2018). Sitthisak et al. (2008) stated that e-assessment includes supporting it using a computer, for example with web-based assessment tools. they have stated. In other words, e-assessment involves the use of any web-based method that allows systematic inferences and judgments to be made about a student's skills, knowledge, and abilities. This can offer a wide range of assessments that address a wider range of skills and qualifications that are not directly assessed through traditional methods (De Villiers et al., 2016). E-assessment has improved the measurement of student outcomes and made it possible for them to receive immediate and direct feedback (Gilbert et al., 2011).

E-assessment can take different forms, such as automated administrative procedures, digitization of paper-based systems, and multiple-choice tests and online tests that include assessment of problem-solving skills (Ridgway et al., 2004). Osuji (2012) said that e-assessment can be assumed as the use of ICT to facilitate the entire assessment process, from designing and submitting assignments to their assessment. According to Love and Cooper (2004), evaluation systems should consider interface, accessibility, security, usability, information to be collected, hardware and software technology, and information storage and processing.

Most studies agree that E-assessment is an electronic assessment, where all assessment procedures from the beginning to the end of the assessment should be carried out electronically. This means that the design, testing, recording the response, and providing feedback are all completed using ICT (Alruwais et al., 2018). Whitelock (2009) said that e-assessment is a new assessment paradigm and methodology playing an increasingly important role in the transformation of higher education. E-assessment has attracted increasing attention in the research community as a result of both the changing nature of higher education and the expectations for e-assessment practice

(Nicol, 2007). Whitelock (2009) points to other important factors in the interest in e-assessment research in relation to its potential and the challenges facing higher education today. Tools and techniques for e-assessment can be used in a variety of ways. They can be used with a stand-alone computer in classrooms or over a complex network that includes various software and hardware solutions in distance education (Stödborg, 2012).

Online Measurement and Assessment Tools

Wordwall

It is an application that provides students with fun and course content in different game formats. Wordwall is a gamification-based online assessment tool for creating different types of interactive tests such as Matching, Wheel of Fortune, Open the Box, True False, Grouping, Anagram, Word Completion, Maze Game, Word Search, Random Cards, multiple choice and drag and drop. Wordwall is a Web 2.0 tool that is both easy to use and useful for creating your own teaching resources. With Wordwall, activities specific to your class and interactive processes that students will enjoy can be done. Wordwall events can be created both printable and interactive. There are 21 printable materials and 33 interactive course materials in the Wordwall application. However, some of them are paid and some are free (Url 1).

Google Form

It is a tool where you can prepare online forms such as surveys, exams and evaluations offered to users who are members of Gmail, free of charge. Google forms tool helps you easily evaluate surveys, quizzes and other forms results. It is one of the most preferred evaluation tools because it has both a useful and easy interface. Let's write down what the types of questions the Forms application offers us, Short answer answer, Paragraph type answer, Multiple choice questions, Checkboxes, Dropdown

options, File sending feature, Linear scale, Multiple choice table and Table shaped checkboxes. It also provides services in all languages. But it does not allow to create very complex forms (Url 2).

Quizizz

It is a web 2 tool where teachers can create course content and quizzes. In this tool, students are given points for both correct answers and quick answers. The application can be easily installed on computers, tablets and phones. It is also compatible with Google Classroom. This application can be used to provide motivation before the lesson and to make a fun introduction, and to follow the evaluation and deficiencies at the end of the lesson.

Socrative

It is a web 2 tool that offers test preparation, the opportunity to use the test both online and by printing. In general, it can be preferred at the end of the lesson with its fun and fast use. Students can participate in the test prepared by their teachers through the program, using their own names, a pseudonym, and an icon. Compatible with phone, tablet and computer.

Nearpod

It is a web 2 tool that offers the opportunity to present online and test students themselves. The teacher uploads the presentation about the lesson to the program (you can add multiple choice, fill-in-the-blank, or true-false questions to the intermediate parts of the presentation), students enter the system using the codes given to them, watch the presentation and give feedback.

Kahoot

It is a game-based learning platform used as educational technology in schools and other educational institutions. Learning games "kahoots" are user-created multiple choice quizzes that can be accessed via a web browser or the Kahoot app.

Classmarker

It is a preferred tool for preparing exams or tests in any language for multiple users. Many world-famous companies or educational institutions can use this program for satisfaction or training activities. This program can be installed on technological devices and is easy to use and functional. Short or long structured questions can be created, most importantly, a question bank can be created and it can select random questions from this bank, prepare a test, and offer analysis.

EclipseCrossword

Crossword puzzles can be easily prepared with the Eclipse Crossword program, which has a free and easy interface. It is a kind of hook puzzle that science teachers can use in lessons and quickly prepare for science subjects or concepts in virtual or non-virtual ways. With this puzzle, science lessons can be evaluated.

Gloster

It is a cloud-based developed platform. On this platform, concept cartoons and digital posters can be prepared by using multimedia elements such as text, graphics, sound and video together. In addition, Glogs developed and shared by different users can be accessed and ideas can be obtained to create original works.

Advantages of E-Assessment

With the development of technology, evaluation has become both easier and faster (Kundu, 2020). E-assessment has made assessment improved, accurate and faster than traditional paper-based measures (De Villiers et al., 2016). Students prefer E-assessment as they have more control, user-friendly interfaces and tests as games and simulations similar to learning environment and entertainment activities (Ridgway et al., 2004). It is also fast and easy to use (Eljinini & Alsamarai, 2012). E-assessment provides immediate feedback compared to paper testing, which helps to improve learning level (Gilbert et al., 2011). According to Bennett (2002), technology is at the center of learning and will continue to exist at this center. He also stated that the technology would not only facilitate testing but would also support real assessment. According to Hamilton and Shoen (2005), web-based tests have significant advantages in cost reduction, ease of use, reliability, reproducibility, scoring, consolidation of results and data management.

In many studies, it has been seen that e-assessment increases student performance (Gilbert et al., 2011). Students' performance also increases their learning motivation (Marriott, 2009). It also helps students in remote areas to learn and evaluate, and provides students with the flexibility to take the exam (Way, 2012). The traditional paper test takes time for the teacher, but the e-assessment offers the teacher the opportunity to make the assessment more accurately and faster (Gilbert et al., 2011; Crews and Curtis, 2010). In addition, e-assessment provides the teacher with faster feedback to students (Ridgway et al., 2004; Way, 2012). E-assessment enables the teacher to monitor students' performance and to analyze many assessments (Ellaway & Masters, 2008). Using e-assessment can reduce the burden of teachers to evaluate large numbers of students (Nicol, 2007).

E-assessment supports higher-order thinking skills such as critical thinking, reflective thinking on cognitive processes, and supports educational goals by facilitating group work projects. E-assessment has the ability to rank questions that cannot be generated using paper testing, for example software simulation, helps to represent knowledge simply and quickly (Ridgway et al., 2004)

The use of e-assessment reduces the cost of evaluating the student because it saves time (Gilbert et al., 2011). In addition, E-Assessment has its own security set that provides the questions and the student cannot copy the questions, it also includes authentication and password verification to verify the student's identity (Crews & Curtis, 2010). It helps to reduce cheating by presenting the questions in different order.

Disadvantages of E-Assessment

Although e-evaluation has many advantages, e-assessment is not completely free of disadvantages that prevent its widespread implementation and acceptance (Bacigalupo et al., 2010). Many studies have pointed out the disadvantages of e-assessment. Isaias and Issa (2013) state that most institutions lack technological infrastructure. Whitelock and Brasher (2006) drew attention to the lack of trust between students and teachers, mainly to technological inadequacies. According to Bacigalupo et al. (2010) stated that it affects students' motivation negatively. Redecker et al. (2012) stated that he had doubts about the effectiveness and impartiality of teachers. While saying that computer distraction is a disadvantage for e-assessment, Mason (2014) mentioned a very important point that affects the success of students as a whole. Whitelock (2009) states that e-evaluation gives incomplete feedback. Kocdar et al. (2018) emphasized that students participating in e-assessment had certain difficulties with authentication, and Xu and Mahenthiran (2016) emphasized that there is a possibility of cheating as a serious concern associated with e-assessment compared to traditional paper-based assessment. Some studies have also argued that cheating and plagiarism are easier and more common in e-evaluation (Koçdar et al., 2018). Apampa et al. (2011) and Mellar et al. (2018) categorizes cheating and plagiarism in easy assessments such as imitation, taking materials for exams, looking at the answers of others. Kocdar et al. (2018) and Dermo (2009) clearly stated that such forms of malpractice undoubtedly affect the validity and reliability of e-assessments.

There are some difficulties in applying e-assessment in higher education. Different studies have been explored about these challenges and suggested solutions:

1. The student's technological inadequacy and inexperience negatively affect the evaluation process (Donovan et al., 2007). In order to eliminate this, students can be given an initial training so that they can experience e-assessment (Way, 2012).
2. Lack of computer and internet access (Crews and Curtis, 2010). To solve this problem, it should provide students with a fully equipped laboratory with internet access.
3. Lack or weak technological infrastructure (Way,2012). For this, the technological infrastructure must be fully provided to establish and operate the e-assessment system.
4. Because teachers have technological inadequacies, they need a training to make them feel confident in using the E-assessment system (Ridgway et al., 2004).

Conclusion

It is obvious that technology is spreading rapidly around the world. It is seen that these technologies have an effect on all of the future plans of people from their use in their daily lives. The concept of metaverse, which has been put forward with the integration of these technologies recently and which is a technological life style, is a proof of this. Like the concept of metaverse, the concept of metaeducation has of course taken on a usable structure.

Technologies used in the field of education are likely to provide a more successful and less costly education. When all technologies related to education are considered (such as student and teacher avatars, online education, interactive teaching programs, communication technologies, internet, etc.), metaeducation can be established. Considering the teacher and evaluation dimension of this education, it is understood that this is not impossible. With this, it will be possible for teachers to be able to evaluate students and do them in meta-education. As a matter of fact, it is in a position where e-assessment can be made.

E-Assessment is one of the online evaluation forms of students. There are many computer programs available for this. Considering the advantages and disadvantages of these evaluations, it can be said that they become usable for students and the future of education. Although it is said that during the e-assessment process, problems of trust between the teacher and the student may occur or that socialization will decrease with these evaluations, it should not be forgotten that there are technologies that can be overcome. As a result, it is known and used that online chat, video calls and instant and effective communication can be made.

References

- Alenezi, A. (2017). Obstacles for teachers to integrate technology with instruction. *Education and Information Technologies*, 22(4), 1797-1816.
- Alruwais, N., Wills, G. & Wald, M. (2018). Advantages and challenges of using e-assessment, *International Journal of Information and Education Technology*, 8(1), 34-37.
- Apampa, K.M., Wills, G. & Argles, D. (2011). Towards a blob-based presence verification system in summative e-assessments, *International Journal of e-Assessment*, 1(1),
- Ashton, H.S. & Thomas, R.C. (2006). Bridging the gap between assessment, learning and teaching. In Proceedings of the 10th International Computer Assisted Assessment Conference, Loughborough.
- Bacigalupo, D. A., Warburton, W. I., Draffan, E. A., Zhang, P., Gilbert, L., & Wills, G. B. (2010). A formative eAssessment co-design case study. In 2010 IEEE 10th International Conference on Advanced Learning Technologies (ICALT), 35–37.
- Batane, T., & Ngwako, A. (2017). Technology use by pre-service teachers during teaching practice: Are new teachers embracing technology right away in their first teaching experience? *Australasian Journal of Educational Technology*, 33(1), 48–61.
- Bennett, R. E. (2002). Inexorable and inevitable: The continuing story of technology and assessment. *Journal of Technology, Learning, and Assessment*, 1 (1).
- Brink, R& Lautenbach, G. (2011). Electronic assessment in higher education, *Educational Studies*, 37(5), 503-512.
- Browne, C. C. (2019). A qualitative multiple case study investigating novice elementary teachers' use of information communication technology in 1:1 classrooms (Order No. 27540412). Available from ProQuest Dissertations & Theses Global. (2307784784).

- Brownell, M., Kiely, M. T., Haager, D., Boardman, A., Corbett, N., Algina, J., & Urbach, J. (2017). Literacy learning cohorts: Content-focused approach to improving special education teachers' reading instruction. *Exceptional Children*, 83(2), 143–164.
- Buabeng-Andoh, C. (2012). Factors influencing teachers' adoption and integration of information and communication technology into teaching: A review of the literature. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 8, 136-155.
- Buenger, K. A. (2019). Early childhood teachers' attitude towards and use of technology in the classroom. Available from Dissertations & Theses @ Grand Canyon University. (2205629848).
- Crews, T. B. & Curtis, D. F. (2010). Online course evaluations: Faculty perspective and strategies for improved response rates, *Assessment & Evaluation in Higher Education*, 36(7), 965–878.
- Crisp, G. (2011). *Teacher's Handbook on E-Assessment: A Handbook to Support Teachers in Using Assessment to Improve and Evidence Student Learning and Outcomes*, Creative Commons, San Francisco, California
- De Villiers, R., Scott-Kennel, J. & Larke, R. (2016). Principles of effective e-assessment: a proposed framework, *Journal of International Business Education*, 11, 65-92.
- Dermo, J. (2009). E-assessment and the student learning experience: a survey of student perceptions of e-assessment, *British Journal of Educational Technology*, 40(2), 203-214.
- Donovan, J., Mader, C. & Shinsky, J. (2007). Online vs. traditional course evaluation formats: Student perceptions, *J. Interact. Online Learn*, 6, 158–180.
- Edwards, C., L. (2021). Experiences of teacher educators utilizing technology in teacher preparation programs. (Doktora Tezi). ProQuest Dissertations and Theses veri tabanından erişildi.

- Eljinini, M. & Alsamarai, S. (2012). The impact of e-assessments system on the success of the implementation process, *Mod. Educ. Computer Science.*, 4(11), 76–84.
- Ellaway, R. & Masters, K. E. N. (2008). AMEE guide AMEE guide 32: E-learning in medical education part 1: Learning, teaching and assessment,” *Med. Teach.*, 30, 455–473.
- Gilbert, L., Whitelock, D. & Gale, V. (2011), Synthesis Report on Assessment and Feedback with Technology Enhancement, Electronics and Computer Science EPrints, Southampton
- Gipps, C.V. (2005). What is the role for ICT-based assessment in universities? *Studies in Higher Education*, 30 (2), 171-180.
- Gülen, S., Dönmez, İ. & İdin, Ş. (2022). STEM education in Metaverse environment: Challenges and opportunities. *Journal of STEAM Education*, 5 (2), 100-103. <https://doi.org/10.55290/steam.1139543>
- Hamilton, D. & Shoen, E. (2005). Same song, second verse: Evaluation and improvement of an established assessment program. In K. Martell & T. Calderon, *Assessment of student learning in business schools: Best practices each step of the way* (1(2), 138-153). Tallahassee, Florida: Association for Institutional Research.
- Herzberg, T. S., Rosenblum, P., & Robbins, M. E. (2017). Teachers' experiences with literacy instruction for dual-media students who use print and braille. *Journal of Visual Impairment & Blindness*, 111(1), 49-59.
- Isaías, P., & Issa, T. (2013). E-learning and sustainability in higher education: an international case study. *The International Journal of Learning in Higher Education*, 20(4), 77–90.
- Jension, J., & Hebert, C. (2017). Developing serious pedagogy for serious games: Digital game based teaching in K-12 schools. Digital Games Research Association DiGRA.

- Johnson, B. (2022). A Qualitative Descriptive Study on Reading Teachers' Experiences with Information and Communication Technology (Doktora Tezi). ProQuest Dissertations and Theses veri tabanından 25.07.2022 tarihinde erişildi.
- Khatatneh, N., & Teh, K. (2018). The effects of computerized learning games on the third grade students in Karak governorate. *International Journal of Academic Research in Progressive Education and Development*, 7(2), 96–111.
- Kocdar, S., Karadeniz, A., Peytcheva-Forsyth, R. and Stoeva, V. (2018). Cheating and plagiarism in Eassessment: students' perspectives, *Open Praxis*, 10(3), 221-235.
- Kundu, A., Bej, T. & Dey, K.N. (2020). Indian educators' awareness and attitude towards assistive technology, *Journal of Enabling Technologies*, 14(4), 233-251.
- Love, T. & Cooper, T. (2004). Designing online information systems for portfolio-based assessment: Design criteria and heuristics. *Journal of Information Technology Education*, 3, 65-81.
- Mackenzie, D. (2003). Assessment for E-Learning: What are the Features of an ideal E-Assessment System? CAA Conference Proceedings, 185-194.
- Marriott, P. (2009). Students' evaluation of the use of online summative assessment on an undergraduate financial accounting module," *Br. J. Educ. Technol.*, 40(2), 237–254.
- Mason, J. C. (2014). Theorizing why in digital learning: opening frontiers for inquiry and innovation with technologies. In D. G. Sampson, D. Ifenthaler, J. M. Spector, & P. Isaías (Eds.), *Digital systems for open access to formal and informal learning* (pp. 101–120). New York: Springer.
- Mellar, H., Peytcheva-Forsyth, R., Kocdar, S., Karadeniz, A. and Yovkova, B. (2018). Addressing cheating in e-assessment using student authentication and authorship checking systems: Teachers' perspectives, *International Journal for Educational Integrity*, 14(1),1-21.

- Nicol, D. (2007). E-assessment by design: using multiple-choice tests to good effect, *Journal of Further and Higher Education*, 31(1), 53-64.
- Osuji (2012). The use of e-assessments in the Nigerian higher education system, *The Turkish Online Journal of Distance Education*, 13(4), 140-152.
- Redecker, C., Punie, Y., & Ferrari, A. (2012). eAssessment for 21st century learning and skills. In A. Ravenscroft, S. Lindstaedt, C. D. Kloos, & D. Hernandez-Leo (Eds.), 21st century learning for 21st century skills (pp. 292–305). Germany: Springer.
- Rich, P. J., Browning, S. F., Perkins, M., Shoop, T., Yoshikawa, E., & Belikov, O. M. (2019). Coding in K-8: International trends in teaching elementary/primary computing. *TechTrends*, 63(3), 311-329.
- Ridgway, J. McCusker, S. & Pead, D. (2004). Literature review of e-assessment. Bristol.
- Sitthisak, O. Gilbert, L. and Davis, H. C. (2008). An evaluation of pedagogically informed parameterised questions for self-assessment,” *Learn. Media Technol.*,33(3), 235–248.
- Slykhuis, D. A., Schmidt-Crawford, D. A., Graziano, K. J., & Foulger, T. S. (2020). Professional expectations for teacher educators: The Teacher Educator Technology Competencies (TETCs). In A. C.
- Stokes-Beverley, C., & Simoy, I. (2016). Advancing Educational Technology in Teacher Preparation: Policy Brief. Washington, D.C.: U.S. Department of Education.
- Tekin, Z., Gülen, S., & Dönmez, İ., (2022). *Metaverse ortamında STEM eğitimi*. Paradigma yayıncılık.
- Thomson, K., & Falchikov, N. (1998). Full on until the sun comes out: The effects of assessment on student approaches to studying. *Assessment & Evaluation in Higher Education* 23(4), 379–390.

- Url, 1. https://wordwall.net/features_ Access: 29.07.2022
- Url, 2. <https://www.turkceogretimi.com/egitim-amacli-yazilimlar/google-formlar-ile-olcme-degerlendirme> Access: 29.07.2022
- Way, A. (2012). The use of e-assessments in the Nigerian higher education system, *Turkish Online J. Distance Educ.*, 13(1), 140–152.
- Whitelock, D. (2009). E-assessment: developing new dialogues for the digital age, *British Journal of Educational Technology*, 40(2), 199-202.
- Whitelock, D. M., & Brasher, A. (2006). Developing a roadmap for e-assessment: which way now? In M. Danson (Ed.) Proceedings of the 10th CAA International Computer Assisted Assessment Conference (pp. 487–501). Loughborough: Professional Development, Loughborough University.
- Xu, H., & Mahenthiran, S. (2016). Factors that influence online learning assessment and satisfaction: Using Moodle as a Learning Management System. *International Business Research*, 9(2), 1-18.

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