Journal of Positive School Psychology http://journalppw.com
2022, Vol. 6, No. 2, 1043 – 1052

Bringing Technology into The Classroom Amid Covid 19, Challenge and opportunity

Ahmad Al Yakin[1], Ahmed J. Obaid[2], Muthmainnah[3], Raghda Salam Al. Mahdawi[4], Haitham Abbas Khalaf[5], Shokhan M. Al-Barzinji[6]

[1]*Department of Civic Education Teacher Training and Education Faculty, Universitas Al Asyariah Mandar, Polewali Mandar, Indonesia*
ahmadalyakin76@gmail.com
[2]*Faculty of Computer Science and Mathematics, University of Kufa, Najaf, Iraq*
ahmedj.aljanaby@uokufa.edu.iq
[3]*Department of Language Education, Teacher Training and Education Faculty, Universitas Al Asyariah Mandar, Polewali Mandar, Indonesia*
muthmainnahunasman@gmail.com
[4]*Department of Computer Engineering, Collage of Engineering, University of Diyala:Diyala, Iraq*
raghdasalam@uodiyala.edu.iq
[5]*College of Medicine, University of Anbar, Ramadi, Iraq*
med.haitham.alakidi@uoanbar.edu.iq
[6] *College of Computer Science and Information Technology, University of Anbar, Ramadi, Iraq*
shokhan.albarzinji@uoanbar.edu.iq

Abstract.

Amid Covid 19 since 2020 until 2021 Educators around the world were forced to migrate to online learning in such unusual circumstances. The use of technology has grown increasingly crucial in students' life outside of school, and it can also help them better understand complex subjects or foster peer collaboration. As a result of these benefits, contemporary educational practice recommends that teachers adopt some type of technology in their classrooms — however many teachers experience problems in accomplishing. This study aims to explore how lecturers in Indonesia incorporate technology to facilitates their students during online. This study also examines lecturers technological content knowledge, the among technologies and learning outcomes. Fifty-four lecturers at west Sulawesi Province in Indonesia participate in this study. The result of this study findings the important lecturer's perspective of technology. The data showed majority of the lecturers still low of technological knowledge. The data showed 37 percent educator need ICT training/workshop, 48 percent of educator's low knowledge about distance learning such as Synchronous, Asynchronous, Blended, Mooc, Hybrid, LMS, 44,3 percent of respondent's low pedagogical content knowledge and 96 percent of respondents reported they are need pedagogical tools or ICT tools training/workshop. Online learning applications are hindered by low-speed or no internet, although most participants thought that E-learning tenders may help them grasp and practice pedagogical materials and professional resources. The current research synthesis, we'll be able to learn more about lecturer competence of online learning and teaching in 21 century era.

Keywords: Technologies knowledge, 21 century skill, ICT Workshop, Higher Education and Digital Lecturer.

I Introduction

The use of big data analytics in pandemic management can aid in the rapid identification and tracking of affected persons. To identify infected individuals, CCTV cameras and facial recognition technologies can be used also technology can help prevent its spread by educating persons on the ground about it, alerting them to the situation, and empowering

them to make informed decisions, thereby reducing its impact in a noticeable way. there are several innovative approaches to pandemic response may now be tested thanks to the convergence of technologies such as mobile, the cloud, analytics, robots and AI/ML, as well as 4G/5G and high-speed internet.

Regarding this phenomenon, in the midst of covid 19 in the field of education, the use of digital technology as a solution in the learning process . According to [1] and [2] stated that digital technology, access to knowledge, globalization, equity, and accountability are the five main trends affecting education in the 21st century. This has a direct and indirect impact on the habits of students and teachers, too.

In addition, [3]; Technological developments can be used for rapid education. As a result, instructors are faced with a new set of barriers, which require new skills and knowledge to utilize this new technology pedagogically. [2]:[4];[5];[6] and [7] noted, engaging with these developments in the context of instruction requires teachers to approach their work as educators and they show how today's instructors must move away from traditional teaching methodologies and tools that support a computerized approach that is more suited to the needs of 21st century learners in the digizilla era.

[8] showed that the creation of conducive conditions, as well as the provision of support and administration, are important attitudes of teachers regarding the use of ICT in education, according to [9] stating an important impact in their intention to utilize ICT is the ability of teachers to combine knowledge of technology, pedagogy , and content is critical to successful ICT integration. According to [10] There are a number of aspects that contribute to a successful ICT. This complexity explains in part why technology integration is still such a difficult task. [11] and [12] observed that pre-service teachers in particular and newly certified teachers in general found the use of ICT in various ways problematic.

According to [13] educating students especially higher education students in the midst of covid 19 has become more complex and demanding profession, since they are exposed to a large amount of digital technology and are extremely skilled at using new technologies. A teacher's ability to effectively and appropriately incorporate technology into instructional duties is therefore critical in educational contexts. [14]; [15]; [16];[17] [18] and [10] claims, teachers are expected to integrate technology with pedagogy and material. unfortunately,

lecturers' understanding of how ICT might be used as a pedagogical aid in teaching and learning is very low. In the exploration of technological integration, based on the perspective of [19]; [20] [21] [13] mention the primary goal of technology-enhanced teaching. In order to do this, lecturers must have a solid grasp on the concept of technology use, pedagogical approach – using technologies in constructive ways to develop educational content – and what makes learning easy or difficult, as well as how technology may help students more in learning. In addition, to be more effectiveness in teaching in this digital age, teachers require a unit that combines three basic areas of knowledge: innovative technology, 21th century skill and digital literacy.

This study will address that gap by looking at lecturer’s under-standing of technological knowledge and their understanding to explore of the using technologies in the virtual classroom at west Sulawesi Indonesia its covered from some universities and institution were examined in this study.

2 Previous Research

Need a framework to accommodate what educators difficult to plan and develop successful education for the COVID-19 era to understand the current situation, its must distinguishes between online and remote learning in general, as [22] pointed out while studying how colleges and universities were coping with the unexpected and quick move towards remote learning (in March 2020). Since we're dealing with an emergency situation, they recommended using the term "emergency remote teaching."

"The digital divide needed to function online [23] and [22] stated the loss of context for using technology in the classroom occurs when educators do not understand the global changes and transformations of 21st century skills-based education

The 21st century skills that future generations need to acquire to confront globalization issues related to advances in information and technology have been recognized by [24] for example, digital age literacy, imaginative thinking, efficient communication and high productivity are among the four key categories of 21st century abilities that have been Literacy skills for digital-age workers are outlined in NCREL's 2003 report as follows: basic literacy; Scientific literacy; economic literacy; technological literacy.

In addition, [25]; [23]; [26]; [27] and [28] explained the 21th century meaning heavily reliant on Information and Communication Technology, 21st-century skills are essential (ICT). [29]; [30]; [31] and [32] findings on 21 century skill and in order to enhance students' 21st century skill, educator as vital role in education settings where they are needed integrate design thinking, digital pedagogy, innovative methodology, smart digital classroom management in teaching and instructional information design curriculum to promote achievement and basic ICT knowledge skill.

Exploring lecturer technological knowledge in this study considered essential digital literacy for 21 century educator. Investigating technological knowledge and understanding of their in using and linked Ipads app, digital pedagogy and innovative methodology make it easier to designing ICT workshop and training integrates in teaching for lecturer.

3 Method

The goal of this study was not to prove hypotheses; rather, it was to analyze phenomena in order to create theory from facts related to the lecturer technological knowledge in online learning process. As a result, this study took a qualitative approach. The research was carried out at West Sulawesi Province, Indonesia. Participants in this study were higher education lecturers at west Sulawesi and a total respondents 56 lecturers participated from urban area 35 lecturers, rural area 8 respondents and surbuban area 12 respondents.

The data in this study consisted about lecturer technologies knowledge, ICT knowledge, portable knowledge, HoTs apps knowledge, web features, syncronous, Asyncronous, Blended, Mooc, Hybrid, LMS knowledge and digital literacies. A qualitative data was analyzed with quantitative analysis. The random sampling was chosen in selecting the sample.

Questionnaire is a common study tool used to collect data for educational studies There are several instances in which it's used to gather information on occurrences that can't be witnessed directly, [33-35]. In this study the questionnaire was distributed to the lecturers that's integrates mobile apps and technology in virtual teaching amid Covid 19. The questionnaire was distributed utilizing an electronic technique, namely the internet and spread by using mobile phone randomly.

The following diagram depicts the research process from planning through presentation.

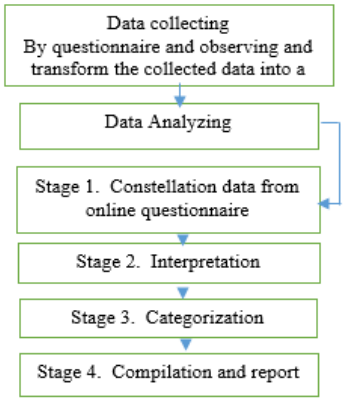

Fig.1. Flowchart of Lecturer Technological Knowledge Collecting Data

The following are the data collection procedures in this study mainly used nonverbal interaction or questionnaires, and as supporter primarily used observation. The research approach used in this study is descriptive quantitative research, and the findings will be processed and analyzed to reach a conclusion. This indicates that the focus of the study on numeric data.

In collecting the data, the information was gathered from the participants' responses to a questionnaire, which was then analyzed by the researcher. The information was gathered from the participants' responses to online questionnaire, which was then analyzed and interpreted by the researcher.

The researcher employed a questionnaire that was presented to the participants and filled out by them based on their own feelings in order to collect data.

The researcher employed a questionnaire that was presented to the participants and filled out by them based on their own feelings in order to collect data.

The validity of the data must be evaluated in the following ways to avoid inaccuracies in the data to be analyzed:

1. Data collecting on the same research subjects over time.

2. Other sources that can be accounted for, and if necessary, triangulation

3. Examining research topics

4 Technological Knowledge

The lecturers participated in this study from Universitas Sulawesi Barat, Universitas Al Asyariah Mandar, STIKES Biges Polewali, Universitas TOMAKA Mamuju, Institut Agama Islam (IAI DDI Polman), STAIN Majene, Sekolah Tinggi Theology Mamasa dan Akademi Keperawatan YPPP Wonomulyo and most of the respondents were female n= 35 and male n=21, from 54 lecturers participated, all of the lecturers have device like smartphone (mobile phone) and laptop. The research was conducted on March, 2021. The lecturer's belief, most of them stated integrates technologies amid Covid 19 is new for them.

Based on the data from the first statement on diagram 1 below findings 37 percent respondents answering they are never attended any training/ Workshop/ Workshop on the use of ICT and its integration in learning/ teaching, 25, 9 percent attended only one times workshop, 13 percent respondents attended twice times ICT workshop and 24, 1 percent more than three times. The data ICT training is displayed on the fig 2.

Fig.2. ICT training in teaching amid covid 19

The second statement exploring lecturer's knowledge about the use of basic ICT such as basic devices, namely computers, laptops, projectors, LCD, Wi-Fi, smartphones and modems. All these devices can be used with an internet connection or without an internet connection in the learning process.

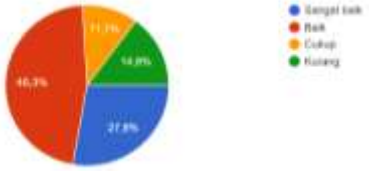

Fig.3. Lecturer Understanding of basic ICT as tools in teaching

However, 11, 1 of respondent's percent and 14, 8 percent of respondents less knowledge of basic ICT tools in teaching, meaning they are not sure about the internet connection also they are can't identify which is the best ICT to facilitate their virtual classroom.

The next statement about lecturer's knowledge of portable devices such as laptops, smartphones, tablets and digital applications that support my teaching needs to facilitate students/students achieve learning outcomes, 21st century skills. As shown on diagram below 16 of respondents (29,6%) from 54 of respondents answering very good, 48, 1 percent of respondents reply good, 14.8 Percent of respondents enough category and 7,9% of respondents in less category.

Fig. 4. Lecturer Technological of Digital Apps to Achieve 21th Century Skills

The result on the fig.4 indicating that there are 22, 2 percent of lecturers understanding about technology application to facilitate the students 21th century skills is categorized very low. The fourth statement interrogates lecturer's knowledge about Ipads applications that support HoTS (higher of thinking skills). Based on the data in diagram 4 indicate most of the lecturers understanding Ipads to support 21th century skills there are 50,9 percent of respondents answering very well, but 49 percent of respondents they are in less category.

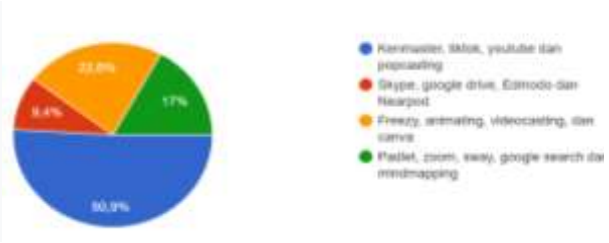

Fig.5. Lecturer Technological of Ipads Apps

In **fig 5**, it is explained that 49 percent or 26 of lecturers still have limited digital technology apps. In this case it can be illustrated that the use of technology in the classroom is whenever teachers choose an application or piece of technology, they must remember to apply and choose the right technology to support low order thinking skill or higher order thinking skill.

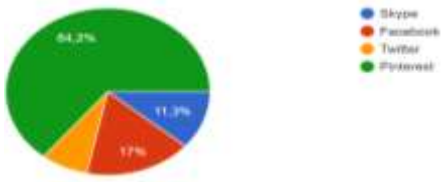

Fig 6. Lecturer Technological of Ipads Apps for communication skills

Lecturer technology knowledge of Ipads applications that support communication skills (21st century) on the diagram 5 shown 64, 2 subjects of research answering Pinterest, 17% of respondents answering Facebook and 11.3 % of respondents answering Skype, 0 Percent of respondents answering twitter, unfortunately no one of the respondents answering twitter, as we know twitter is one of the famous social media to building communication and connected globally.

The question deals with the mobile application that supports collaboration skills (21st century). Lecturers understanding displayed on the diagram below:

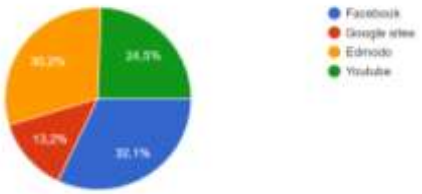

Fig. 7. Lecturer Understanding of Collaboration skill apps

The sixth statement about using mobile application to facilitate collaboration skill, the findings clearly that 32.1 percent of lecturer use Facebook, 13, 2 percent of respondents answering Google sites, 30,2 percent of respondents answering Edmodo. There are 32,1 percent of respondents choose Youtube, this data shown lecturer cannot utilize technology for collaboration skill.

Fig. 8 below displayed about lecturer technological knowledge for critical thinking. The question investigating about the kind of critical thinking mobile application to help students in HoTS.

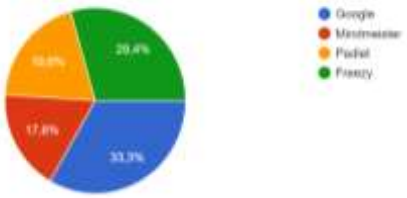

Fig 8. Lecturer Technological Knowledge of Collaboration skill apps

Based on the data on **fig.8**, showed the ability of the lecturers to use mobile application for critical thinking skill. From 54 subjects of the research, 33 percent of lecturer (17 respondents) answering Google, 17.6 percent of respondents answering Mindmeister, 19, 6 percent of respondents answering Padlet and 29, 4 percent (15 respondents) answering Freezy, this data indicate lecturer don't understand and misconception of this mobile application function.

The statement eighth in understanding of technological knowledge refer to Ipads apps that support critical skills skills (21st century), on the diagram subject research seems have answering

Pinterest 17.6 percent of respondents, Picasa 37.3 Percent of respondents and Facebook 37.03 percent of respondents.

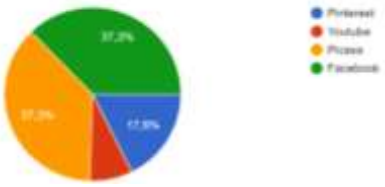

Fig.9. Lecturer Technological Knowledge of Creative skill apps

Based on this **fig.9**. it is known that there are 19 lecturers answering Facebook as an app that can help students to think critically. From this statement, it is known that 37.7 percent (19 respondents) do not know the types of apps used to support 21st century skills both for themselves and for their students.

The next question exploring about lecturer technological knowledge of ICT/ICT features available on their devices such as teaching apps, learning apps, search engines and websites; 30.2 percent of respondents very good category, 43.4 percent of respondent's good category, 17 percent of respondents enough category and 9.4 percent of respondents less category.

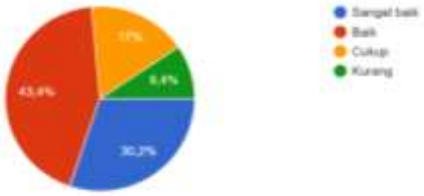

Fig. 10. Lecturer technological knowledge of ICT/ICT features.

Lecturer knowledge of ICT/ICT and social media features available on the internet that lecturers can integrate into their learning also in their teaching, for example digital pedagogy, bloom taxonomy apps and others digital learning apps displayed on **fig. 11** below:

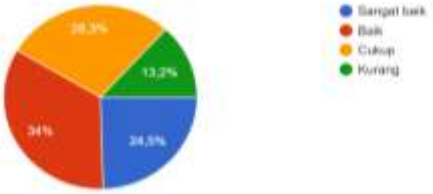

Fig.11. Lecturer technological knowledge of digital pedagogy, bloom taxonomy apps and digital learning apps

The lecturers statement shown some of them understanding of ICT/ICT and social media features like digital pedagogy, bloom taxonomy apps and Digital learning apps; 24.5 percent very good category, 34 percent of respondent's good category, 28.3percent of respondents enough category and 13.2 percent of respondents less category. Then lecturers understanding of distance learning such as Syncronous, Asyncronous, Blended, Mooc, Hybrid, LMS described on fig. 12.

Fig.12. Lecturer understanding of Distance learning such as Syncronous, Asyncronous, Blended, Mooc, Hybrid, LMS

The statement of lecturer knowledge about learning terms during covid such as Online, Virtual, Remote Learning and Distance Learning; 24.5 percent of respondents very good category, 37.7 percent of respondents good category, 24, 5 percent of respondents enough category and 13.2 percent of respondents less category

Fig. 13. Lecturer knowledge about learning terms during Covid 19

Lecturer understanding about Online, Virtual, Remote Learning and Distance Learning terms based on the subject's research answering there are 37.7 percent of respondents (20 respondents) still don't understand the difference between the terms.

The twelfth statement of lecturers knowledge of digital skills supports lecturer profession as a 21st century educator from 54 subjects research; 22.2 percent of respondents (12 people) very good category, 40.7 percent (22) of respondents good category, 20.4 percent (11) of respondents enough category and 16.7 percent (9) of respondents less category displayed on **fig.14** below.

Fig 14. Lecturer knowledge about digital skills supports lecturer profession as a 21st century educator

The data from **fig.14** shown there are 21 lecturers who have low understanding of digital skills that support their profession as lecturers and as 21st century educators. The results in data indicating lecturer needed ICT literacy. The next survey relating to lecturer knowledge and skills in using mobile devices such as laptops, smartphones, tablets and their applications in teaching is displayed on **fig.15** below.

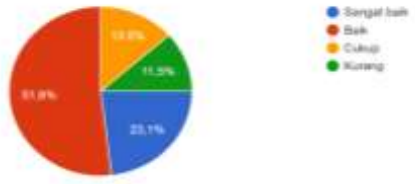

Fig.15. Lecturer knowledge and skill in using mobile devices such as laptops, smartphones, tablets and their applications in teaching.

The highlight research findings the subjects' research level knowledge and skill in using mobile devices such as laptops, smartphones, tablets and their applications in teaching most of them very good category 23.1 percent of respondents and 51.9 percent of respondent's good category. But, the data showed 13.5 percent of respondents enough and 11.5 percent of respondents in less category.

The last statement about lecturer needed training on how to use, teach and train the students/students to use applications or basic ICT, as a source of learning and skills; strongly agree 63 percent of respondents and agree 33.3 percent of respondents expressed in the following.

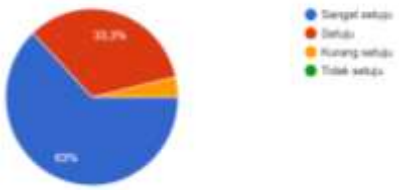

Fig.16. Lecturer needed ICT training/ Workshop

This study investigating lecturer technologies knowledge and their understanding on integrate ICT amid covid 19. The result of this study indicate the lecturer statements toward the use of technology. Unfortunately, that the nature of the items in previous studies did not pay attention to covering different aspects given the conditions of the 21st century classroom and 21st century educators, but this study does, and the proportion of agreement is quite reassuring. As a result, research findings can be used to create teacher training in integrating technology that remains to help students achieve their 21st century skills.

The research data illustrated the most important of technological knowledge in this digital era. Understanding of pedagogy and integrate technology is aimed to assist educators think about how they use mobile applications in their teaching systematically, logically, and with a long-term, big-picture perspective. Essentially, the mindset about digital-age education that combines issues about mobile app features, learning transformation, motivation and long-term learning objectives. Each day, teachers have the opportunity to use this device in a variety of ways, from curriculum preparation through drafting learning objectives all the way to constructing student-centered activities. A lecturer should also think about how the app might add to their educational goals for the course they are teaching. As a result, teachers

are better able to identify the pedagogical position and purpose of their numerous app-based learning and teaching activities in the context of their overall course objectives and in relation to the larger developmental needs of the students.

5. Conclusion

In this conclusion, the author states that technologies knowledge and how to use, linked each other. The technologies as a tools to make learning and teaching more practices, effective and efficient. Therefore, the overall performance of lecturers is required, and digital assistance will be used according to the wishes of the individual or group of lecturers. Compared to traditional teaching approaches before Covid19, the overall of this study results clearly show that full integration of technology, iPads app, ICT in learning and the ability of lecturers to combine technology, gamification approach in blended or hybrid learning environment in the future of learnings that can improve 21st century skills create learning more fun, enjoyable, and impressive learning outcomes or academic achievements for students to be able to compete in globally

References

[1] Wilson, D., Alaniz, K., & Sikora, J. (2016). Digital media in today's classrooms: The potential for meaningful teaching, learning, and assessment. Rowman & Littlefield.

[2] Kilbane, C. R., & Milman, N. B. (2013). Teaching models: Designing instruction for 21st-century learners. Pearson Higher Ed.

[3] Freeman, A., Adams Becker, S., Cummins, M., Davis, A., & Hall Giesinger, C. (2017). *NMC/CoSN horizon report: 2017 K–12 edition*. Austin, Texas: The New Media Consortium.

[4] Smaldino, S. E., Lowther, D. L., Russell, J. D., & Mims, C. (2008). Instructional technology and media for learning.

[5] Mynbayeva, A., Sadvakassova, Z., & Akshalova, B. (2018). Pedagogy of the twenty-first century: Innovative teaching methods. *New Pedagogical Challenges in the 21st Century. Contributions of Research in Education*.

[6] Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration?. *Educational technology research and development*, 53(4), 25-39.

[7] Petko, D., Prasse, D., & Cantieni, A. (2018). The interplay of school readiness and teacher readiness for educational technology integration: A structural equation model. *Computers in the Schools, 35*(1), 1–18. https://doi.org/10.1080/07380569.2018.1428007.

[8] Brinkerhoff, J. (2006). Effects of a long-duration, professional development academy on technology skills, computer self-efficacy, and technology integration beliefs and practices. *Journal of Research on Computing in Education, 39*(1). https://doi.org/10.1080/15391523.2006.10782471.

[9] Teo, T., & Milutinovic, V. (2015). Modelling the intention to use technology for teaching mathematics among pre-service teachers in Serbia. *Australasian Journal of Educational Technology, 31*(4). https://doi.org/10.14742/ajet.1668.

[10] Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for integrating technology in teacher knowledge. *Teachers College Record, 108*(6), 1017–1054 https://www.learntechlib.org/p/99246/

[11] Gao, P., Chee, T. S., Wang, L., Wong, A., & Choy, D. (2011). Self-reflection and pre-service teachers' technological pedagogical knowledge: Promoting earlier adoption of student-centred pedagogies. *Australasian Journal of Educational Technology, 27*(6), 997–1013. https://doi.org/10.14742/ajet.925

[12] Tondeur, J., Van Braak, J., Sang, G., Voogt, J., Fisser, P., & Ottenbreit-Leftwich, A. (2012). Preparing pre-service teachers to integrate technology in education: A synthesis of qualitative evidence. *Computers & Education*, 59(1), 134-144. https://doi.org/10.1016/j.compedu.2011.10.009

[13] Altun, T, & Akyildiz, S. (2017). Investigating Student Teachers' Technological Pedagogical Content Knowledge (TPACK) Levels Based on Some Variables. European Journal of Education Studies, 3(5), 467-485. Retrieved from www.oapub.org/edu. doi: 10.5281/zenodo.555996

[14] Mouza, C., Karchmer-Klein, R., Nandakumar, R., Ozden, S.Y., & Hu, L. (2014). Investigating the Impact of An integrated Approach to the Development of Preservice Teachers' Technological Pedagogical Content Knowledge (TPACK). Computers & Education, 71, 206-221. https://doi.org/10.1016/j.compedu.2013.09.020

[15] Sadaf, A., Newby, T., & Ertmer, P. (2012). Exploring pre-service teachers' beliefs about using web 2.0 technologies in K-12 classroom. *Computers & Education, 59*(3), 937–945. https://doi.org/10.1016/j.compedu.2012.04.001.

[16] Abbitt, J. T. (2011). Measuring technological pedagogical content knowledge in preservice teacher education: A review of current methods and instruments. *Journal of Research on Technology in Education, 43*(4), 281–300. https://doi.org/10.1080/15391523.2011.10782573

[17] Agyei, D. D., & Keengwe, J. (2014). Using technological pedagogical content knowledge development to enhance learning outcomes. *Education and Information Technologies, 19*, 155–171. https://doi.org/10.1007/s10639-012-9204-1.

[18] Akyüz, D. (2016). TPACK analysis of preservice teachers under different instruction methods and class levels. *Turkish Journal of Computer and Mathematics Education, 7*(1), 89–111. https://doi.org/10.17762/turcomat.v7i1.108

[19] Valtonen, T., Kukkonen, J., Kontkanen, S., Mäkitalo-Siegl, K., & Sointu, E. (2018). Differences in pre-service teachers' knowledge and readiness to use ICT in education. Journal of Computer Assisted Learning. 34(2), 174-182. https://doi.org/10.1111/jcal.12225

[20] Lei, J. (2009). Digital natives as preservice teachers: What technology preparation is needed? *Journal of Computing in Teacher Education, 25*(3), 87–97. https://doi.org/10.1080/10402454.2009.10784615.

[21] Bulut, A. (2012). Investigating perceptions of preservice mathematics teachers on their technological pedagogical content knowledge (TPACK) regarding geometry. Master thesis, Middle East Technical University, Ankara. https://hdl.handle.net/11511/22026

[22] Hodges, Charles, Stephanie Moore, Barb Lockee, Torrey Trust, and Aaron Bond. 2020. "The Difference Between Emergency Remote Teaching and Online Learning." *Educause Review*, March 27, 2020. http://hdl.handle.net/10919/104648

[23] García, Emma, and Elaine Weiss. 2020. *A Policy Agenda to Address the Teacher Shortage in U.S. Public Schools. The Sixth Report in 'The Perfect Storm in the Teacher Labor Market' Series.* Economic Policy Institute, forthcoming 2020. http://www.epi.org

[24] NCREL & Metiri. (2003). EnGauge 21st century skills: Literacy in digital age. Napierville. IL & Los Angeles. CA: NCREL & Metiri.

[25] Lewin, C., & McNicol, S. (2015). Supporting the development of 21st century skills through ICT. *KEYCIT 2014-Key Competencies in Informatics and ICT*, (7), 181-198.

[26] Claro M., Salinas A., Cabello-Hutt T., San Martín E., Preiss D.D., Valenzuela S. & Jara I., "Teaching in a Digital Environment (TIDE): Defining and measuring teachers' capacity to develop students' digital information and communication skills," Computers & Education, 2018, DOI:10.1016/j.compedu.2018.03.001.

[27] Van Laar, E., Van Deursen, A. J., Van Dijk, J. A., & De Haan, J. (2017). The relation between 21st-century skills and digital skills: A systematic literature review. *Computers in human behavior, 72*, 577-588.. https://doi.org/10.1016/j.chb.2017.03.010

[28] Tindowen, D. J. C., Bassig, J. M., & Cagurangan, J. A. (2017). Twenty-First-

Century skills of alternative learning system learners. *Sage Open*, *7*(3), https://doi.org/10.1177/2158244017726116

[29] Turiman, P., Wook, T. S. M. T., & Osman, K. (2019). 21 St Century Skills Mastery Amongst Science Foundation Programme Students. *Int. J. Adv. Sci. Eng. Inf. Technol.*, *9*(1), 46-53.

[30] Razali, N. A., & Sanusi, M. N. S. M. (2020). *Analysis of mastery of science process skills and 21st century skills among secondary school students*. Jurnal Pendidikan Sains dan Matematik Malaysia, *10*(1), 16-20.

[31] Siong, W. W., & Osman, K. (2018). *Pembelajaran Berasaskan Permainan dalam pendidikan STEM dan penguasaan kemahiran abad ke-21*. Politeknik & Kolej Komuniti Journal of Social Sciences and Humanities, *3*(1), 121-135.

[32] Lin, L., Shadiev, R., Hwang, W. Y., & Shen, S. (2020). From knowledge and skills to digital works: An application of design thinking in the information technology course. *Thinking Skills and Creativity*, *36*, 100646. https://doi.org/10.1016/j.tsc.2020.100646

[33] Gall, M. D., Gall, J.P., & Borg, W.R. (2003). Educational Research: An Introduction (7th edition). Boston: Ally & Bacon.

[34] Ebrahimi M., Obaid A.J., Yeganegi K. (2021) Protecting Cloud Data Privacy Against Attacks. In: Favorskaya M.N., Peng SL., Simic M., Alhadidi B., Pal S. (eds) Intelligent Computing Paradigm and Cutting-edge Technologies. ICICCT 2020. Learning and Analytics in Intelligent Systems, vol 21. Springer, Cham. https://doi.org/10.1007/978-3-030-65407-8_37.

[35] Ibrahim, K., Obaid, A. (2021). Fraud usage detection in internet users based on log data. International Journal of Nonlinear Analysis and Applications, 12(2), 2179-2188. doi: 10.22075/ijnaa.2021.5367.