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# Understanding students' learning of Mathematics through the integration of ICT: A systematic survey

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***Abstract:*** **Understanding students' learning of Mathematics through ICT (information and communication technology) can help create engaged students and lead to better learning outcomes. The main objective of this study is to analyse how integrating ICT into the teaching and learning process can help improve students' understanding of Mathematics. 30 articles published between 2014 to 2018 from search engine ERIC and Science Direct on this topic were analysed using a systematic literature review. ICT tools and approaches used to enhance students' understanding were examined and discussed. The findings show that there are strengths and weaknesses related to learning Mathematics using ICT. This systematic review offer insights and suggestions for teachers, school administrators, and policymakers on how to improve students' learning of Mathematics through the integration of ICT.**

***Keywords:*** **Learning Mathematics, students' understanding, ICT, systematic, literature review.**

## 1. INTRODUCTION

In 2018, 5.14 billion people or 68% of the world's population owns mobile phones, which is one of the main reasons behind the growing use of mobile technology (Curto Prieto et al., 2019). ICT (information and communication technology) use, including mobile technology, is increasing year after year in tandem with technological developments worldwide. Similarly, the education sector is affected by this trend, with more and more attention being given to technology-based learning in the classrooms. Students' learning is being enhanced with the implementation of *Teknologi Maklumat dan Komunikasi* or ICT through the use of resources such as smartphones and tablets.

Education is fundamental to the development of a country. Numerous studies have been conducted to understand the role of a national education system in developed countries. Finland, Switzerland, Belgium, Singapore, Netherlands, and Japan are among the countries that prioritise the education system in their national development planning. These countries are seen as examples by other countries that are seeking to improve their education system, especially with the current focus on 21st-century learning, which requires some form of ICT integration into the education system. This study examined the integration of ICT in learning Mathematics, which includes models such as PPE model and Frayer model (O-Connor, 2015; Dikkartın Övez & Kıyıcı, 2018), software such as ScrathMaths, C+ programming, WTL, Geogebra, Applet, and multiplication software, as well as the use of hardware such as computers, LCDs, tablets, smartphones, and interactive boards.

The development of technology tools and networks have allowed for the integration of ICT in teaching and learning (T&L) (Shyshkina et al., N.d.). Many ICT-integrated learning platforms have been introduced in schools to enable distance learning, online classes and so on. Virtual learning platforms such as VLE and E-learning enables learning to take place at any suitable place and time (Herrador-Alcaide & Hernández-Solís, 2017; Umoh & Akpan, 2014).

Furthermore, the use of ICT tools in learning encourages knowledge inquiry and curiosity because the tools allow the teaching process to be varied and customised according to the students' learning styles. As a result, students are more interested in the lessons due to the variety of approaches being used.

The U.S. and many European countries have been using computer technology in the field of education since the early 60s. Despite not having the same early start, Malaysia is determined to keep up with the changes in technology-based education. ICT, in the context of Malaysian education, is not only used to help teachers with T&L but also assist them in completing other related tasks such as office work. As mentioned earlier, ICT can motivate teachers to implement T&L that matches the interests of their students, leading to overall educational excellence in the long run.

Iberoamericana (2018) found that the use of the Wiris and Geogebra have improved the quality of education and knowledge sharing among the students and help stimulate their cognitive thinking skills. The wide use of multimedia enables a higher level of understanding and interactivity. The use of ICT in formal education is often considered to be a great challenge. It is therefore important to motivate teachers and students to use ICT, which require different sets of learning method throughout different phases. Issues such as low interest in learning and the need to facilitate students during Mathematics lessons need to be addressed (Tamansiswa, 2018). However, increasing ICT usage in the T&L processes can benefit the education system at different levels. According to Pandolfini (2016), most of the changes are related to the methods used, going from being student-centred to becoming technology-centred.

Learning Mathematics can develop thinking skills and life skills, and lead to promising careers. With ICT usage, Mathematics can help enhance different types of skills and open up opportunities for students. It is therefore important for teachers to become skilled and capable of implementing T&L creatively, such as using mobile applications to engage students (Al-Takhyneh, 2018). The U.S. National Council of Mathematics Teachers emphasises the importance of using technology in Mathematics education (NCTM, 2000) and many researchers have stated the importance of understanding how to successfully integrate ICT in the learning Mathematics (Calder & Murphy, 2018; Çapuk, 2015; Israel, 2016; Mojica-Casey & Dekkers, 2014; Oluwadare, 2015; Kumar & Hema 2018).

## 2. METHODOLOGY

### 2.1 Criteria of Study

This study used the systematic literature review method to review relevant published articles on this topic. Four criteria were applied in selecting the articles. First, the articles were published in a 5-year time frame between 2014 and 2018. Secondly, this literature review was done on published articles only. Thirdly, the articles were published abroad in the English language. Finally, this study considered both quantitative and qualitative approaches.

### 2.2 Search Strategies

The search was conducted using a specific search term which is “Technology” The databases used were ERIC and Science Direct. Titles and abstracts were examined carefully to identify technology-oriented research in the learning of Mathematics among students.

## 3. FINDINGS

A total of 161,151 articles were found in two different databases, 70,751 articles in ERIC and 90,400 articles in Science Direct. 138,131 articles were rejected because they do not have the full text. The rest of the articles were then refined based on the five-year time frame. A total of 8,429 articles were removed to narrow down to the latest articles on the use of technology in Mathematics learning.

Each article was then filtered through careful reading of the abstract. Consequently, 29,804 articles were excluded. The selection was made based on the criteria during the systematic review. Finally, a total of 30 relevant articles were found to have met all criteria, with 20 articles from ERIC and 10 articles from Science Direct.

### 3.1 Location

All the selected articles were studies conducted outside Malaysia. The 30 studies came from 19 countries, as shown in Table 1.

**Table 1: Location of the selected studies**

| Country | Number | Author (Year) |
|---|---|---|
| Argentina | 1 | Rodríguez et al. (2015) |
| Iran | 3 | Mahmoudi et al. (2015), Taleb et al. (2015),Taleb and Hassanzadeh (2015) |
| Thailand | 2 | Meepracha (2015), Waiyakoon et al. (2015) |
| US | 4 | Çapuk (2015), James (2016), DePountis et al. (2018), Wang et al. (2014) |
| Sweden | 1 | Genlott and Grönlund (2016) |
| UK | 1 | Benton et al. (2018) |
| Peru | 1 | Cieza and Lujan (2018) |
| Mongolia | 1 | Technology (2014) |
| Japan | 1 | Dizon and Thanyawatpokin (2018) |
| Australia | 2 | Calder and Murphy (2018), Mojica-Casey and Dekkers (2014) |
| Nigeria | 3 | Israel (2016), Oluwadare (2015) ,Umoh and Akpan (2014) |
| Finland | 1 | Kinnari-Korpela (2015) |
| Kenya | 1 | O-Connor (2015) |
| Kazakhstan | 1 | Abykanova et al. (2016) |
| Croatia | 1 | Preradovic et al. (2016) |
| Turkey | 3 | Dikkartın Övez and Kıyıcı (2018), Herrador-Alcaide and Hernández-Solís (2017), Onal and Gologlu Demir (2017) |
| Arab | 1 | Al-Takhyneh (2018) |
| Indonesia | 1 | Nisiyatussani et al. (2018) |
| India | 1 | Kumar and Hema (2018) |

Most of the studies were carried out in the U.S. with four studies, followed by Turkey, Iran, and Nigeria with three studies. All these studies sought to elevate the current education system to become at par with the current Fourth Industrial Revolution (4IR) era.

### 3.2 Participants

The sample of the selected studies consisted of teachers, university students, secondary school students, primary school students, and pre-school students. The different types of sample selected by the studies are shown in Table 2.

**Table 2: The sample of the selected studies**

| Sample | Number | Author (Year) |
|---|---|---|
| Teachers | 5 | Benton et al. (2018), DePountis et al. (2018), Rodríguez et al. (2015), Taleb et al. (2015), Waiyakoon et al. (2015) |
| Teachers and students | 2 | Calder & Murphy (2018), Çapuk (2015) |
| University | 5 | Abykanova et al. (2016), Al-Takhyneh (2018), Herrador-Alcaide and Hernández-Solís (2017), Israel (2016), Umoh and Akpan (2014) |
| Secondary school students | 7 | Dizon & Thanyawatpokin (2018), Kinnari-Korpela (2015), Mojica-Casey and Dekkers (2014), Nisiyatussani et al. (2018), Onal and Gologlu Demir (2017), O-Connor (2015), Wang et al. (2014), |
| Primary school students | 8 | Dikkartın Övez and Kıyıcı (2018), Genlott and Grönlund (2016), James (2016), Mahmoudi et al. (2015), Meepracha (2015), Kumar and Hema (2018), Taleb and Hassanzadeh (2015), Technology (2014) |
| Pre-school students | 3 | Cieza and Lujan (2018), Oluwadare (2015), Preradovic et al. (2016) |

The majority of these studies chose primary school and secondary school students as their sample and their amount is seven and eight respectively. Only two studies involved a sample of both teachers and students.

### 3.3 Results of ICT integration method evaluation

The integration of ICT applications should facilitate the T&L process and help create meaningful learning. All the articles selected investigated ICT integration in learning Mathematics in any method to distribute, search, and display information. The integration method mentioned in the selected studies are mobile technology, digital technology, interactive learning technology, ScratchMaths, C+ programming, interactive boards, WTL, video, VLE, personal computers, tablets, computer games, blogs, Geogebra, Applets, PPE models, Frayer model, Facebook, email, multiplication software, E-learning, Clicker, and multimedia stories.

#### 3.3.1 Digital Technology

Digital technology is not only limited to the Internet and computer-based technology but also includes television, mobile phones, faxes, telegram, and any medium that can be used to deliver information. Seven studies focused on digital technology in the T&L of Mathematics. Calder and Murphy (2018) found that teachers and students share their ideas through digital technology. DePountis et al. (2018), on the other hand, looked at special education teachers who teach visually-impaired students and how these students benefit from learning Mathematics using digital technology.

Another five studies involved pre-schoolers, primary school students, secondary school students, and university students as the sample (Çapuk, 2015; Israel, 2016; Mojica-Casey & Dekkers, 2014; Oluwadare, 2015; Kumar & Hema, 2018). All of these studies suggest that ICT integration improves the students' performance in Mathematics. The students also recognise and appreciate the various interactions between themselves and their peers via ICT applications. The findings suggest that learning Mathematics using ICT integration enables innovative teaching methods that can prove to be successful.

#### 3.3.2 Computer Software

Computer software refers to programs that instruct computers to perform specific tasks. A wide range of computer software was used in selected studies which include C+ programming, ScratchMaths, WTL, Geogebra, Applet, PPE Model, Frayer Model, Multimedia Story, Clicker, and multiplication software. PPE and Frayer models were used to assess the effectiveness of ICT in learning and cognitive teaching strategies. Linking everyday life to Mathematics was found to be very effective in improving students' learning (O-Connor, 2015; Dikkartın Övez & Kıyıcı, 2018; Cieza & Lujan, 2018). Benton et al. (2018) suggest that the integration of ICT in learning increases students' comprehension, allowing them to better solve Mathematical problems. Furthermore, ICT integration has even helped students to achieve high scores in the subject (Genlott & Grönlund, 2016; Wang et al., 2014; Taleb & Hassanzadeh, 2015). In one study (Nisiyatussani et al., 2018), secondary school students were found to have responded positively to learning Mathematics by using Geogebra and Applet software. Interactive multimedia storytelling is an effective ICT tool that has been shown to enhance Mathematical skills among pre-school students (Preradovic et al., 2016).

#### 3.3.3 Multimedia Learning

Multimedia technology involves computer-based applications that provide information to users through a variety of media. Multimedia learning involves different media such as text, video, animations, sophisticated graphics, and simulation to deliver the lessons. Two previous studies have investigated the use of multimedia-based learning through video and computer games (Kinnari-Korpela, 2015; Mahmoudi et al., 2015). These studies found that the usage of short video lectures and computer games in learning Mathematics can help teachers to carry out interesting and effective T&L sessions, which adds to the students' understanding of Mathematics.

#### 3.3.4 Mobile Technology

In terms of mobile technology, the selected studies examined tablets, personal computers, interactive boards, and smartphones. Two studies, in particular, involved the use of tablets among primary school students and Special Education teachers in Thailand. Both studies have a common objective which is to develop models and to assess the efficiency of Mathematics learning applications. Meepracha (2015) found that tablet-based learning applications for Mathematics can enhance knowledge and understanding through the use of visuals, colours, and sounds to spark interest among the students. Waiyakoon et al. (2015) demonstrated how the design of tablet-based T&L using Learning Object Model Design directly benefit disabled students and their teachers.

The interactive board is considered part of mobile technology. James (2016) identified a significant percentage of fourth-graders who used interactive boards and participated in specialized learning activities were able to meet or exceed grade-level standards in Mathematics. Another study by Onal and Gologlu Demir (2017) attempted to determine the attitudes and opinions of secondary school students towards the use of interactive whiteboards in Mathematics lessons. The findings of this study show that the male students' attitudes towards the interactive whiteboards are more positive than the female students', and the level of positive attitude towards Mathematics decreases as the class level increases.

Another set of studies focused on personal computer and smartphone use among teachers, university students, and primary school students. Al-Takhyneh (2018) surveyed the attitude of 57 Arab university students towards learning through mobile technology in the open learning system. 80% of students surveyed showed a positive attitude towards this approach. Taleb et al. (2015), on the other hand, examined Mathematics teachers' attitudes towards using the application and found that they are interested in using mobile technology in their teaching. Another study, Grenlott Gronlund (2016), found that when controlled for gender, the use of personal computers increases students' reading skills, Math scores, and the amount of homework completed, and money earned.

### 3.3.5 Virtual Learning

Virtual learning is defined as any electronic-based learning that can take place anywhere, regardless of time constraint. This approach to learning does not require teachers to be physically present in front of their students. Instead, the teaching process occurs online. Herrador-Alcaide and Hernández-Solís (2017) analysed the usability of an ICT implementation in a virtual learning environment (VLE) for distance education, with Turkish university students as its sample. The study found that as a higher education distance learning model, the VLE is a good system that supports the student-centred learning process. Umoh and Akpan (2014) conducted a study on 30 university students in Uyo, Nigeria, to investigate their perceptions of the challenges of using e-Learning in the T&L of Mathematics. The overall findings show that there is a significant difference in students' perceptions of the challenges of using e-Learning tools. Only higher education students were involved in the two studies on virtual learning, possibly because this approach requires students who are better at self-managing their study when there is no face-to-face interaction with the instructors.

### 3.3.6 Other Learning Technologies

Online applications such as Facebook, email, and blog are also used in learning. As a social networking application, Facebook enables individuals to reach a large number of people at the same time. Email, on the other hand, can be used to send or share information with others. Rodríguez et al. (2015) analysed the use of mobile technology in Mathematics and English subjects at Argentinian universities under different contexts and concluded that Facebook and email provide better opportunities for learning.

Blogs offer an open space for individuals to discuss their thoughts, including what they learn during Mathematics class. Dizon and Thanyawatpokin (2018) compared the effects that Facebook and blogs have on writing skills, namely, comprehension writing, lexical richness, and syntactic complexity among Japanese secondary school students learning English as a foreign language (L2). Despite its ability to provide an environment where students can interact openly or privately through a Facebook group, Facebook was found to be much more distracting for them than the formal educational approach while blogs offer a more conducive environment for improving L2 writing skills (Wang & Kim, 2014).

## 4. DISCUSSION

This systematic review examined Mathematics T&L via the integration of ICT and the related issues and challenges. 30 published articles were selected from two databases for analysis. The research questions posed in this systematic review are "What are the students' level of understanding in Mathematics with ICT integration?" and "What are the methods of ICT integration used in learning Mathematics?"

### 4.1 What is the level of students' understanding of Mathematics through ICT integration?

Students have been the focus of previous studies that discuss the development and integration of ICT in education, especially Mathematics education. TIMSS and PISA, the benchmarks for student achievement in Mathematics and Science around the world, have emerged as a direct method of comparison. Thus, these studies are partly aimed at

improving students' understanding of Mathematics with respect to the TIMSS and PISA rankings. The results of these benchmarks have inspired many countries to conduct research that will improve their students' performance. Even Malaysia aspires to place itself within the top one-third ranking.

Eight of the selected studies analysed students' understanding of Mathematics via integration of ICT (Dikkartın Övez & Kıyıcı, 2018; Genlott & Grönlund, 2016; James, 2016; Mahmoudi et al., 2015; Meepracha, 2015; Kumar & Hema, 2018; Technology, 2014; Taleb & Hassanzadeh, 2015). These studies were conducted in primary schools and involved primary level students only. Many studies chose to focus on students because they are the future users of any new technology. Dikkartın Övez and Kıyıcı (2018) and James (2016) argue that students can become more actively engaged when learning Mathematics if they link what they learn with their everyday life. Students also understand Mathematics more easily when ICT is integrated effectively (Meepracha, 2015; Kumar & Hema, 2018; Taleb & Hassanzadeh, 2015). Use of ICT can also increase Mathematics literacy achievement, scores, and results (Genlott & Grönlund, 2016; Technology, 2014; Genlott & Grönlund, 2016). Overall, these studies demonstrate how students' understanding of learning Mathematics can improve through the integration of ICT.

**4.2 What are the methods of ICT integration used in learning Mathematics?**

ICT can be integrated into the learning of Mathematics through various means such as digital technology, computer software, multimedia learning, mobile technology, virtual learning, and other learning technologies. ICT hardware such as computers, LCDs, tablets, smartphones, and interactive boards are used to facilitate this integration. ICT integration has been shown to help students understand Mathematics better, and at the same time, improve their Mathematics results at the individual level as well as collectively at the national level.

Applications such as Facebook, email, and blogs are also used in learning to facilitate communication between teachers and students (Rodríguez et al., 2015; Dizon & Thanyawatpokin, 2018) and are very helpful in improving the understanding of the students. These technologies enable student-centred activities to be carried out which can help enhance cognitive thinking skills. However, there are drawbacks to using these technologies, such as the possibility of the students gaining access to pornographic materials. As mentors, teachers must actively and pro-actively monitor and act against such negative behaviours.

## 5. CONCLUSION

ICT integration can help increase students' understanding of Mathematics. As with any form of approach or implementation, ICT integration into Mathematics learning has its advantages and disadvantages. Thus teachers, as an agent of change, should utilise its advantages while being aware of its disadvantages to ensure that the education system is progressing towards the right direction, technology-wise.

## 6. IMPLICATIONS OF THE STUDY

The findings of this systematic review offer several suggestions on increasing students' understanding of Mathematics via integration of ICT. In this approach, teachers should first and foremost take on the role of facilitators or mentors. They should also facilitate more student-centred activities that could improve the quality of learning and learn to keep themselves updated with the rapidly evolving technology. The findings of this study can also benefit policymakers in formulating new policies in education at the regional or national levels and offers justification for the resources that should be allocated to provide schools with the necessary hardware, software, and reliable Internet connection. The school administration should also ensure that their ICT infrastructure and their teachers' level of ICT skills are at the best possible level and in accordance with all ICT requirements mandated by the government or other education authority (Umar & Hassan, 2015).

Teachers and students are equally involved in integrating ICT in learning (Amuko et al., 2015). Effective use of ICT in Mathematics T&L can motivate students, facilitate the students and teachers' tasks, as well as smoothening the related administrative tasks within the school (Tamansiswa, 2018).

## REFERENCES

[1] Abykanova, B., Nugumanova, S., Yelezhanova, S., Kabylkhamit, Z. & Sabirova, Z. 2016. The use of interactive learning technology in institutions of higher learning. International Journal of Environmental and Science Education 11(18): 12528–12539.

[2] Al-takhyneh, B. 2018. Attitudes towards Using Mobile Applications in Teaching Mathematics in Open Learning Systems 33(1): 1–16.

[3] Amuko, S., Miheso, M. & Ndeuthi, S. 2015. Opportunities and Challenges: Integration of ICT in Teaching and Learning Mathematics in Secondary Schools, Nairobi, Kenya. Journal of Education and Practice 6(24): 1–6. Retrieved from www.iiste.org

[4] Benton, L., Saunders, P., Kalas, I., Hoyles, C. & Noss, R. 2018. Designing for learning mathematics through programming: A case study of pupils engaging with place value. International Journal of Child-Computer Interaction. doi:10.1016/j.ijcci.2017.12.004

[5] Calder, N. & Murphy, C. 2018. Using apps for teaching and learning mathematics : A socio- technological assemblage 194–201.

[6] Çapuk, S. 2015. ICT Integration Models into Middle and High School Curriculum in The USA. Procedia - Social and Behavioral Sciences 191: 1218–1224. doi:10.1016/j.sbspro.2015.04.409

[7] Cieza, E. & Lujan, D. 2018. Educational Mobile Application of Augmented Reality Based on Markers to Improve the Learning of Vowel Usage and Numbers for Children of a Kindergarten in Trujillo. Procedia Computer Science 130: 352–358. doi:10.1016/j.procs.2018.04.051

[8] Curto Prieto, M., Orcos Palma, L., Blázquez Tobías, P. & León, F. 2019. Student Assessment of the Use of Kahoot in the Learning Process of Science and Mathematics. Education Sciences 9(1): 55. doi:10.3390/educsci9010055

[9] DePountis, V. M., Pogrund, R. L., Griffin-Shirley, N. & Lan, W. Y. 2018. Technologies Used in the Study of Advanced Mathematics by Students who Are Visually Impaired in Classrooms: Teachers' Perspectives. Journal of Visual Impairment & Blindness 109(4): 265–278. doi:10.1177/0145482x1510900403

[10] Dikkartın Övez, F. T. & Kıyıcı, O. D. 2018. 6th Grade Students' Views about Mathematical Teaching Based on Technology Integration. World Journal of Education 8(5): 160. doi:10.5430/wje.v8n5p160

[11] Dizon, G. & Thanyawatpokin, B. 2018. Web 2.0 tools in the EFL classroom: Comparing the effects of Facebook and blogs on L2 writing and interaction. The EuroCALL Review 26(1): 29. doi:10.4995/eurocall.2018.7947

[12] Genlott, A. A. & Grönlund, Å. 2016. Closing the gaps - Improving literacy and mathematics by ict-enhanced collaboration. Computers and Education 99: 68–80. doi:10.1016/j.compedu.2016.04.004

[13] Herrador-Alcaide, T. C. & Hernández-Solís, M. 2017. Numerical-technological skills and work experience in the perceived usefulness in an accounting virtual learning environment. Turkish Online Journal of Educational Technology 16(3): 115–130. Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-85025073960 &partnerID=40&md5=e46e43bdcd609a8216d05e6a9fc1deae

[14] Iberoamericana, U. 2018. Information and Communication Technologies as a Didactic Tool for the Construction of Meaningful Learning in the Area of Mathematics . pdf.

[15] Israel, O. O. 2016. Effects of Mathematics Innovation and Technology on Students Performance in Open and Distance Learning. Research in Pedagogy 6(1): 66–75. doi:10.17810/2015.24

[16] James, L. 2016. Mathematics Awareness through Technology, Teamwork, Engagement, and Rigor. Journal of Curriculum and Teaching 5(2): 55–62. doi:10.5430/jct.v5n2p55

[17] Kinnari-Korpela, H. 2015. Using short video lectures to enhance mathematics learning - experiences on differential and integral calculus course for engineering students. Informatics in Education 14(1): 69–83. doi:10.15388/ infedu.2015.05

[18] Mahmoudi, H., Koushafar, M., Saribagloo, J. A. & Pashavi, G. 2015. The Effect of Computer Games on Speed, Attention and Consistency of Learning Mathematics among Students. Procedia - Social and Behavioral Sciences 176: 419–424. doi:10.1016/j.sbspro.2015.01.491

[19] Meepracha, W. 2015. The Learning Application Development on Tablet for Mathematics subject. Procedia - Social and Behavioral Sciences 197(February): 1621–1626. doi:10.1016/j.sbspro.2015.07.210

[20] Mojica-Casey, M. & Dekkers, J. 2014. Research Guided Practice : Student Online Experiences during Mathematics class in the Middle School 469–476.

[21] Nisiyatussani, N., Ayuningtyas, V., Fathurrohman, M. & Anriani, N. 2018. Geogebra Applets Design and Development for Junior High School Students to Learn Quadrilateral Mathematics Concepts. Journal on Mathematics Education 9(1): 27–40. doi:10.22342/jme.9.1.4162.27-40

[22] O-connor, B. W. M. 2015. Effects of Mathematical Vocabulary Instruction on Students ' Achievement in Mathematics in Secondary Schools of Murang ' a 6(18): 201–208.

[23] Oluwadare, F. A. 2015. ICT Use in Preschool Science Education: A Case Study of Some Private Nursery Schools in Ekiti State. Journal of Education and Practice 6(31): 75–79. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ1083397&site=ehost-live

[24] Onal, N. & Gologlu Demir, C. 2017. The Use of the Interactive Whiteboard in Mathematics and Mathematics Lessons from the Perspective of Turkish Middle School Students. International Journal of Higher Education 6(3): 195. doi:10.5430/ijhe.v6n3p195

[25] Pandolfini, V. 2016. Exploring the Impact of ICTs in Education : Controversies and Challenges Exploring the Impact of ICTs in Education : Controversies and Challenges 8(June): 28–53. doi:10.14658/pupj-ijse-2016-2-3

[26] Preradovic, N. M., Lesin, G. & Boras, D. 2016. Introduction of digital storytelling in preschool education: A case study from Croatia. Digital Education Review (30): 94–105.

[27] R. RAJ, K. & G, H. 2018. Effects of Multimedia Instructional Strategy for Enhancing Students' Learning and Retention in Mathematics. i-manager's Journal on School Educational Technology 13(2): 7. doi:10.26634/jsch.13.2.13826

[28] Rodríguez, G., Spiegel, A., Salviolo, M. & Peña, A. 2015. Math, English and Netbooks at the University. Learning Across Contexts? Procedia - Social and Behavioral Sciences 176: 714–721. doi:10.1016/j.sbspro.2015.01.531

[29] Shyshkina, M., Kohut, U. & Popel, M. (n.d.). The Systems of Computer Mathematics in the Cloud-Basedd Learning Environment of Educational Institutions (Cc).

[30] Taleb, Z., Ahmadi, A. & Musavi, M. 2015. The Effect of M-learning on Mathematics Learning. Procedia - Social and Behavioral Sciences 171: 83–89. doi:10.1016/j.sbspro.2015.01.092

[31] Taleb, Z. & Hassanzadeh, F. 2015. Toward Smart School: A Comparison between Smart School and Traditional School for Mathematics Learning. Procedia - Social and Behavioral Sciences 171: 90–95. doi:10.1016/j.sbspro.2015.01.093

[32] Tamansiswa, U. S. 2018. Developing Multimedia Application Model for basic Mathematics Learning 10(November): 1347–1356.

[33] Technology, C. 2014. The Effect of Using XO Computers on Students ' Mathematics and Reading Abilities : Evidences from Learning Achievement Tests Conducted in Primary Education Schools in Mongolia Shinobu Yamaguchi Tokyo Institute of Technology, Japan JavzanSukhbaatar Instit 10(2): 89–102.

[34] Umar, I. N. & Hassan, A. S. A. 2015. Malaysian Teachers' Levels of ICT Integration and Its Perceived Impact on Teaching and Learning. Procedia - Social and Behavioral Sciences 197(February): 2015–2021. doi:10.1016/j.sbspro.2015.07.586

[35] Umoh, J. B. & Akpan, E. T. 2014. Challenges of Blended E-Learning Tools in Mathematics : Students ' Perspectives University of Uyo 3(4). doi:10.5539/jel.v3n4p60

[36] Waiyakoon, S., Khlaisang, J. & Koraneekij, P. 2015. Development of an Instructional Learning Object Design Model for Tablets Using Game-based Learning with Scaffolding to Enhance Mathematical Concepts for Mathematic Learning Disability Students. Procedia - Social and Behavioral Sciences 174: 1489–1496. doi:10.1016/j.sbspro. 2015.01.779

[37] Wang, Y., Chung, C.-J. & Yang, L. 2014. Using Clickers to Enhance Student Learning in Mathematics. International Educafile:///Users/yeasothashanmugarao/Desktop/ Web 2.0 tools in the EFL classroom- Comparing the effects of Facebook and blogs on L2 writing and interaction.pdftion Studies 7(10): 1–13. doi:10.5539/ies.v7n10p1