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Ruzanna Topchyan, Ph.D.

TECHNOLOGY INTEGRATION

AT A GLANCE

Technology skills have been listed among the 21st century skills that were supposed to help students to prepare themselves for joining the future workforce. As it has constantly been mentioned, in today's world of rapid technological advances, there exists a growing need for highly education and skilled workforce with the knowledge of science, technology, engineering and mathematics, as well as employees who are innovative, creative, productive who can contribute to the economic growth of their countries. While the question whether technology should drive curriculum or be driven by it is still a hot topic for discussion, technology integration has been one of the research topics in K-12 and post-secondary education research for several years now. In recent years, a number of studies were conducted to explore: (i) teachers' perceptions, attitudes and beliefs in relation to technology integration and use, (ii) teacher knowledge and readiness for technology integration, and (iii) impact of technology use on student learning. Sample studies are presented below.

Teachers' Perceptions, Attitudes and Beliefs in Relation to Technology Integration and Use

Webster (2017) conducted a qualitative study using grounded theory to: (a) examine what philosophy of technology assumptions are present in the thinking of K-12 technology leaders, (b) how the assumptions might influence technology decision making, and (c) whether technological determinist assumptions were present. The subjects in the study were technology directors and instructional technology specialists from school districts. Data were collected using interviews and a written questionnaire. Three broad philosophies of technology views were identified: (i) an instrumental view of technology, (ii) technological optimism, and (iii) a technological determinist perspective that sees technological change as inevitable. Two main approaches seemed to guide the technology decision making of technology leaders: (i) *Educational goals and curriculum should drive technology*, and (ii) *Keep up with Technology (or be left behind)* with *Keep up with technology (or be left behind)* having greater weight in technology decision making. The researcher cautioned that the risk here is that technology adoption decisions can be made

quickly, without aligning the technology implementation with educational goals which might not have the desired impact on teaching and learning.

Bindu (2017) explored whether gender and age differences impacted using Information and Communication Technology (ICT) in teaching in Indian teachers in United Arab Emirates. The data were collected through both questionnaire and interviews. The findings of the study suggested that teachers had a positive attitude towards using ICT irrespective of their gender and age. However, the ICT awareness of teachers was at the average level and was influenced by their gender and age. The researcher concluded that ICT use for educational purposes should be given greater consideration than it was receiving.

Khlaif (2017) conducted a study to explore the factors influencing teachers' attitudes towards the integration of tablets into their classrooms for instructional purposes. Data were collected from 15 teachers using semi-structured interviews in Palestine. The findings of the study revealed that teachers were using tablets because they were facilitating their teaching and providing equality of access to the Internet and educational technology for students in rural schools. However, there seemed to be diversity in teachers' attitudes towards tablets based on a variety of factors such as technical support and the availability of suitable educational resources.

Lindberg, Lindberg, Olofsson, Olofsson, Fransson, and Fransson (2017) conducted a study to examine Swedish upper secondary school teachers' and students' views and use of ICT in education. In total, 25 individual teachers and 39 students in small focus groups were interviewed. The teachers' views and use of ICT were diverse. Teachers and students identified similar challenges when using ICT in education, e.g. time and subject, the shortcomings of a school's learning management system (LMS) and teachers' digital competence.

Summers, Zadrozny, Van Overschelde, Huynh, Solem, and Boehm (2017) conducted a study to investigate pre-service teachers' perceptions and change in spatial thinking after using geospatial technology in a prepared geospatial technology module. Results of the study suggested an improvement in spatial thinking, as well as a receptive attitude toward the use of geospatial technology as a teaching tool.

Gandhi and Lynch (2017) conducted a study that attempted to compare male and female teachers' knowledge of common ICT software, their perceptions towards using ICT and their perceived self-confidence in integrating ICT in their classes in two international schools in Thailand. Data were collected using an online questionnaire. The questionnaire measured: (i) knowledge of common ICT software, (ii) perceptions of ICT use, and (iii) perceived self-confidence in integrating ICT in their classes. A total of 145 teachers participated in the study. The results of the study suggested that both male and female teachers had high knowledge of common ICT software. However, the male teachers had more positive perceptions of ICT and higher perceived self-confidence in integrating ICT into their classes as compared to the female teachers.

Voet and De Wever (2017) conducted and exploratory study with 22 4th grade teachers in Flanders (Belgium) on their beliefs about technology, ways in which technology was implemented, and factors influencing the adoption process. Semi-structured interviews were used to collect data. The results of the study suggested that most teachers held positive beliefs about technology, and that use of technology was driven by several rationales. Although a significant group of teachers was thoughtful of how their own use of technology could support students' learning, student use remained limited to instances where technology served as a resource for the task, rather than a tool for supporting cognitive or social activity. It appears that teachers were not yet aware of technology's ability to scaffold inquiry activities. Furthermore, limitations in school infrastructure often prevented them from experimenting with more pervasive student uses of technology.

Teacher Knowledge and Readiness for Technology Integration and Use

While teachers might have positive attitude towards technology use in classrooms, their knowledge of using technology for educational purposes, or their readiness for using technology in their classrooms can be conditioned by a number of aspects. Several studies addressed these issue.

Kalonde(2017) explored the significance of technology integration familiarization and the subsequent professional development (PD) provided to rural middle school teachers with several opportunities to gain technological skills for technology use in rural middle school math and science classrooms. 63 rural middle school math and science teachers were surveyed on technology use and PD offered for technology integration into classrooms. The results of the study suggested that there was need for PD to familiarize rural teachers with newer and essential instructional technologies and to gain technological skills in instructional technology integration. Additionally, the results suggested that while the teachers were willing to integrate technology in their classrooms, their lack of familiarity and knowledge on some present technologies affected their technology usage and could create some unforeseen challenges in the classrooms.

Hlásná, Poulová, and Klímová (2017) conducted a study to explore the use of ICT in classes in primary schools in the Czech Republic to identify how, why and how often the teachers use ICT in their teaching. The findings of the study indicated that although more than 50% of the teachers at primary schools used ICT in their teaching on a daily basis, they needed further continuous methodological training which would contribute to their effective use of ICT in classrooms. The results also showed that the teachers who had participated in a methodological course on ICT use appeared to implement ICT in their classes more than those who had not attended such training. In addition, the results revealed that the use of ICT was not influenced by the length of the teaching practice and that the use of ICT still did not have any impact on the relationship between the teacher and pupils and among pupils themselves. Nevertheless, the results suggested that there should be ample and continuous trainings which would ensure that teachers have relevant competences for using ICT in their classrooms.

Turgut (2017) conducted a study to compare technological pedagogical content knowledge (TPACK) among teacher candidates, pre-service and in-service English as a foreign language (EFL) teachers in Turkey. The results of the study suggested that the three groups of teachers showed significantly different levels of self-efficacy related to different components of TPACK. Additionally, the study identified that participating in technology program did not raise the level of teachers' self-efficacy in technology use, which seems to lead to a much earlier comment made by Yan and Yuhang (2012) that teachers' knowledge of technology cannot be automatically translated into their use of technology for instructional purposes.

Impact of Technology Use on Student Learning

The ultimate goal of formal education is student learning and the use of technology should also serve that. Several studies reported use of technology by different disciplines. Some of the studies are presented below.

Reeves, Gunter, & Lacey. (2017) conducted a study to determine how integrating mobile devices (iPads) into a Pre-Kindergarten curriculum using informal feedback from students affects students' academic achievement. The study employed a two-group, quasi-experimental design consisting of 28 students from two Pre-K classrooms. The experimental group utilized iPads with guided instruction, coupled with informal feedback from students, to target emergent literacy and early math skills; the control group did not have access to iPads. All students were given the Florida VPK Assessment at the beginning and end of the study. Results of the ANCOVA revealed significantly higher Phonological Awareness and Mathematics measures

for the iPad class, suggesting that integrating mobile learning in content-specific areas using informal student feedback effectively increases early childhood education students' academic achievement.

Sahlin, Tsertsidis, and Islam (2017) conducted a study to find which activities and outcomes were evident in the usages of computing devices and how those devices aided elementary-level students in their learning activities. The study was conducted in Sweden. The data were collected using participant observations and unstructured interviews. The major activities found were dealing with: (i) educational application assignments, (ii) storytelling, (iii) report writing and (4) practical interaction assignments. The researchers concluded that ICTs aided students in becoming more concentrated, focus driven, engaged and amused, thus making learning more interesting.

Yeh (2017) conducted a study on a podcast learning project integrated into an English speaking and listening class for the purpose of promoting extensive listening and fostering independent learning. The data were collected through a questionnaire, students' podcast diaries, and observation notes on student project presentations, seeking to examine students' learning experiences as well as their views of using podcasts for pedagogical purposes. Results of the study suggested that students were strategic in choosing podcasts suitable for their interests and proficiency levels. Overall, they found learning from podcasts not only convenient but also useful in enhancing their language proficiency and world knowledge. Researchers attributed students' general satisfaction with the experience to factors including freedom of choice, meaningful practice, and close integration with the syllabus. However, students also experienced frustration with podcasts containing unscripted authentic content delivered at a fast speech rate.

Alresheed, Raiker, and Carmichael (2017) explored the overt and covert factors that affect Computer Assisted Language Learning (CALL) use and integration in Saudi Arabian secondary schools. A case study approach using mixed methods was employed to interview and observe a sample of teachers and school inspectors in urban and rural secondary schools. Results were supplemented with an online questionnaire. The findings were favorable for CALL to be used in Saudi Arabian English language classrooms.

Maloy, Trust, Kommers, Malinowski, and LaRoche (2017) examined the use of 3D technology by teachers and students in four middle school history/social studies classrooms. As part of a university-developed 3D Printing 4 Teaching & Learning project, teachers integrated 3D modeling and printing into curriculum topics in world geography, U.S. history, and government/civics. Seven key insights emerged: (i) teachers and students initially found it challenging to imagine ways to use 3D printed physical objects to represent social science concepts; (ii) students found 3D printing projects were a positive, self-fulfilling way to show their ideas about history topics; (iii) teachers and students found the 3D modeling program difficult to use; (iv) 3D modeling and printing altered the teacher-as-expert/student-as-novice relationship; (v) 3D modeling and printing changed how teaching and learning happened in history/social studies classrooms; (vi) partnering with content and technical experts was an important element of success; and (vii) some teachers shifted their thinking about the value of using 3D printing in history/social studies classes.

Yang, Yu, Gong, and Chen (2017) conducted an experimental study in a primary school with 143 students from 4 classes on the use of technology-rich classroom (TRC) for changing the classroom from teacher-centered learning to more student-centered learning that encompasses replacing lectures with active learning, integrating self-paced learning programs and/or cooperative group situations, ultimately holding the student responsible for their own advances. The experimental group comprised of two classes in a TRC environment. The environment was equipped with Wi-Fi, wireless display, dual screens, and site facilitators. Additionally, an iPad was made available for every student in the class. The other two classes were the control group and had a MMC environment, in which a computer and a projector were equipped. The experiment lasted for one full semester with 12 weeks. The results of the study indicated that the

scores of students' perceptions in TRC were significantly higher than scores in MMC, and students spend more time engaged in individual learning and collaborative learning in the TRC than in the MMC.

Chauhan (2017) conducted a meta-analysis of academic papers that measured the impact of technology on learning effectiveness in elementary students. The results confirmed that the technology has a medium effect on learning effectiveness of elementary students.

Conclusion

As the discussion above suggests, previous research reported about teacher favorable attitudes towards technology integration. However, there seems to be a need for professional development to help teachers better understand the most effective use of technology for instructional purposes. The use of technology seems to create a paradigm shift from teacher-centered instructional model to student-centered instructional model which creates more opportunities for students to engage into their own learning processes. Technology use has been explored and reported in some disciplines, but more research should be conducted to better understand the effective use of technology in different classrooms. And finally, while teachers and students nowadays are using technology in their everyday lives, educators would have made a wrong assumption thinking that the skills that they developed could be readily transferred into their classroom use of technology. As previous research suggests teachers, other than needing technology knowledge, will need technological pedagogical content knowledge to effectively use technology in their classrooms.

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