

Technology Integration Experiences of Teachers

Ahmet Naci Çoklar

Necmettin Erbakan University, Turkey

Işıl Kabakçı Yurdakul

Anadolu University, Turkey

Abstract

Teachers are important providers of educational sustainability. Teachers' ability to adapt themselves to rapidly developing technologies applicable to learning environments is connected with technology integration. The purpose of this study is to investigate teachers' technology integration experiences in the course of learning and teaching processes. In doing so, qualitative research methods have been applied. The participants of the study were four teachers of different subject fields who work at a public secondary school in 2015–2016 school years and regard themselves as competent in technology integration. The study results indicated that the teachers took a teacher-centered stand in technology integration and the teachers' most prominent reasons to start technology integration were the search for quality in education. Also the teachers, as IT school teachers, reported receiving support from close friends, the Ministry of National Education (MoNE), and online resources. The problems that the teachers faced in the processes of technology integration were mostly related to issues connected with the access to technology and technology proficiency.

Keywords: technology integration, sustainability, technology.

Introduction

Technology integration is one of the dimensions of sustainable development (Pouzevara, Mekhael and Darcy, 2014; Armenta, Serrano, Cabrera, & Conte, 2012), proposed as a means to provide sustainable development (Yarime et al., 2012). It is suggested that technology integration initiatives should also be seen through a sustainability lens (Polly, Mims, Shepherd, & Inan, 2010; Iliško & Ignatjeva, 2014). Technological innovation is an important provider of sustainable development within the fields of education. In educational institutions, technological innovation and integration are valuable tools for educational initiative and sustainable future (Uwasu, Yabar, Hara, Shimoda, & Saijo, 2009). Moreover, establishing infrastructure and technology integration to education is a prerequisite of technological innovation. Thus, the effects of information and communication technologies on student learning, quality of education, and sustainable development provide a basis for the integration of technology within the sphere of education.

Teachers are important providers of educational sustainability. Teachers' ability to adapt themselves to rapidly developing technologies applicable to learning environments is connected with technology integration (Bentham, 2013; Ortega & Fuentes, 2015). Technology integration in education has a multidimensional structure that consists of various components and indicators. In this vein, the factors influencing technology integration include human resources as well as technological resources. Technology integration is defined as an efficient and effective use of technology embracing all aspects of learning and teaching processes including learning and teaching environments, curriculum, and infrastructure (Yalın, Karadeniz & Şahin, 2007).

During technology integration processes, a variety of issues may cause problems including teachers' limited access to the Internet (Clark, 2006; Bauer & Kenton, 2005), time constraints (Yalın, Karadeniz, & Şahin, 2007; Zhao & Frank, 2003; Mumtaz, 2000), teachers' lack of basic technological skills (Hew & Brush, 2007), teacher attitudes towards technology integration (Hew & Brush, 2007; Lim & Khine, 2006; Ertmer, 2005; Iliško & Ignatjeva, 2014), school culture (Hu, Clark, & Ma, 2007), and teachers' need for professional development regarding technology integration (Göktaş, Yıldırım, & Yıldırım, 2009; Gülbahar & Güven, 2008; Koehler & Mishra, 2005; Glazer, Hannifin, & Song, 2005). On the other hand, the problems stem from teachers' lack of knowledge, skills, or efficacies, being the most prominent obstacles to an effective technology integration (Brinkerhoff, 2006; Hew & Brush, 2007; Lim, 2007; Lim & Khine, 2006; Oncu, Delialioğlu, & Brown, 2008; Shulman, 2004; Yalın, Karadeniz, & Şahin, 2007; Zhao, 2007). Moreover, there exist studies reporting issues related not only to teachers' technology use but also to their lack of skills or efficacies (Çiftçi, Taşkaya ve Alemdar, 2013; Korkmaz ve Usta, 2010). Thus, this situation indicates that teacher efficacies play a central role among the factors influencing effectiveness of technology integration in education.

In order to alleviate common problems (such as lack of basic skills, negative attitudes, and need for professional development) and enable teachers to use technology effectively in their own teaching, pre-service education should equip teacher candidates with knowledge and skills enabling them the use of technology. Therefore, it is important that teacher training institutions include technological tools appropriate to the subject matter and provide pre-service teachers with quality education (Erdemir, Bakırcı, & Eyduran, 2009). However, the literature suggests that students in teacher training institutions often do not have a chance to transfer their technology knowledge to out-of-school activities when technology instruction is given as a separate course. For this reason, it is emphasized that pre-service teachers should earn technological skills in connection to the subject matter (Van Melle, Cimellaro, & Shulha, 2003). In addition, researchers state that the learning environments in which the use of technology becomes integrated with the subject matter improve students' achievement and foster their higher order thinking skills (Lim & Ching, 2004).

The purpose of this study was to describe both initial and current technology integration states experienced by the teachers who consider themselves successful in integration due to their use of technology, means of support, problems they encounter and solutions they devise, and their suggestions for the future teachers.

Method

This study employed a qualitative research design and featured interview study elements. The participants of the study were four teachers who work at a secondary school in Meram District of Konya Province in Turkey during 2015–2016 school year. Several methods were used to meet inclusion criteria. First, the researchers consulted the school's information technology teacher about those teachers who make an effective and high-level use of technology. The IT teacher gave a total of four teachers name from four different subject fields. Then, the researchers got in touch with those teachers to inform them about the study and to ask their opinions about the perceived by them level of technology integration. Finally, the teachers who consider themselves good and efficient filled in the educational technology standards scale by Çoklar (2008) to confirm their self-perception, and were included in the study. The participants' characteristics are given in Table 1.

Table1
Participant Characteristics

Teachers	Gender	Subject Matters	The total score (max 205, min 41)
Mine	Female	Turkish	186 (High-Level)
Fatih	Male	Science	193 (High-Level)
Deniz	Female	Culture of Religion and Morality	173 (High-Level)
Akif	Male	English	194 (High-Level)

The teacher participants were from four different subject fields, namely Turkish, Science, Culture of Religion and Morality (CoRM) and English. As to genders, two of the participants were females and the other two were males. All participants were classified as high-level technology users based on their Educational Technology Standards Scale (ETSS) scores.

In order to determine the teachers' level of technology integration, the researchers developed a semi-structured interview form. Interview is one of the qualitative data collection methods through which researchers try to understand the participants' perspectives on specific matters through their answers to pre-decided question (Yıldırım & Şimşek, 2011). In line with the purpose of the study, the researchers developed questions covering the technologies used by the teachers in learning processes. The researchers informed each of the participants about the purposes of the study and research process, and obtained their written and oral consent prior to the interviews. The data were analyzed employing inductive analysis techniques. In doing so, first, the researchers transcribed and organized interview records. After validating the accuracy of transcriptions, the researcher made a holistic review of the data to form a general understanding. Then, the data were divided into pieces, and each piece was named and coded. Also, an educational technology expert and a qualitative research expert examined the established codes and themes to evaluate accuracy of coding. In light of expert opinions and suggestions, the researchers gave codes and themes to their final form. Established themes were supported with direct quotes to form findings (Gay, Mills, & Airasian, 2006; Cresweell, 2005).

Research Findings

Characteristics of the School and Participant Teachers

The teachers were coded from Mine to Akif and their general characteristics were as follows.

Mine (Teacher 1) was a teacher of Turkish graduated from the Turkish Teaching Department of the Faculty of Education. She also held a master of education degree in the same major. She was 29 and had eight years of teaching experience. She reported using computer, projector, and PowerPoint presentation technologies.

Fatih (Teacher 2) was a science teacher with eight years of teaching experience. He stated that he considered the use of technology as a must in his area. He also mentioned his interest in technology, especially in computers. He stated that he had a good level of knowledge in both the use of the Internet and office packet programs. He also mentioned that he often prepared presentations for his lessons, and he used PowerPoint presentations and animations he found online.

Deniz (Teacher 3) was a 38-year-old female Culture of Religion and Morality (CoRM) teacher. She had 10 years of teaching experience, and reported using computer and the Internet for teaching purposes.

Akif (Teacher 4) had had 20 years of experience in teaching English since 1995 and was a 43-year-old male. He mentioned using presentations and online videos frequently, and considered himself a technology user with a good level of skills.

Teachers' Initial Processes to Use Educational Technologies

In this session, the participants' initial processes to start using technology were presented bearing in mind their reasons to start using them, support the participants received, difficulties they faced and the ways they overcame those difficulties.

The Reasons that Intrigued the Teachers to Use Technology

Improving the quality of instruction appears to be a common reason for the participants to use technology. Mine (Turkish) stated that, in her early career, she realized students forgot the content in a short period of time and she decided to use visuals in conjunction with verbal content based on a literature review pointing that retention improves as the number of senses involved is increased. To do so, she chose to use PowerPoint and Prezi to employ visual and auditory content simultaneously. According to her, the increased student interest and positive results influenced her decision to keep using technology. Similarly, Akif (English) expressed that using technology became a necessity once he realized students were attracted to visual content and students' visual memories were more advanced. He stated that he decided to use technology to make lessons more active and improve retention. Deniz (CoRM) mentioned that the richness of the content available online intrigued her to start using technology. She stated that while her early experiences were more about directly using online materials, she grew to be able to produce different materials on her own. She mentioned that she became aware of the importance of activating student participation and the role of the materials she created (like puzzles). Fatih (Science) stated that visual content and providing concrete examples were inherent, and therefore important, in his teaching. He mentioned that he started actively using technology to provide concreteness by finding various materials online.

Support the Teachers Received During the Initial States of Integration

Support is an important part of the technology integration process (Buabeng-Andoh, 2012; Ertmer, 2005). In this context, the researchers investigated what institutions, people, and resources provided support for the teachers. Fatih (Science) expressed receiving support from the information technology teacher, who is also a close friend of his. In this scope, he pointed one person as an important means to receive support. Both Mine (Turkish) and Akif (English) mentioned the facilities MoNE provided as an institution; however, each teacher emphasized different means of support. Mine (Turkish) stated that she received support from Education Information Network (EIN) founded by MoNE. EIN is especially useful as an online material repository. On the other hand, Akif (English) stressed the in-service professional development courses that the Ministry provides for the teachers such as computer and instructional material design courses. Thus, it can be said that institutional support takes multiple forms. Deniz (CoRM) expressed that she found institutional support insufficient, and that an individual's efforts were more important. She mentioned making use of websites to receive support.

The Hardships the Teachers Faced at the Initial States of Technology Integration

The problems the teachers experience in early stages of technology integration were investigated as well. Mine (Turkish) expressed that the most important problem she faced was access to the Internet, more specifically inability to access educational websites. Fatih stated that he did not have any problem finding teaching materials, yet the limited number of physical tools such as projectors was a serious constraint for him. Likewise, Deniz (CoRM) express a fewer number of projectors as a serious problem. In addition to the insufficient number of physical tools, Akif (English) pointed out to the inconvenience of the physical environment, and teachers' inability to purchase such technologies due to high costs. He also mentioned the adverse effects of portable equipment such as time required to set up projector and computer each time, and prepare classroom environment for technology use.

As ways to handle the problems, the teachers mentioned using mobile internet connection, bringing personal portable computers to the classroom, purchasing a personal projector, and requesting a classroom to be arranged specifically for the course. Especially the last solution is noticeably a administrator oriented solution.

Technology Integration in Educational Processes

The teachers provided information on how they use technology in the entire range of the educational process, from preparation to evaluation. Based on their statements, the Internet appears to be a common reference source.

Mine stated that she first searched for online presentations and checked whether they were appropriate for the students' level, and prepared new ones when suitable presentations were not available. She mentioned using materials to pique students' attention at the beginning of the classroom sessions:

... As I begin teaching a lesson, I have them watch an animation, video or a cartoon related to the topic to gather students' attention. By doing so, I pique the children's attention.) She also included an introductory slide in his presentations as an advanced organizer *(In the introduction phase of a lesson, I use PowerPoint presentations specifically to provide list of topic that will be covered.*

The participant stated that she used hyperlinks as much as possible to enrich presentations with visuals and auditory content, and that for evaluation purposes, he made use of unit tests on EİN and got students answer them on the smart board.

Fatih (Science) argued that his course was quite suitable for technology integration and acknowledged the importance of preparation prior to the class meetings. He described his practices of using video sharing sites and a personal educational animation archive in the preparation phase. He also stressed the importance of time management:

Since our lessons are limited to 40-minute intervals, we time and spread the content among classes.), and role of technology to enhance instruction (Besides, we have to present the fundamental content verbally. Once we lay the basis for the class, we use technology as a means to support learning.

As to assessment and evaluation, the participant stated that he used paper-based tests and presentation at different times. For the questions which require embedded visuals, he preferred presentations and the Internet.

Deniz (CoRM) stated that she used video technology to arouse emotions so that students could feel the importance of the topic:

Let me give an example. For instance, our topic is bad habits. First, I will use a video about the status of a person under influence of alcohol or drugs to bring students attention to the topic.

In this context, she emphasizes preparation for the class. She mentioned producing presentations for instruction and evaluation; however, she reported employing personal video archives and the Internet (youtube.com) quite often because she found videos important.

Akif stated that he used the Internet to find documents and generate ideas, yet he remained cautious about the online content:

We make use of the internet during class preparation. I utilize online environment in preparing documents or searching details about the topic. In doing so, we must be careful. As you know, the internet is full of mindless, uncontrolled information. It takes a great deal of time to select correct and proper information, but it aids us in class preparation. To enrich our opinions and horizons...).

The participant told that in order to gather students' attentions to the topic, he used materials such as pictures, videos and presentations through technology. (*At the introduction phase of the lesson, a good picture, video, presentation or audio draws students interest perfectly and provides a strong start.*) He added that at the presentation phase, technology helps teachers in teaching the topic, providing details, providing concrete examples, and that videos allow one to review the content as long as it is desired:

During presentation phase, we utilize it [technology] to ease the knowledge transfer, provide details and elaboration, and give examples. Let's consider the shopping process. We can present how shopping works, the tenses and terms used in shopping visually through videos step-by-step. We also have a change to stop and replay.

Similarly to the other participants, Akif stated he used technology to present questions and other evaluation materials, and create scenarios based on materials to evaluate students.

The teachers' statements regarding their use of technology indicate that although they use technology for students, their approach to technology integration is teacher-centered rather than student-centered. While their practices seem to adopt a student-centered use of technology for the purposes of strengthening attention, improving retention, and activating more senses; none of the participants mentioned using technology to elicit student-student interaction and foster collaboration.

Current Technology Integration Problems of the Teachers

As the participants consider themselves competent in technology integration now, the researchers asked them about the problems they encounter in the current practices. In this context, Mine (Turkish) mentioned being unable to use technology as much as it was desired due to the pressure to complete mandatory curriculum content.

... Since Turkish is a five-hour course, I can use technology effectively in the three of these five hours at most. I would love to make an effective use of technology in all five hours, yet the curriculum I have to cover prevents me.

Fatih (Science) told that sometimes the level of students' knowledge had a substantial influence upon technology integration.

Let me put it this way, I don't know if this is something our education system brings about, yet when students' levels are not suitable you cannot easily manage the situation. I mean, my purpose of using presentation is to first cover the entire presentation, and then utilize visuals to summarize, to repeat... When we cannot complete the former, there is no time for the latter.

Deniz (CoRM) pointed out physical facilities as an obstacle to technology integration: *Of course, I did my best with available facilities. But, sadly, there are things I could not accomplish: ...Due to some physical constraints, we have some issues about this matter.* Akif (English) referred to the time required to prepare materials as a significant issue for technology integration:

...for example, a presentation prepared by another teacher may not work for me. Therefore, I have to prepare my own presentation in line with my teaching style to make my lesson more active, more teachable. And this takes time...

Discussion

Mortensen (2001) maintained that sustainability is of importance for teacher education. He claimed that teachers should be trained to keep up with the rapid developments in technology. In this context, technology integration becomes a key concept for sustainability of educational processes. Teachers are fundamentally important in the technology integration processes because without their active involvement, integration does not happen. In line with that, Gooler, Kautzer, & Knuth (2000) argued that the most important role in the effective use of technology in education belongs to teachers. In this context,

four teachers who claimed to use computers effectively and practice a good level of technology use participated in the study. The following section provides the findings.

All of the teachers who claimed to use technology conceptualize technology as digital tools, materials, and media. The technologies and materials they use include computer, smart board, projector, PowerPoint presentations, animations, videos, and the Internet. These technological resources are in line with the ones emphasized by MoNE of Turkey through the FATİH Project. MoNE (2012) explained the aims of the FATİH Project as providing equal opportunity in education through information and communication technologies, improving technological infrastructure of the schools, and enhancing the quality of learning outcomes by providing access to technology and materials. For this reason, it is understandable that the teachers mentioned digital technologies and materials when they were talking about technology integration processes. This situation may also be related to the perceived usefulness of such tools and materials. In his Technology Acceptance Model, Davis (1989) defined perceived usefulness as the level of one's belief that the use of a system will improve his/her performance at work.

The participants' main reason to use technology was to improve the quality of education. Their reasons to start using technology for educational purposes included enhancing retention, improving the effect through visuals, activating more senses, eliciting active student participation, employing rich online resources, and providing concrete examples. These opinions of the teachers of varying experience may be formed due to their perceived usefulness (Davis, 1989) and their ability to think about technology integration (Tsai & Chai, 2012). Tsai and Chai (2012) suggest that teachers' ability to think about technology integration should be supported. The teachers, based on their experience, pointed to the probable usefulness of technology as their starting points. Likewise, the teachers' opinions and the opinions from other research studies show similarities. Dursun (2006) argued that knowledge retention is important and teachers have to create learning environments that utilize visual and auditory learning resources and address multiple senses.

The participants' sources of support during the initial phases of technology integration included close friend(s), information technology teacher, MoNE (content and materials on EİN, in-service education courses etc.), and information on the Internet. According to Ertmer (2005) and Ortega and Fuentes (2015), support given to teachers is a critical means to handle obstacles of technology integration. Moreover, Andoh (2012) emphasized the importance of leadership support and technical support in the success of ICT integration. The participants of the study preferred friends and the Internet as their sources of support due to its accessibility and practicality.

Among the problems encountered during the initial phases of integration, the participants named the access to the Internet and educational websites, limited number of projectors, unsuitable physical environment, high cost of technological equipment, and waisting classroom time in carrying and setting up the equipment. In other words, access to technology and using it were the problems faced at the beginning. In addition to the physical problems in the initial phase, the current problems of the teachers are centered on educational processes such as failure to teach the topic within the classroom time, failure to cover the entire curriculum, and insufficient level of students. Therefore, it can be concluded that the teachers' initial problems on technology integration developed from accessing and using technology to pedagogy focused issues. Hixon & Buckenmeyer (2009) regarded technical problems as external factors influencing technology integration,

and claimed that as technological tools evolve new problems are likely to emerge. Çakır & Yıldırım (2009) found similar results in their study with pre-service teachers.

The teachers' processes of integrating technology into lessons were examined in four phases: prior to class, introduction, during instruction, and evaluation. Prior to class preparations included finding presentations to suit the topic and editing them or creating new presentations if there is none available, and finding documents, videos and animations online. Similarly, Wastiau et al. (2013) argued that the Internet has become one of the most important resources in classroom preparation and finding educational materials. Education Information Network (EIN) component of the FATİH Project being run by MoNE also aims to provide materials for teachers and activate the potential of the Internet also in the course of learning events (MoNE, 2012). As to finding learning materials, the Internet is an important resource for teachers (Fu, 2013).

During the introduction to the class phase, the participants employed technology to draw students' attention through materials, explain the instructional goals through slides, and activate emotions through videos. During the instruction phase, the participants preferred to use technology to effectively utilize presentations and other materials, simultaneously use visual and auditory content, support and enrich instruction with animations and videos, ease instruction through presentations, provide concreteness, and repeat the content as needed. As to the evaluation phase, the teachers stated that they utilize unit tests on EIN and other educational websites, use projectors to elicit active participation, and include videos and visuals in various forms of assessment. All sorts of the educational use of technology mentioned here show the purposes of using educational technologies (Aldunate & Nussbaum 2013; Bentham & Sharpe, 2013; Cheung & Slavin 2013; Fu, 2013; Kabadayi, 2016; Makrakis, Kostoulas-Makrakis, 2012). Furthermore, Bentham (2013) maintained that the use of technology makes information and concepts more tangible so that it helps teaching and comprehension. Wastiau et al. (2013) mentioned reusability and repeatability of the content, providing concrete examples, and providing equal opportunity for students as far as the advantages of using computers in education are concerned. Therefore, the results of the current study comply with the ways of using technology stated in the literature.

Taken together, the results of the study indicate that the teachers participating in the study employ a teacher-centered approach to technology integration rather than a student-centered approach. Pipere, Veisson, & Salite (2015) and Bentham (2013), Hixon & Buckenmeyer (2009) suggest that technology integration work for students; for this reason, teachers should surpass traditional education through the use of technology and plan the processes considering mainly students.

The teacher shed light on the use of technology in technology integration based on their experiences. In their statements, online resources and MoNE facilities like EIN became prevalent. Therefore, in-service training programs to introduce the facilities to other teachers and to increase their awareness would be beneficial. As the subject matter has an influence on the technology integration processes, the best practices of teachers successful in integration may serve as examples to other teachers. New studies examining this situation would also be beneficial. Technology integration, ideally, focuses on students; however, the results of this study showed that the teachers follow a teacher-centered approach to integration. In this respect, the teachers can also be informed about how to properly integrate technology, following a student-centered approach.

References

- Aldunate, R., & Nussbaum, M. (2013). Teacher adoption of technology. *Computers in Human Behavior*, 29(3), 519–524.
- Armenta, A., Serrano, A., Cabrera, M., & Conte, R. (2012). The new digital divide: the confluence of broadband penetration, sustainable development, technology adoption and community participation, *Information Technology for Development*, 18(4), 345–353.
- Bauer, J., & Kenton, J. (2005). Toward technology integration in the schools: Why it isn't happening. *Journal of Technology and Teacher Education*, 13(4), 519–5.
- Bentham, H. (2013). Clearing the path that has been laid: A conceptualization of education for sustainable development. *Journal of Teacher Education for Sustainability*, 15(2), 25–41.
- Brinkerhoff, J. (2006). Effects of a long-duration, professional development academy on technology skills, computer self-efficacy, and technology integration beliefs and practice. *Journal of Research on Technology in Education*, 39(1), 22–43.
- 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 & Development using Information & Communication Technology*, 8(1), 136–155.
- Cheung, A. C., & Slavin, R. E. (2013). The effectiveness of educational technology applications for enhancing mathematics achievement in K-12 classrooms: A meta-analysis. *Educational Research Review*, 9, 88–113.
- Creswell, J. W. (2013). *Qualitative Inquiry and Research Design Choosing Among Five Approaches* (3rd ed.) Los Angeles, CA: SAGE.
- Çakır, R., & Yildirim, S. (2009). What do computer teachers think about the factors affecting technology integration in schools? *Elementary Education Online*, 8(3), 952–964.
- Çiftçi, S., Taşkaya, S.M. & Alemdar, M. (2013). Sınıf öğretmenlerinin fatih projesine ilişkin görüşleri. [The Opinions of classroom teachers about fatih project]. *Elementary Education Online*, 12(1), 227–240.
- Çoklar, A. N. & Odabaşı, H. F. (2009). Educational technology standards scale (ETSS): A study of reliability and validity for Turkish preservice teachers. *Journal of Computing in Teacher Education*, 25(4), 135–142.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340.
- Dursun, F. (2006). Öğretim sürecinde araç kullanımı [The use of tool in teaching]. *İlköğretim Dergisi*, 1, 8–9.
- Erdemir, N., Bakırcı, H., & ve Eydur, E. (2009). Öğretmen adaylarının eğitimde teknolojiyi kullanabilme özgüvenlerinin tespiti [Determining of student teachers' self-confidence using technology in instruction], *Journal of Turkish Science Education*, 6(3), 99–108.
- 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.
- Fu, J.S. (2013), ICT in education: A critical literature review and its implications. *International Journal of Education and Development using Information and Communication Technology* 9(1), 112–125.

- Gay, J.R., Mills, G.E., & ve Airasian, P. (2006). *Educational research: competencies for analysis and applications*. (8th Ed.), Pearson Merrill Prentice Hall, Upper Saddle River, N.J.
- Glazer, E., Hannafin, M.J., & ve Song, L. (2005). Promoting technology integration through collaborative apprenticeships, *Educational Technology Research and Development*, 53(4), 57–67.
- Gooler, D., Kautzer, K., & Knuth, R. (2000). *Teacher competence in using technologies: The next big question*. PREL Briefing Paper. ERIC Document Reproduction Service No. ED452175.
- Göktaş, Y., Yıldırım, S., & ve Yıldırım, Z. (2009). Main barriers and possible enablers of ICTs integration into pre-service teacher education programs. *Educational Technology ve Society*, 12(1), 193–204.
- Gülbahar, Y., & ve Güven, I. (2008). A survey on ICT usage and the perceptions of social studies teachers in Turkey. *Educational Technology ve Society*, 11(3), 37–51.
- Hew, K. F., & Brush, T. (2007). Integrating technology into K-12 teaching and learning: current knowledge gaps and recommendations for future research. *Education Technology Research & Development*, 55, 223–252.
- Iliško, Dz., & Ignatjeva, S. (2014). E-learning and education for sustainability. In U. M. Azeiteiro, W. L. Filho & Sandra Caeiro (Ed.). *Environmental Education, Communication and Sustainability series* (pp.167–185). Peter Lang, Frankfurt am Main.
- Hixon, E., & Buckenmeyer, J. (2009). Revisiting technology integration in schools: Implications for professional development. *Computers in the Schools*, 26, 130–146.
- Hu, P.J., Clark, T.H.K., & ve Ma, W.W. (2007). Examining technology acceptance by school teachers: A longitudinal study. *Information and Management*, 41, 227–241.
- Kabadayi, A. (2016). A Suggested in-service training model based on Turkish preschool teachers' conceptions for sustainable development. *Journal of Teacher Education for Sustainability*, 18(1), 5–15.
- Koehler, M. J., & Mishra, P. (2005). What happens when teachers design educational technology? The development of technological pedagogical content knowledge. *Journal of Educational Computing Research*, 32(2), 131–152.
- Lim, C. P. (2007). Effective integration of ICT in Singapore schools: Pedagogical and policy implications. *Education Technology Research & Development*, 55(1), 83–116.
- Lim, C. P. & Ching, C. S. (2004). An activity-theoretical approach to research of ICT integration in Singapore schools: Orienting activities and learner autonomy. *Computers ve Education*, 43, 215–236.
- Lim, C. P., & Khine, M. (2006). Managing teachers' barriers to ICT integration in Singapore schools. *Journal of Technology and Teacher Education*, 14(1), 97–125.
- Makrakis, V., & Kostoulas-Makrakis, N. (2012). Course curricular design and development of the M. Sc. programme in the field of ICT in education for sustainable development. *Journal of Teacher Education for Sustainability*, 14(2), 5–40.
- Mayer, R. E. (2014). Incorporating motivation into multimedia learning. *Learning and Instruction*, 29, 171–173.
- MoNE, – Ministry of National Education (2012). *Milli Eğitim Bakanlığı FATİH Projesi p [Ministry of National Education-Fatih Project]*. Retrieved 14 December, 2015 from: http://http://fatihprojesi.meb.gov.tr/en/?page_id=10

- Mortensen, L. L. (2000). Teacher education for sustainability. Global change education: the scientific foundation for sustainability. *Journal of Science Education and Technology*, 9(1), 27–36.
- Mumtaz, S. (2000). Factors effecting teachers' use of information and communications technology: A review of the literature. *Journal of Information Technology for Teacher Education*, 9(3), 319–342.
- Oncu, S., Delialioglu, O. & Brown, C.A. (2008). Critical components for technology integration: How do instructors make decisions? *Journal of Computers in Mathematics and Science Teaching*, 27(1), 19–46.
- Ortega, J. L. G., & Fuentes, A. R. (2015). Communication skills training in trainee primary school teachers in Spain. *Journal of Teacher Education for Sustainability*, 17(1), 86–98.
- Patton, M.Q. (2005). *Qualitative research. Encyclopedia of statistics in behavioral science*. New Jersey: John Wiley & Sons.
- Polly, D., Mims, C., Shepherd, C. E., & Inan, F. (2010). Evidence of impact: Transforming teacher education with preparing tomorrow's teachers to teach with technology (PT3) grants. *Teaching and Teacher Education*, 26(4), 863–870.
- Pouezevara, S., Mekhael, S., & Darcy, N. (2014). Planning and Evaluating ICT in Education Programs Using the Four Dimensions of Sustainability: A Program Evaluation from Egypt, RTI International. *International Journal of Education and Development using Information and Communication Technology*, 10(2), 120–141.
- Shulman, M. (2004). Superintendent conceptions of institutional conditions that impact teacher technology integration, *Journal of Research on Technology in Education*, 36(4), 319–343.
- Tsai, C.C., & Chai, C. S. (2012). The “third”-order barrier for technology integration instruction: Implications for teacher education. In C. P. Lim & C. S. Chai (Eds), Building the ICT capacity of the next generation of teachers in Asia. *Australasian Journal of Educational Technology*, 28(6), 1057–1060.
- Usta, E. & Korkmaz, Ö. (2010). Pre-service teachers' computer competencies, perception of technology use and attitudes toward teaching career. *Journal of Human Sciences*, 7(1), 1335–1349.
- Uwasu, M., Yabar, H., Hara, K., Shimoda, Y., & Saijo, T. (2009). Educational initiative of Osaka University in sustainability science: mobilizing science and technology towards sustainability. *Sustainability Science*, 4(1), 45–53.
- Van Melle, E, Cimellaro, L, & Shulha, L. (2003). A dynamic framework to guide the implementation and evaluation of educational technologies. *Education and Information Technologies*, 8(3), 267–285.
- Wastiau, P., Blamire, R., Kearney, C., Quittre, V., Van de Gaer, E., & Monseur, C. (2013), The use of ICT in education: a survey of schools in Europe. *European Journal of Education*, 48, 11–27.
- Yalın, H.İ., Karadeniz, Ş., & Şahin, S. (2007). Barriers to information and communication Technologies integration into elementary schools in Turkey. *Journal of Applied Sciences*, 7(24), 4036–4039.
- Yarime, M., Trencher, G., Mino, T., Scholz, R. W., Olsson, L., Ness, B., & Rotmans, J. (2012). Establishing sustainability science in higher education institutions: towards an integration of academic development, institutionalization, and stakeholder collaborations. *Sustainability Science*, 7(1), 101–113.

- Yıldırım, A., & Şimşek, H. (2011). *Sosyal Bilimlerde Nitel Araştırma Yöntemleri [Qualitative Research in Social Science]* (8th Ed.). Ankara: Seçkin Publishing.
- Zhao, Y. (2007). Social studies teachers' perspectives of technology integration. *Journal of Technology and Teacher Education*, 15(3), 311–333.
- Zhao, Y., & Frank, K. (2003). Factors affecting technology uses in schools: An ecological perspective. *American Educational Research Journal*, 40(4), 807–840.

Correspondence related to this paper should be addressed to Assoc.Prof.Dr. Ahmet Naci Çıklar from Necmettin Erbakan University, Ahmet Keleşoğlu Education Faculty. Email: ahmetcoklar@hotmail.com