



Integration of Information and Communication Technology in Teaching and Learning among National Teachers' Colleges in Uganda

*¹Charles Nyakito, ²Prof. Vencie B. Allida, PhD and ¹Catherine Amimo, PhD

¹University of Eastern Africa, Baraton, Kenya

²Northern Caribbean University, Jamaica

*Corresponding Mail: nyakito60@gmail.com

Abstract: *Teacher education institutions in Uganda, like in the world over, are faced with the challenge in training teachers who are compliant with twenty first century pedagogy that involves the integration of ICT in the teaching and learning process. The purpose of this study was therefore to investigate the level of ICT integration in the teaching and learning practices of the teacher educators among the National Teachers' Colleges in Uganda and relate it with some factors. A total population sampling technique was used to draw all the 253 teacher educators in the colleges because the total population was rather small and if some members were left out, insufficient data would have been obtained. Descriptive statistics and Pearson Correlation were used to analyze the data. The results revealed a low level of ICT integration in the teaching and learning practices of the teacher educators and a significant positive relationship between the extent of ICT integration and the teacher educators' attitudes, self-efficacy, college ICT vision, administrative support and college ICT policy. There was no significant relationship between the extent of ICT integration and technical support. The researchers recommended continuous professional development opportunities for the teacher educators, a system of peer coaching and mentorship, review of teacher education curriculum and regular support supervision in the colleges.*

Keywords: ICT integration, National Teachers' Colleges, teacher educators, teaching and learning, ASSURE lesson plan.

Introduction

Integration of ICT in the teaching and learning transactions is of great importance in the 21st century. (Robinson & Aronica, 2015; Spector, 2010). Teacher training institutions, therefore, are expected to train educators who are capable of integrating ICT in their instructional practices. The emphasis on ICT-mediated learning has been made based on the assumption that ICT-rich learning environments provide opportunities for students to acquire 21st century skills and competencies such as problem solving, collaboration, digital literacy, critical thinking, creativity and media literacy. As a result, teacher education institutions are now faced with the challenge to restructure their curriculum to be able to train teachers who can successfully integrate ICT into teaching and learning practices (Sang et al, 2010; Ottenbreit-Leftwich, Glazewski,

Newby & Ertmer, 2010, Tømte, Enochsson, Buskvist & Kavstein, 2015).

In spite of efforts to digitalize learning in educational institutions, a number of international and local studies have reported that school teachers lack the necessary skills to use ICT as a pedagogical tool in the teaching and learning process (Ndibalema, 2014; D'Aprile, 2017). Students are still taught how they were taught in the 1950s, many decades earlier, because of the inadequate use of ICT as a pedagogical tool (Eyyam & Yaran, 2014). Although the influence and development of ICT within societies is dramatic, many classrooms, staff rooms, schools and colleges appear to work in an incredibly similar way to those of 20 years ago (Ndibalema, 2014). The study was directed by the following research questions:

1. What are the levels of ICT Integration in teaching and learning among the Teacher

Educators in the National Teachers Colleges in Uganda?

2. Is there a significant relationship between the teachers' ICT integration in teaching and learning and (a) their attitudes (b) self-efficacy (c) College ICT vision (d) administrative support, (e) technical support, (f) ICT infrastructure and (g) College ICT policy issues?

Review of Related Literature

Many educational institutions worldwide have heavily invested in ICT infrastructure development. For example, the National Center for Education Statistics reported that 97% of rural public teachers had at least one computer in their classrooms (Ertmer et al, 2012; National Education Association and American Association of Teachers, 2008). The proliferation of computers in the classrooms is because a positive association has been realized between ICT integration and increased student learning (D'Aprile, 2017; Eyyam & Yaran, 2014; Montgomery, 2017). Equally, when ICT was integrated in the teaching and learning engagements with learners, Higgins, Juscroft-D'Amgelo & Crawford (2019) found a significant positive influence on learning in the examination of 24 studies. Unfortunately, Hao and Lee (2015) reported that although ICT has the potential to positively influence teaching and learning in the classroom, it is currently underutilized in schools. Many teachers are still resistant to integrate ICT in their instructional practices even though infrastructural challenges have been addressed (Hao & Lee, 2015; Tondeur, et al, 2017; Zehra & Bilwani, 2016).

Several influences of ICT integration in teaching and learning have been identified that determine whether or not teachers will integrate ICT in their teaching practices (Tømte, Enochsson, Buskqvist & Kavstein, 2015; Montgomery, 2017). Based on the literature, the factors that impact the integration of ICT in the instructional practices mainly focus on the demographic characteristics of the teachers (Tezci, 2011) such as teachers' attitudes towards ICT (Drent & Meelissen, 2018), ICT vision and policy (Tondeur et al., 2015) and ICT infrastructure (Tondeur et al., 2015).

Teachers' Attitudes

Recent studies have acknowledged that attitudes do influence ICT integration in teaching and learning (Al-Mashaqbeh, 2012; Iscioglu, 2011; Kilinc et al,

2016; Zehra & Bilwani, 2016). The integration of ICT in teaching and learning is positively or negatively influenced by how teachers feel about ICT (Burden & Hopkins, 2016; Sahin, Top, & Delen 2016; Tondeur, Saddiq, Scherer & Bavan, 2017). Van Der Ross & Tsibolane (2017) in their study of 64 teachers in South Africa observed that teachers' attitudes influenced their ICT integration in the classroom.

Self-Efficacy

Research has shown that self-efficacy of teachers has an effect on their job satisfaction and professional dedication (Newhouse, 2012; Dexter, 2018; Skaalvik & Skaalvik, 2017), turnover from the teaching profession (Zehra & Bilwani, 2016; Eyyam & Yaran, 2014; Pelgrum, 2011; Ford 2017) and is a significant predictor of the engagement of learners (D'Aprile, 2017). Latest research on self-efficacy and the application of ICT in teaching backs up the assertions and belief that higher levels of ICT self-efficacy will lead to higher levels of conviction in becoming an effective ICT teacher (Yamamoto & Yamaguchi, 2016).

Accessibility to ICT Infrastructure

Past studies have consistently shown that ICT infrastructure is one of the factors affecting the use of technology among teachers (Spector, 2010; Montgomery, 2017). Unfortunately, in Africa, in the coming years, inaccessibility to appropriate and supportive infrastructure may persist for a while (Ford, 2017). For instance, Ford's (2017) survey reported limited access to infrastructure and electricity in combination with poverty as key factors keeping Kenya from making advancement in ICT integration in classroom instruction. In Rwandan schools, Rubagiza, Were and Sutherland (2011) noted that limited access to ICT resources negatively influenced how teachers and students integrated ICT into the instructional process.

School ICT Vision

The institutionalization and communication of a specific achievable vision is an essential component of the effective and efficient incorporation of ICT in teaching and learning because the vision provides direction and intent for future progress (Burden & Hopkins, 2016). The process of defining the vision of the school requires the compilation of a mission statement that shows the methods to be followed in order to achieve pre-established goals. The vision will stimulate and empower teachers to work towards achieving objectives and goals, pave the way for career growth for teachers, set a level of

excellence, allow progress to take place by using the skills, capabilities and resources available, and ensure that management practices and actions are constructive and realistic (Tondeur, et al. 2015).

Administrative Support

School administrators are strategically placed to positively influence whether or not teachers integrate ICT in their instructional practices. Scholars have demonstrated that administrative support is essential to influence teachers to integrate ICT in their instructional practices (Al-Mashaqbeh, 2012; Ertmer et al. 2012; Iscioglu, 2011). By providing opportunities for professional development in schools and enabling teachers to attend workshops and enroll for short online courses, administrators can propel their teachers to integrate ICT in their instructional practices. Administrators can also promote collegial sharing, opportunities for mentorship and coaching among the teachers, provide a model for the teachers to emulate and encourage teachers to advance beyond the status quo of traditional teacher centered instructional practices.

Technical Support

As cited in Yamamoto and Yamaguchi (2016), Resta describes technical support as a situation where professional staff members are capable of supporting and assisting teachers in the application of instructional technology. The relevance of technical support for teachers is undeniable. Studies have indeed demonstrated that technical support has an influence on improving teacher application of ICT (Dexter, 2018; Bakar & Mohamad, 2008). Technical support is therefore, needed for educational institutions to promote the successful application of ICT by teachers in their teaching endeavors.

School ICT Policy Issues

Policy and planning are critical in defining the goals of the use of ICT in education and in identifying priorities for resource allocation (Tondeur et al, 2015). They also point out that the school administrators and the centres they are responsible for have main tasks to enable, enforce and track the use of ICT for teaching and learning purposes.

Dexter (2018) note that ICT policies that merely acknowledge the strategic role of Technology for progress and expansion have ranked countries low on ICT appreciation. They further state that although access to computers is minimal, internet costs are high and the computer-to-population ratio

is inadequate; they cite Sri Lanka and the Pacific Islands as examples. ICT policies in nations ranked high in ICT recognition go beyond interventions that promote ICT programs, such as Australia, Malaysia and Japan. These nations have high income levels and even provide their citizens with ample ICT resources.

Research Methodology

This section describes the methodology that was used to guide the study.

Research Design

The design of the study was quantitative with basic descriptive inclination since it sought to measure the relationship that existed among the variables. The purpose of the study was to investigate the level of ICT integration in the teaching and learning practices of the teacher educators and also determine the relationships that existed between the level of integration and some related factors.

Population and Sampling

The population constituted 253 teacher educators, including the Principals, from 4 out of 5 National Teachers' Colleges in Uganda. The fifth College was excluded because it was used for pilot study. A total population sampling technique was used to draw all the 253 teacher educators in the colleges because the total population was rather small and if some members were left out, insufficient data would have been obtained.

Research Instrument

For the purpose of this research, a self-developed questionnaire was used which consisted of questions that were divided into 9 categories: (a) demographic data; (b) attitude towards ICT integration; (c) computer self-efficacy; (d) college ICT vision; (e) administrative support (f) technical support (g) accessibility to ICT infrastructure (h) college ICT policy issues; and (i) level of ICT integration in teaching and learning. The questionnaire was personally administered to the sample by the researcher.

Validity and Reliability

The validity of the instrument was ascertained through extensive literature review. A pilot study was also conducted with 40 participants from a non-participating college that enabled making appropriate adjustments to the instrument. The reliability of the instrument was ensured through computing Cronbach's coefficient in different

dimensions of the questionnaire after the pilot study as presented in table 1.

Data Analysis Plans

Descriptive statistic in Means and Standard deviation were used to analyze the data for research question one relating to the level of ICT integration in teaching and learning. The interpretation of the Means was such that: 1.0-2.0 designated a low level

of integration, 2.1-3.0 designated moderate level of integration and 3.1-4.0 designated a high level of integration; while Spearman's correlation coefficient was computed to analyze the data for research question two that involved relating level of ICT integration as a dependent variable to related independent variables, both cases using SPSS Version 23.

Table 1: Table of reliability test of the questionnaire

Questionnaire Dimension	Coefficient Alpha	Number of Items
Attitudes	.833	8
Self-efficacy	.941	8
ICT Vision	.844	8
Administrative support	.638	8
Technical support	.818	8
Accessibility to ICT Infrastructure	.784	8
ICT Policy issues	.836	8
Extent of ICT integration	.878	8

Table 2: Means and Standard Deviation of levels of ICT integration

Item in the Questionnaire	N	Mean	Interpretation	Std. Dev
I create visuals, graphics, charts and drawings	253	1.52	Disagree	.843
I download teaching materials regarding my subject	253	3.11	Agree	1.038
I use computer to develop schemes and lesson plan	253	1.63	Disagree	.818
I use email to ask and send assignments to my students	253	1.64	Disagree	.888
I have created and use chart rooms with my students	253	1.59	Disagree	.834
I use ASSURE lesson plan format to prepare my lessons	253	1.39	Strongly Disagree	.643
I encourage pupils to search for information on internet	253	3.41	Agree	.716
I use computer for demonstration with presentations	253	1.75	Disagree	.953
Overall Mean		2.00	Disagree	.526

Findings of the Study

This section presents findings of the study based on the analysis of the data obtained from the questionnaires and interview.

Research Question 1: What are the Levels of ICT integration in teaching and learning?

It is notable from table 2 that the overall level of teacher educators' integration of ICT is low, with the arithmetic mean of 2.00 (designating a low level of integration) and a standard deviation of 0.53. Since the standard deviation is relatively low, that is, less than one, it indicates convergence among the study sample, meaning that the majority of the study sample had a mean of approximately 2.00 (disagreeing with the statements). The results also show that the highest integration in the teacher educators' responses was encouraging pupils in class to search for information on internet, where the arithmetic mean was 3.41 (designating a high level of integration) and a standard deviation of 0.72. Downloading teaching materials regarding subject areas was second highest with the

arithmetic mean of 3.11 (designating a high level of integration) and a standard deviation of 1.04, implying a wide disparity among the teacher educators at the level of downloading teaching materials regarding subject areas. The lowest level of integration among the teacher educators was using the ASSURE lesson plan format to prepare lessons with an arithmetic mean of 1.39 (designating a low level of integration) and a standard deviation of 0.64 implying a convergence at this level, meaning that many teacher educators strongly disagreed with using the ASSURE lesson plan format to prepare lessons.

The result that there is low level of ICT integration in teaching and learning by the teacher educators is not surprising since a number of studies by different scholars have reported similar low levels of ICT integration by teachers (Yu, T., Lin, M., & Liao, Y. 2017; Ngah & Masood, 2015). These studies generally reported a low to moderate level of ICT integration in teaching, although many teachers were aware that integration of ICT in teaching enhances effective learning. The degree of ICT

adoption among Malaysian secondary school teachers was investigated by Lau and Sim (2014) who observed that older teachers would more regularly use educational technology in classroom instruction than new teachers. Older teachers could easily integrate educational technology into their teaching practice with their benefit of both teaching experience and basic competency in ICT. Lawless

and Pellegrino (2017) argued that if teacher-training programs also concentrated on ICT skills and innovative approaches for classroom tasks, educators could also accept and integrate ICT into their classrooms. The duration of the training period should be adequate to ensure that trainee teachers have sufficient practice to reinforce their confidence in the use of ICT in the classroom.

Table 3: Correlations between the Independent and Dependent Variables

		Extent of ICT Use	Attitude	Self- Efficacy	ICT Vision	Administrative Support	Technical Support	ICT Infrastructure	ICT Policy
Extent of ICT Use	Pearson Correlation	1	.150*	.756**	.347**	.257**	-.007	.156*	.485**
	Sig. (2-tailed)		.017	.000	.000	.000	.910	.013	.000
	N	253	253	253	253	253	253	253	253
Attitude	Pearson Correlation	.150*	1	.147*	-.186**	.203**	.070	-.301**	-.383**
	Sig. (2-tailed)	.017		.020	.003	.001	.269	.000	.000
	N	253	253	253	253	253	253	253	253
Self-Efficacy	Pearson Correlation	.756**	.147*	1	.587**	.117	.074	.249**	.567**
	Sig. (2-tailed)	.000	.020		.000	.063	.241	.000	.000
	N	253	253	253	253	253	253	253	253
ICT Vision	Pearson Correlation	.347**	-.186**	.587**	1	.109	.068	.482**	.782**
	Sig. (2-tailed)	.000	.003	.000		.085	.280	.000	.000
	N	253	253	253	253	253	253	253	253
Administrative Support	Pearson Correlation	.257**	.203**	.117	.109	1	.236**	.203**	.130*
	Sig. (2-tailed)	.000	.001	.063	.085		.000	.001	.039
	N	253	253	253	253	253	253	253	253
Technical Support	Pearson Correlation	-.007	.070	.074	.068	.236**	1	.124*	.107
	Sig. (2-tailed)	.910	.269	.241	.280	.000		.049	.091
	N	253	253	253	253	253	253	253	253
ICT Infrastructure	Pearson Correlation	.156*	-.301**	.249**	.482**	.203**	.124*	1	.497**
	Sig. (2-tailed)	.013	.000	.000	.000	.001	.049		.000
	N	253	253	253	253	253	253	253	253
ICT Policy	Pearson Correlation	.485**	-.383**	.567**	.782**	.130*	.107	.497**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.039	.091	.000	
	N	253	253	253	253	253	253	253	253

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Research Question 2: Is there any significant relationship between the teachers' ICT integration in teaching and learning and (a)their attitudes (b)Self-efficacy (c) College ICT vision (d) Administrative Support (e) Technical Support (f) ICT infrastructure (g) College ICT Policy?

As seen in Table 3, this research question called for testing of the following null hypothesis: *there is no significant relationship between teachers' extent of ICT use and the following dependent variables: (a)their attitudes (b)Self-efficacy (c) College ICT vision (d) Administrative Support (e) Technical Support (f) ICT infrastructure (g) College ICT Policy.*

The null hypothesis was tested through Pearson Correlations as reflected in Table 3. Nature of existing correlations (r) among variables would be either positive or negative and was interpreted based on the following criteria: $\geq .70$ = strong relationship; $\geq .50$ = moderate relationship and $\leq .50$ = weak relationship.

In table 3, we can see the positive relationships between the independent variable (teachers' extent of ICT use) and six dependent variables namely attitude (Sig. = .017; $r=.150$), self-efficacy (Sig=.000; $r=.756$), ICT Vision (Sig=.000; $r=.347$), Administrative Support (Sig=.000; $r=.257$, ICT Infrastructure (Sig=.013; $r=.156$) and ICT Policy (Sig =.000; $r=.485$). Of all these relationship, the relationship between ICT usage and self-efficacy was strong and positive while the rest of relationships were weak yet positive. Therefore, the influence of teachers' ICT use is higher on teachers' self-efficacy than in other dependent variables under investigation. The Sig being lesser than the critical value (0.05) led the researchers to reject part of the null hypothesis and maintain the alternative hypothesis which states: *there is a significant relationship between teachers' extent of ICT use and (a)their attitudes (b)Self-efficacy (c) College ICT vision (d) Administrative Support (e) ICT infrastructure (f) College ICT Policy*. Therefore, teachers' extent of ICT use in teaching positively relates with the aforementioned variables, meaning to say, the more the extent of teachers' ICT usage in the teaching and learning transactions, the higher the teachers' attitude, self-efficacy, College ICT Vision, administrative support, ICT Infrastructure and College ICT Policy.

The findings of this study are in consonance with the findings of previous researchers who established in their studies positive relationships between the teachers' levels of ICT integration in teaching and learning and: the teachers' attitudes towards ICT (Al-Mashaqbey, 2012; Zehra & Bilwani, 2016), the teachers' ICT self-efficacy (Newhouse, 2012; Skaalvik & Skaalvik, 2017; Dexter, 2018), School ICT vision (Burden & Hopkins, 2016; Tondeur et al., 2015), administrative support (Al-Mashaqbey, 2012; Ertmer, et al. 2012; Iscioglu, 2011), accessibility to ICT infrastructure (Tondeur et al., 2015; Montgomery, 2017; Ford, 2017) and issues of ICT policy (Tondeur et al., 2015).

The study, however, did not find any relationship between the use of ICT and Technical Support. Therefore, the researchers accepted part of the null hypothesis which stated: *there is no significant*

relationship between teachers' extent of ICT use and technical support. This finding, however, seems to contradict the popular association that has been established between the level of ICT integration and technical support extended to the teachers by many previous researchers who have established that technical support is important to help maintain the ICT equipment for teaching, troubleshooting during classroom instruction and giving the teachers confidence in the use of the equipment because of the presence of someone who can assist when something goes wrong (Kipsoi, Changach, & Sang, 2012; Yamamoto & Yamaguchi, 2016).

Conclusions and Recommendations

This section presents the conclusions of the study, followed by the recommendations:

Conclusions

The level of ICT integration in teaching and learning in the National Teachers' Colleges is generally low. Majority of the teacher educators did not integrate ICT in their teaching practices. However, some of the teacher educators agreed that they download teaching materials regarding their subject areas and some also agreed that they encourage their learners to search information in the internet. The low level of ICT integration in teaching and learning by the teacher educators among the National Teachers' Colleges in Uganda could be attributed to the negative attitudes of the teacher educators, low levels of self-efficacy, lack of clear college ICT vision, inadequate administrative support, inadequate ICT infrastructural development and a lack of clear ICT policy in the colleges.

Recommendations

The study recommends that the Ministry of Education and Sports in Uganda should provide continuous professional development opportunities for the teacher educators in the National Teachers' Colleges to equip them with relevant ICT knowledge and skills. It should also review teacher education curriculum to include a compulsory course on ICT as a stand-alone discipline. Furthermore, ICT should be infused in all disciplines for teachers' capacity building. The ministry should further promote benchmarking between colleges so that teacher educators can benefit from the best practices of their colleges.

College administrators should promote a system of coaching and mentorship among the teacher educators so that the more experienced and skilled can help their novice colleagues in integrating ICT in their instructional practices. The administrators

should also spearhead the development of comprehensive shared visions and policy plans involving all stakeholders on ICT in education.

Reference

- Al-Mashaqbeh, I. F. (2012). The use of computer skills in teaching and administration support. *Damascus University Journal*, 2(8) 31-50.
- Bakar, R., & Mohamed, S. (2008). Teaching using information and communication technology: Do trainee teachers have the confidence? *International Journal of Education and Development using ICT*, 4(1), 5-12.
- Burden, K., & Hopkins, P. (2016). Barriers and challenges facing pre-service teachers use of mobile technologies for teaching and learning. *International Journal of Mobile and Blended Learning*, 8(6) 1–20.
- D'Aprile, V. (2017). *Let's get digital: Teachers perspectives and practices of effective technology integration* (Master's thesis). Department of Curriculum, Teaching, and Learning, Ontario Institute for Studies in Education University of Toronto, Toronto, Canada.
- Dexter, S. (2018). Leadership for IT in schools. In J. Voogt & G. Knezek (Eds.), *International handbook of information technology in primary and secondary education* (pp. 543–554). New York, NY: Springer.
- Drent, M., & Meelissen, M. (2018). Which factors obstruct or stimulate teacher educators to use ICT innovatively? *Computers & Education*, 51(1), 187-199.
- Ertmer, P. A., Ottenbreit-Leftwich, A. T., Sadik, O., Sendurur, E., & Sendurur, P. (2012). Teacher beliefs and technology integration practices: a critical relationship. *Computers & Education*, 5(9) 423-435.
- Eyyam, R., & Yaratana, H. S. (2014). Impact of use of technology in mathematics lessons on student achievement and attitudes. *Social Behavior and Personality*, 4(2) 31-42.
- Ford, D. M. (2017). Technologizing Africa: On the bumpy information highway. *Computers and Composition*, 2(4) 302-316.
- Hao, Y., & Lee, K. S. (2015). Teachers' concern about integrating Web 2.0 technologies and its relationship with teacher characteristics. *Computers in Human Behavior*, 4(8) 1-8.
- Higgins, K., Huscroft-D'Angelo, J., & Crawford, L. (2019). Effects of technology in mathematics on achievement, motivation, and attitude: A meta-analysis. *Journal of Educational Computing Research*, 5(7) 283-319.
- Iscioglu, E. (2011). Perceived computer self-efficacy of secondary education teachers. *New Educational Review*, 2(3) 189-198.
- Lau, B., & Sim, C. (2008). Exploring the Extent of ICT Adoption Among Secondary School Teachers In Malaysia. *International Journal of Computing and ICT Research*, 2 (2), 19-36.
- Lawless, K. A., & Pellegrino, J. W. (2017). Professional Development in Integrating Technology into Teaching and Learning: Knowns, Unknowns, and Ways to Pursue Better Questions and Answers. *Review of Educational Research*, 7(7) 575-614.
- Kilinc, A., Ertmer, P.A., Bahcivan, E., Demirbag, M., Sonmez, A. & Ozel, R. (2016). Factors influencing Turkish preservice teachers' intentions to use educational technologies and the mediating role of risk perceptions. *Journal of Technology and Teacher Education*, 2(4) 37-62.
- Kipsoi, E. J., Chang'ach, J. K., & Sang, H. C. (2012). Challenges Facing Adoption of Information Communication Technology (ICT) in Educational Management in Schools in Kenya. *Journal of Sociological Research*, 3(1) 15–18.
- Montgomery, M. C. (2017). *Factors that influence technology integration in the classroom* (Doctoral dissertation). Department of Education, University of Maryland, College Park, College Park, Maryland.
- National Education Association & American Federation of Teachers. (2008). *Access, adequacy and equity in education technology: Results of a survey of America's teachers and support professionals on technology in public schools and classrooms*. Washington, DC: National Education Association.
- Ndibalema, P. (2014). Teachers, Attitudes towards the Use of Information Communication Technology (ICT) as a Pedagogical Tool in Secondary Schools in Tanzania: The Case of

- Kondoa District. *International Journal of Education and Research*, 2(4) 1-16.
- Newhouse, P. (2012). *Literature review: The impact of ICT on learning and teaching*, Perth, Western Australia: Department of Education.
- Ngah, N. A., and Masood, M. (2015). "Development of ICT instructional Materials Based on Needs Identified by Malaysia Secondary School Teachers" (proceedings of the 2015 Informing Science and IT Education Joint Conference, Greater Manchester, England, June 25-28, 2015).
- Ottenbreit-Leftwich, A., Glazewski, K., Newby, T., & Ertmer, P. (2010). Teacher value beliefs associated with using technology: addressing professional and student needs. *Computers & Education*, 5(5) 1321-1335.
- Pelgrum, W. J. (2011). Obstacles to the integration of ICT in education: results from a worldwide educational assessment. *Computers & Education*, 3(7) 163-178.
- Robinson, K., & Aronica, L. (2015). *Creative schools: Revolutionizing education from the ground up*. London: Penguin UK.
- Rubagiza, J., Were, E., & Sutherland, R. (2011). Introducing ICT into schools in Rwanda: Educational challenges and opportunities. *International Journal of Educational Development*, 3(1) 37-43.
- Sahin, A., Top, N., & Delen, E. (2016). Teachers' first-year experience with Chromebook laptops and their attitudes towards technology integration. *Technology, Knowledge and Learning*, 2(1) 361-378.
- Sang, G., Valcke, M., van Braak, J., & Tondeur, J. (2010). Student teachers' thinking processes and ICT integration: predictors of prospective teaching behaviors with educational technology. *Computers & Education*, 5(4) 103-112.
- Skaalvik E. M., & Skaalvik S. (2017). Dimensions of teacher self-efficacy and relations with strain factors, perceived collective teacher efficacy, and teacher burnout. *Journal of Educational Psychology*. 9(9) 611-625.
- Spector, J. M. (2010). An overview of progress and problems in educational technology. *Interactive Educational Multimedia*, 1(4) 27-37.
- Tezci, E. (2011). Turkish primary school teachers' perceptions of school culture regarding ICT integration. *Educational Technology Research and Development*, 59(3), 429-443.
- Tømte, C., Enochsson, A. B., Buskvist, U., & Kårstein, A. (2015). Educating online student teachers to master professional digital competence: the TPACK framework goes online. *Computers & Education*, 8(4) 26-35.
- Tondeur, J., Siddiq, F., Scherer, R., & Baran, E. (2017). *Exploring the link between pre-service teachers' ICT-related profiles and their TPACK*. Paper presented at the Society for Information Technology and Teacher Education International Conference, Austin, Texas.
- Tondeur, J., van Braak, J., Sang, G., Voogt, J., Fisser, P., & Ottenbreit-Leftwich, A. (2015). Preparing pre-service teachers to integrate technology in education: a synthesis of qualitative evidence. *Computers & Education*, 59(1), 134-144.
- Van Der Ross, D., & Tsibolane, P. (2017). *The influence of teacher attitudes and beliefs on information and communications technology integration behavior in South African high schools*. Paper presented at the 2017 International Conference on Information Resources Management.
- Yamamoto, Y. & Yamaguchi, S. (2016). A study on Teacher's Self-efficacy for promoting ICT integrated Education in primary school in Mongolia. *Journal of International Cooperation* 18(2):1-12.
- Yu, T., Lin, M., & Liao, Y. (2017). Understanding factors influencing information communication technology adoption behavior: The moderators of information literacy and digital skills. *Computers in Human Behavior*, 7(1) 196-208.
- Zehra, R., & Bilwani, A. (2016). Perceptions of teachers regarding technology integration in classrooms: A comparative analysis of elite and mediocre schools. *Journal of Education and Educational Development*, 3(5)1-29.