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The Correlation Between Social Media Usage in Academic Context and Self-Efficacy Towards TPACK of Prospective Science Teachers in Indonesia

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ABSTRACT The purpose of this study is to investigate the relationship between the frequency of Social Media Usage (SMU) in an academic setting and Self-efficacy beliefs towards TK, TCK, TPK, and TPACK of Indonesian prospective science teachers. This research is quantitative based-research design using a self-administered survey. The research was conducted during the second semester of the academic year 2018/2019 from October to November 2018 in the Faculty of Mathematics and Natural Science of a State University located in Semarang City, Indonesia. The sample consists of 217 Indonesian prospective science teachers from the science and Biology Education Department. The result shows that the average Social Media Usage frequency has a statistically high correlation with TK Self-efficacy, TPK, and TPACK. However, in general, it does not correlate with TCK. Second, Social Media Usage for Download Media (DM), Searching Information (SI), and Entertainment and Motivation (EM) generally have a statistically medium correlation with TK, TPK, and TPACK for both male and female participants. Third, Social Media Usage for professional development (PD) has a medium correlation with TK and high correlation with TPK and TPACK. This study implies that training focuses on the application of social media in teaching, and learning should be integrated to improve Indonesian Prospective Science Teachers' TPACK.

Keywords Social Media Usage, Self-Efficacy, TPACK, Prospective Science Teacher, Indonesia

1. INTRODUCTION

Professional Science teachers are crucial to improve the quality of education in Indonesia. They must have four competencies, including pedagogy, personality, professional, social, where they should not only master in their subject matter but also technology and pedagogy. The framework that can show a teacher's knowledge related to pedagogy, technology, and content is TPACK. TPACK's theoretical framework, which was developed by Mishra & Koehler (2006), stands for technological pedagogical content knowledge (TPACK) (Figure 1).

Teachers should have good TPACK to effectively integrate technology into their teaching. However, some research has shown that most of Indonesian Science teachers did not efficiently use technology in their teaching (Kazu & Erten, 2014; Semiz & Ince, 2012; Smeets, 2005). For example, Kamulung (2017) investigated the level of integration of information technology by Indonesian Biology, Chemistry, and Physics teachers in grade XI high school using the Technology Integration Matrix (TIM) method. He found that the ability of Indonesian Science teachers to Integrate technology in learning Science is only 55% in a medium category between the interval 41%-60%. Furthermore, another researcher found that although most of the Indonesian teachers had the technology to support students learning, their ability to use technology was still relatively low, where most teachers still used conventional methods based on the results of the questionnaire, observations, and interviews (Styaningrum, 2016). There are some complex factors affecting teachers' use of technology in K-12 classrooms such as computer proficiency, computer availability, and technical support such as electricity and hardware facilities (Eteokleous, 2008; Hew & Brush, 2007; Inan & Lowther, 2010). In Indonesia, some researchers show that the main factors are science teachers' lack of skills, knowledge for effective technology use, and management issues because they are

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not adequately prepared to integrate technology in the classroom (Styaningrum, 2016; Sumintono, Wibowo, Mislan, & Tiawa, 2012). Most importantly, evidence shows that low self-efficacy among Indonesian Science teachers becomes an obstacle to integrating technology because it affects their motivation to try and to learn technology (Styaningrum, 2016). Self-efficacy is an individual's confidence in his ability or competence to carry out tasks or actions and overcoming obstacles needed to achieve certain results or outcomes (Bandura, 2001). Many educational experts supported that teachers' self-efficacy has a significant contribution affecting the intention of educational technology integration (Abbitt & Klett, 2007; Ertmer, 2005; Lee & Lee, 2014; Uzun, Ekici, & Sağlam, 2010).

Several studies showed that teachers' use of technology in their classrooms also correlates with their frequency usage of educational Internet use (Sahin, Celik, Akturk, & Aydin, 2013). One of the platforms of technology that is commonly used by students and teachers in an academic context in recent years is social media. Social media is "the Internet-based tool and platform that facilitates sharing of information including the transfer of text, photos, audio, video, and information in general" (Bassell, 2010). It has been an integral part of learning, communication activities, content sharing, and social networking for several decades (Kaplan & Haenlein, 2010; Shirky, 2011). In an academic context, social media is used in University, teacher education, and school settings because it plays a decisive role in meeting students' needs and accessible on the variety of devices (Ahern, Feller, & Nagle, 2016). For example, Lecturers often use Blogs, Skype, Wikis, Facebook; and even mobile apps, such as WhatsApp in distance learning in University (Mnkandla & Minnaar, 2017; Owusu-Ansah, Gontshi, Mutibwa, & Ukwuoma, 2015; Callaghan & Fribbance, 2016; Hussain, Cakir, & Candeger, 2018). The most common use of social media includes searching and studying in collaborative online activities, download media, sharing information, and entertainment (Wheeler, Yeomans, & Wheeler, 2008; Al-Daihani, Jumanah, & Sara, 2018). In teacher education, teacher educator used social media for motivating teacher candidate to collaborate with a cooperative teacher or mentor; providing a friendly atmosphere to encourage reflection to identify and address challenges of teaching practice; giving feedback and continue following up on their progress in teaching practice (Pitipornpatin & Lankford, 2015). In the actual setting of the teaching and learning process, in-service teachers are also reported integrating social media such as Facebook (Blonder & Rap, 2017) and YouTube (Blonder, Jonatan, Bar-Dov, Benny, Rap, & Sakhnini, 2013) in their science classrooms. Although flourishing research evidence shows the potential of social media, there is little research connect between social media use affect TPACK self-efficacy of prospective teachers.

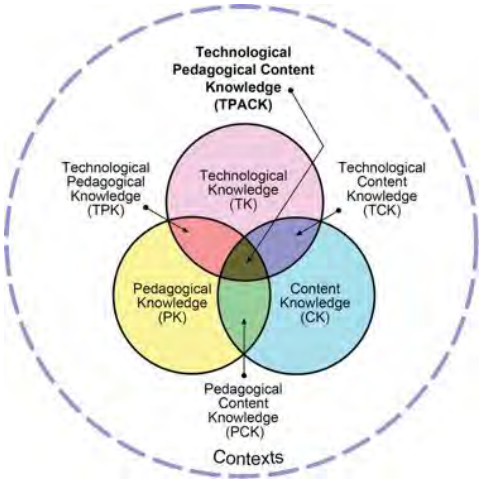

Figure 1 TPACK and its components (Koehler & Mishra, 2009), p. 63

This study has some potential significance, both theoretically and practically. By investigating the correlation between social media and TPACK, future researchers might consider some factors of social media usage that need attention to design the program or intervention that focuses on developing equitable TPACK for all PSTs. This is because prospective teachers who have low self-efficacy towards technology integration tend not to use it in their future teaching practice. Meanwhile, integrating technology into the Sciences classroom is the requirement of National Science Standard not only in Indonesia but also in many countries. Practically, the result of this study would be significant for policy and practice. Teacher educators can also consider the finding of designing the best practice of a professional development program (PDP) through ICT course evaluation. For example, social media can be integrated to improve their KTT Self-efficacy.

There are some operational definitions of the key terms of this research. TPACK framework stands for technological pedagogical content knowledge. It has three essential elements, including CK (Content Knowledge), PK (Pedagogical Knowledge), TK (Technological Knowledge). The intersection between them is PCK (Pedagogical Content Knowledge), TCK (Technological Content Knowledge), and TPK (Technological Pedagogical Knowledge) and TPACK. Since this study would focus on the element related to technology, CK, PK, and PCK were excluded from the analysis. Social Media Usage (SMU) in this project would only focus on five constructs of SMU in the academic life of university students including Searching and Studying (SS), Download Media (DM), Sharing Media (SM), Professionalism Development (PD), and Entertainment

and Motivation (EM). SMU in an informal setting or leisure activity was excluded.

1.1 TPACK Framework

Technological Knowledge (TK) generally includes knowledge on a wide variety of different technologies from simple technology such as a pen to advance technology (Archambault & Crippen, 2009; Ozden, Mouza, & Shinas, 2016; Schmidt et al., 2009). However, TK in the TPACK framework only specifically includes technology associated with digital platforms and computers (Mishra & Koehler, 2006). It also consists of the knowledge of using computer software (basic office programs, operating system, and software related to instruction), using hardware (projection device, interactive whiteboard, etc.), web or the internet research devices (Chuang, 2013; Handal, Campbell, Cavanagh, Petocz, & Kelly, 2013) and using communication platform (social networks, email, forums, chat tools) (Chai, Koh, & Tsai, 2013). Teachers with a high level of technical knowledge tend to use technology more efficiently, which also has an implication in their classroom teaching and learning (Abbitt, 2011; Harris, Mishra, & Koehler, 2007).

Knowledge of Teaching with Technology (KTT) in TPACK Framework is the simplification of three elements in TPACK Frameworks, including Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPACK). The three components are simplified into KTT because PSTs generally interpreted the items related to technology as being conceptually similar (Koh, Chai, & Tsai, 2010). Firstly, in the Science education context, TCK refers to the effectiveness of teaching science with technology integration (Schmidt et al., 2009). It implies that science teachers should master not only their knowledge of science concepts but also an understanding of how it can change with technology that more appropriate to be integrated (Mishra & Koehler, 2006; Schmidt et al., 2009). Secondly, TPK refers to an understanding of how technology can affect the teaching and learning process. For example, teachers should be able to consider the challenges, constraints, and affordance of technology by considering their teaching environment and curriculum (Harris, Mishra, & Koehler, 2007). This also includes what kind of technology more suitable for a particular teaching strategy, classroom management, and students' differences. Thirdly, TPACK is the presentation of science by being integrated with a pedagogical approach by using various technologies (Chai, Koh, & Tsai, 2013).

Current research on TPACK mainly focuses on three major themes, including measuring (students) teachers TPACK, the relationship between TPACK and other components of technology integration, and strategies for developing prospective teachers TPACK (Setiawan, Phillipson, & Isnaeni, 2019). Firstly, two main methods to measure participants' TPACK, including via self-report and via performance (e.g., Kafyulilo, Fisser, Pieters, & Voogt, 2015; Maeng, Mulvey, Smetana, & Bell, 2013). The distinction between them is that TPACK can reflect in one end as knowledge (via self-report) (e.g., Abbitt, 2011; Alqurashi, Gokbel, & Carbonara, 2017), and in the other end as competence or performance that can be observed (via performance) (e.g., Kafyulilo, Fisser, Pieters, & Voogt, 2015; Maeng, Mulvey, Smetana, & Bell, 2013).

1.2 Social Media Usage (SMU) and TPACK

Some researchers argue that social media has a beneficial impact on the academic life of university students (Ahmed, Ahmad, Ahmad, & Zakaria, 2018; Al-Rahmi & Zeki, 2017; Ali, Yaacob, Endut, & Langove, 2016; Arquero & Esteban, 2013). For example, in social media, prospective teachers can contribute to express their idea or perspectives to the group debates to respond to the education issues (Mudaly, Morgan, van Laren, Singh, & Mitchell, 2015). Online chatting in a WhatsApp group can be used as a tool to support prospective teachers' professional development through sharing their experience in a group chatting and support emotionally each other (Cansoy, 2017).

Kivunja (2013) supported that integrating social media is to improve their digital pedagogy as the preparation for them teaching using digital technologies. "Digital Pedagogy in Pre-Service Higher Education is crucial to Better Prepare Teachers in the new classroom because children in their classrooms will be Digital Natives, with skills for digital fluency" (Kivunja, 2013). Students have grown up in a world surrounded by and using computers. In the actual setting, science teachers also integrating social media such as YouTube (Blonder, Jonatan, Bar-Dov, Benny, Rap, & Sakhnini, 2013), Facebook forum (Blonder & Rap, 2017; Köseoglu & Mercan, 2016), Google docs, Skype, Social Networks and Wikis (Ahern, Feller & Nagle, 2016), to support students learning. Social media is also integrated into Moodle to support distance learning (Buus, 2012).

Lau (2018) investigates the correlation between SMU in informal settings (outside of classroom context), including for Media Sharing, Internet Searching, and Video Gaming with TPACK level of pre-service teachers with Path Analysis. He found that Media Sharing is a useful predictor of Technological Knowledge (TK) and Knowledge of Teaching with Technology (KTT). In contrast, Internet Searching and Video Gaming do not correlate with any components of TPACK. However, the research is conducted in a broad context and only focuses on SMU in an informal setting. Meanwhile, some research shows that University students in teacher education using not only social media to media sharing, internet searching, and video gaming but also other activities such as to download media, entertainment, improve motivation, to improve their professionalism as prospective science

teachers. Therefore, further research that investigates the relationship between SMU in an academic context and their TPACK Self-efficacy in Science education needs to be conducted in academic settings.

1.3 Gaps in the literature

Although previous research shows, TPACK correlates with the use of technology level (Kazu & Erten 2014), educational internet use (Sahin, Celik, Akturk, & Aydin, 2013), attitude towards computer (Baturay, Gökçearslan, & Sahin, 2017), attitude towards web-based instruction (Kavanoz, Yüksel, & Ozcan, 2015) and SMU in informal setting or leisure activities (Lau, 2018), no research connect it with SMU in an academic setting or school activities. Lau (2018) suggested that extended research of SMU in an academic setting and specific domain should be identified as an area for future research, especially in the context of Science Education. Previous studies (Kaya, Kaya, & Emre, 2013; Lin, Tsai, Chai, & Lee, 2013; Pamuk, Ergun, Cakir, Yilmaz, & Ayas, 2015; Schmidt et al. 2009) supported that TPACK could be domain-specific. Therefore, in this study, this research would analyze the association between prospective science teachers' demographic characteristics, SMU in their school activities, and their TPACK Self-efficacy in the Indonesian context.

1.4 Research Question (RQ)

Considering the importance of TPACK Self-efficacy, and the wide use of social media among prospective science teachers supported by given gaps of literature, this study proposes to examine issues related to TPACK surveys with a study of Indonesian pre-service teachers. The research question addressed in this study is: What is the relationship between the frequency of Social Media Usage (SMU) in an academic setting and Self-efficacy beliefs towards TK, TCK, TPK, and TPACK of prospective science teachers in Indonesia?

2. METHOD

2.1 Research Design

This research is quantitative based-research design. The research was conducted using a self-administered survey that provides a quantitative or numeric description of the opinions of a population (Creswell, 2008; Robson & McCartan, 2016).

2.2 Time, Location, and Participants

The research was conducted during the second semester of the academic year 2018/2019 from October to November 2018 in the Faculty of Mathematics and Natural Science of a State University located in Semarang City, Central Java Province, Indonesia. The sample of this research study consists of 217 Indonesian prospective science teachers from approximately 250 population invited to participate in this study. The population includes PSTs from the science education Department and Biology Education Department. The response rate of the survey is 86.8 %. The high response rate might because of the reward offered before the study. PST's have been studying science to become secondary school teachers majoring in Science Education and Biology Education at various levels. The second year of 112 Bachelor degree students (51.61%) was not experience with ICT courses, which includes computer and technology integration in the Science classroom because it is offered in the fifth semester. In contrast, 105 Master's degree students (48.38%) were experienced with ICT courses that are expected to be better informed with technology application in their teaching. The majority of participants were female, with 124 students (58%), and a smaller proportion of male students responded to the survey with 93 students (42%). The unbalance ratio between females and males might because the research was conducted in the faculty where strong female-bias in Indonesia.

2.3 Instrument

TPACK Self-Efficacy Scale (TPACK-SeS)

The first research instrument to evaluate TPACK Self-efficacy used in this research was explicitly developed for prospective science teachers (PSTs) by Bilici, Yamak, Kavak, & Guzey (2013). The item has been validated with 808 PSTs from teacher preparation institutions at 17 different universities in Turkey. The items are valid and reliable with the result of item-total correlation coefficients of Exploratory factor analysis (EFA), and Confirmatory factor analysis (CFA) showed a good fit. The item also reliable since Cronbach's alpha coefficient was found to be high. The format for measurement of this instrument was modified from a 100-point rating scale to a 5-point Likert scale (1=Very low, 2=low, 3=medium, 4=High, 5=Very high). Content Knowledge (CK) construct, as well as Pedagogical Knowledge (PK) construct and the intersection, was deleted from the survey because the primary focus is the technology constructs of TPACK. Technological Knowledge (TK) Self-efficacy has six constructs, and Knowledge of Teaching with Technology (KTT) Self-efficacy has 14 constructs. KTT is the composite of Technological Pedagogical Knowledge (TPK), Technological Content Knowledge (TCK), and Technological Pedagogical Content Knowledge (TPACK). The three components are simplified into KTT because prospective teachers generally interpreted the items related to technology as being conceptually similar (Koh, Chai, & Tsai, 2010). The questionnaire was translated by the author into Bahasa Indonesia (the national language of Indonesia).

Social Media Usage in Academic Context

The second research instrument, SMU in an academic context, is developed by looking at the common use of social media both theoretically and practically. The former, extensive literature review is conducted by reviewing related peer-reviewed articles to discuss Media

and Technology usage. We found that the instrument to identify the frequency of social media use has been initially developed by Lau (2018). However, the instrument focus on developing an instrument to measure SMU in an informal setting which not fully reflect SMU in academic life. Therefore, an extended literature review is conducted to explore students' motivation and purpose to use social media in higher education (e.g., Ali, Yaacob, Endut, & Langove, 2016; Bal & Bicen, 2017; Balakrishnan, Teoh, Pourshafie, & Liew, 2017; Arquero & Esteban, 2013; Gupta, 2014; Rosen, Whaling, Carrier, Cheever, & Rokkum, 2013) and in teacher preparation institution (Carpenter & Krutka, 2015). The latter, the common use of social media, is conducted not only theoretically but also practically. Some graduate students were asked what kind of practical activity in Social media that they do during their study. This study was conducted by interviewing three pre-service science teachers enrolled in a teacher preparation program in Indonesia and two graduate students at Monash University Australia. They were asked the common use of Social media in their academic life. The result was rewritten to create the questions.

Based on the result of the literature review and elicitation study, the author them modify SMU in an informal setting, which is developed by Lau (2018). The instrument has five constructs includes five including Searching and Studying (SS), Download Media (DM), Sharing Media (SM), Professionalism Development (PD), and Entertainment and Motivation (EM). Media Sharing, which is developed by Lau (2018), initially has four sub-items, including the use of Social media to watch TV shows, to watch video clips on a computer, to download media files, and to share media files on a computer. In the modified instrument, we remove SMU to watch TV because it is not related to the academic setting and teaching practice. Professional Development (PD) is added as an additional item because prospective teachers also use social media to enhance their professionalism. The scale of SMU frequency uses a five-point scale (never, rarely, sometimes, often, and always). The format of measurement slightly different from Lau (2018) that uses ten-point frequency scales of SMU in an informal setting.

This newly-modified instrument was presented to a group of graduate students studying at the Faculty of Education, Monash University (N=3), and doctoral students (N=1) to be reviewed for content validity. The results were reviewed, and slight alterations were made in language, and questions were added or dropped to strengthen the sub-items of the construct. Minor alterations were made, and the final instrument was used to collect data.

2.4 Data Collection

Ethical approval was obtained from the Monash University Human Research Ethics Committee (MUHREC) with approved number 2018-17330-24853 to ensure that the research follows research ethics principles such as informed consent, privacy, and confidentiality. Before the survey was conducted, the institution where the research was conducted was given a consent form to obtain a letter of permission. The prospective participants were also given information implicitly related to the purpose of research, what they need to do, how long they need to complete the survey, the potential benefits, and risk. The survey was anonymous, so they will not explicitly identify themselves to make sure the data remains confidential. However, they need to input their email address before completing the survey to avoid double response.

Data were collected through a web-based survey using google form because it is free and efficient to collect information (Djenno, Insua, & Pho, 2015). The researcher shares the link of a web-based survey to all of the selected students with the help of lecturers in the Faculty of Mathematics and Natural Sciences who teach the participants. After the link was shared using social networks (WhatsApp group), the participants completed three parts of the survey sequentially. First, they completed their demographic characteristics (gender, level of education, major, and age) in a multiple-choice format. Some alternative answers are provided for each question. Participants can only choose one answer for gender, level of education, major, and age. The second and third part of the survey is TPACK Self-efficacy and SMU in the academic context, respectively. They can only respond to one answer for each item. Fifteen minutes were granted for the students to complete the survey. Participants had a two-week timeframe in which to complete the survey.

After the survey was conducted, the data was downloaded from google form and transferred into Microsoft Excel 2016. All of the students' responses were entered as numerical values so that the computer can read and analyze the data. Therefore, the first step was coding, which aims to transform non-numerical information into numerical information. For example, the self-efficacy scale response, very high, was coded as 5, and 1 for very low. The data were organized into a cross-tabulation.

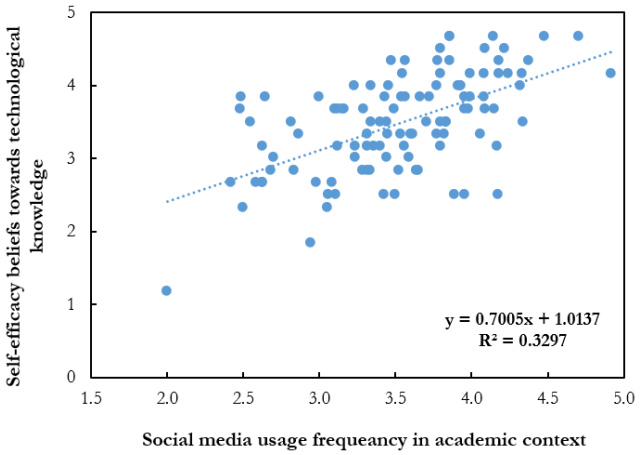

Figure 2 The correlation between the frequency of Social Media in an academic setting and TK Self-efficacy

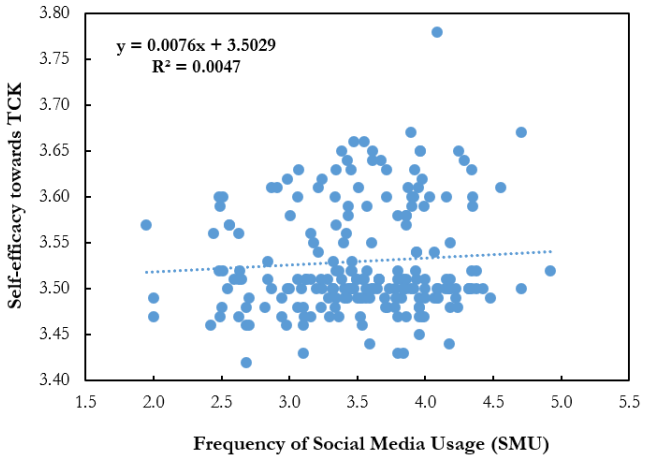

Figure 3 The correlation between the frequency of Social Media in an academic setting and TCK Self-efficacy

2.5 Data Analysis

The data analysis was Inferential Statistics. The examination of Pearson's correlation was used to analyze whether the PSTs' differences in perception of TPACK were related to their SMU. The correlational analysis was presented in a scatterplot. The multiple regression analysis was used to test for the significance of the relationships. The statistics of the multiple regressions of importance in determining the relationship will be the Pearson r, p-value, and effect size (Gall, Gall, & Borg, 2003). Spearman's rank correlation coefficient (r) was counted to see the linear trend using Microsoft Excel. The direction of correlation can be positive, negative, and no correlation (Mertens, 2016). A positive correlation means that the two variables move together in the same direction. A negative correlation means that the two variables differ inversely in the opposite direction. If the correlation coefficient is near zero, no relationship exists. The interpretation to assess the strength of the correlation coefficient and the direction (Cohen, 1992) are presented in Table 1.

Table 1 Interpretation of Spearman's rank correlation coefficient (r)

r-value	Interpretation
r =.10 to .29 or r = −.10 to −.29	low
r = .30 to .49 or r = −.30 to −.49	medium
r = .50 to 1.0 or r = −.50 to −1.0	high

Table 2 Correlation between Social media usage (SMU) and TPACK factor (Pearson's r) according to gender

SMU	Gender	TK		TCK		TPK		TPACK	
		R	R^2	R	R^2	R	R^2	R	R^2
Searching and Studying	Male (N=93)	.51 **	.26	.07	.01	.53 **	.28	.50 **	.25
	Female (N=124)	.37 **	.14	.03	.00	.42 **	.18	.42 **	.18
Download Media	Male (N=93)	.49 **	.24	.10	.01	.47 **	.22	.42 **	.18
	Female (N=124)	.45 **	.21	.02	.00	.53 **	.28	.48 *	.23
Searching Information	Male (N=93)	.33 **	.11	.08	.01	.42 **	.17	.41 **	.16
	Female (N=124)	.37 **	.14	.03	.00	.31 **	.10	.33 **	.11
Professional Development	Male (N=93)	.47 *	.22**	.14	.02	.47 **	.22	.53 **	.28
	Female (N=124)	.36 **	.13**	.15	.02	.55 **	.30	.58 **	.34
Entertainment and Motivation	Male (N=93)	.52 **	.27	.04	.00	.48 *	.23	.39 **	.15
	Female (N=124)	.41**	.17	.08	.01	.36 **	.13	.35 **	.12
Social Media Usage	All (N=217)	0.53**	.27	.07	.00	0.58**	.34	0.57**	.31

* p<0.05; **p<0.01

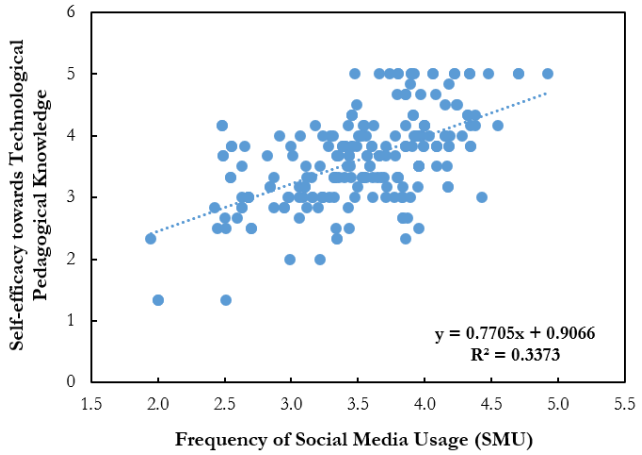

Figure 4 The correlation between the frequency of Social Media in academic setting and TPK Self-efficacy

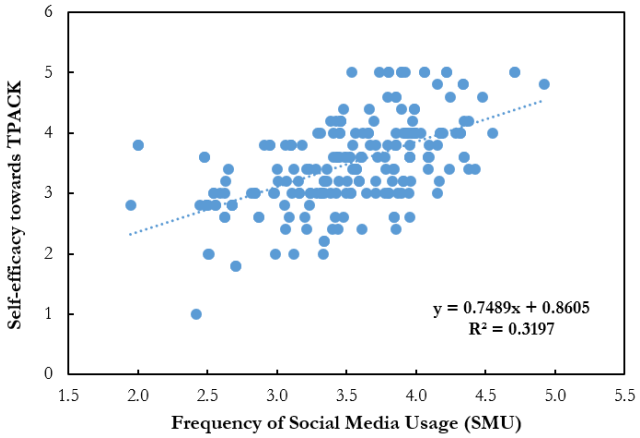

Figure 5. The correlation between the frequency of Social Media in an academic setting and self-efficacy towards Technological Pedagogical and Content Knowledge

The p-value indicates how confident each independent variable has some correlation with the dependent variable. In other words, the p-value indicates whether the relationship found in the r is statistically significant. When $p<.05$, the relationship is statistically significant.

3. RESULT AND DATA ANALYSIS

We found three important findings when the correlation between all construct of SMU and TPACK are analyzed based on gender (Table 2). First, SMU for Searching and Studying has a high statistically significant correlation with TK Self-efficacy, TPK, and TPACK ($r>0.5$) among male participants but has a medium correlation among female participants ($0.3<r<0.5$). Second, SMU for Download Media (DM), Searching Information (SI), and Entertainment and Motivation (EM) generally have a statistically medium correlation with TK, TPK, and TPACK for both male and female participants. Third, SMU for professional development (PD) has a medium correlation with TK and high correlation with TPK and TPACK. Interestingly, this research found that TCK only has a low correlation with SMU for PD for both male ($r=.22$, $p<.05$) and female ($r=.13$, $p<.05$), but it does not correlate with another construct of SMU including SS, DM, SI, and EM.

Figure 2 shows that the average of Social Media Usage frequency has a statistically high correlation with Technological Knowledge Self-efficacy of Prospective Teachers ($r=-.53$, $p<.01$).

In contrast to TK, Figure 3 shows that the average of Social Media Usage frequency has no correlation with the Technological Knowledge Self-efficacy of Prospective Teachers ($r<.1$).

Similar to the correlation between TK and SMU, Social Media Usage has a statistically high correlation with technological Pedagogical Knowledge ($r=-.58$, $p<.01$) (Figure 4) and high correlation with TPACK ($r=-.57$, $p<.01$) (Figure 5).

4. DISCUSSION

The purpose of this paper is to investigate the relationship between SMU in an academic setting and TPACK. This research found that the frequency of SMU, in general, has a statistically high correlation with TK ($r=-.53$, $p<.01$), TPK ($r=-.58$, $p<.01$), and TPACK ($r=-.57$, $p<.01$). However, the frequency of SMU does not correlate with TCK ($r<.1$). The result of this study aligns with the research of Lau (2018) investigating the relationship between SMU in an informal setting and TPACK. He found that although the relationship is not strong, TK correlates with Media Sharing (MS) ($r=.237$, $p<.05$), Internet Searching (IS) ($r=.124$, $p>.05$), and Video Gaming (VG) ($r=.204$, $p<.01$). However, the result of this study is slightly different from his findings. SMU in an informal setting is moderately correlated with all construct of Knowledge of teaching with technology (KTT), which is the composite of TCK, TPK, and TPACK. It might have the effect of the context of formal and informal setting usage of SMU. Some similar research also supports the result of this study. Who found positive relationships exist between the knowledge dimensions in the TPACK and the self-efficacy beliefs in educational Internet use (Sahin, Celik, Akturk, & Aydin, 2013; Kazu & Erten, 2014; Kavanoz, Yüksel, & Ozcan, 2015; Bingimlas, 2018). A study conducted by Kavanoz, Yüksel, & Ozcan (2015) also revealed that the level of general self-efficacy among participants regarding TPACK is associated with their attitudes towards web-based instructions. Some research reported that science teachers who integrate social media such as YouTube (Blonder, Jonatan, Bar-Dov, Benny, Rap, & Sakhnini, 2013), Facebook forum (Blonder & Rap, 2017; Köseoglu & Mercan, 2016), Google docs, Skype, Social Networks and Wikis (Ahern, Feller & Nagle, 2016), to support students learning is

found an increased efficacy towards TPACK. Therefore, integrating social media in teacher education institutions would be beneficial for PSTs.

When further analyzed, the sub-items of SMU in academic settings according to gender, Searching, Download, and Sharing media have a positive correlation with TK, TPK, and TPACK for both males and females with the size of correlation among female PSTs is weaker than males. SMU for professional development also has a high correlation with TPACK Self-efficacy for both males and females. Professional development in this context refers to social media to learn new technological tools for teaching, to create learning media, to update information related to current new technology for teaching, to join distance learning workshop or online short course and to get information from professional teachers about how they apply ICT in their Science classroom. Then, SMU for entertainment and motivation (EM) also has a positive correlation with their TK, TPK, and TPACK for both males and females. EM in this research refers to the use of social media to read online news, listen to music, play Educational Games, watch online videos for entertainment and chat in Social media to improve learning motivation from others. The existence of gender difference as the moderator of the relationship between age and TPACK self-efficacy might be the effect of the ICT-user profile. ICT user profiles are defined as "a framework which is used to identify and categorize students based on how frequently they use ICT" (Tomte & Hatlevik, 2011). An increased level of self-efficacy in ICT is related to both an increased level of educational use and leisure use of ICT.

5. CONCLUSION

The average SMU frequency has a statistically high correlation with TK ($r=-.53$, $p<.01$), TPK ($r=-.58$, $p<.01$), and TPACK ($r=-.57$, $p<.01$). However, the frequency of SMU does not correlate with TCK ($r<.1$). When the correlation was analyzed based on gender, we found three important findings. First, among male participants, SMU for Searching and Studying has a high statistically significant correlation with TK Self-efficacy ($r=.51$), TPK ($r=53$), and TPACK ($r=.50$), but has a medium correlation among female participants with TK Self-efficacy ($r=.37$), TPK ($r=.42$), and TPACK ($r=.42$). Second, SMU for Download Media (DM), Searching Information (SI), and Entertainment and Motivation (EM) generally have a statistically medium correlation with TK, TPK, and TPACK for both male and female participants ($r = .30$ to $.49$). Third, SMU for professional development (PD) has a medium correlation with TK for both males ($r=.47$) and female ($r=.36$). However, PD has high correlation with TPK and TPACK ($r = .50$ to 1.0). Interestingly, this research found that TCK only has a low correlation with SMU for PD for both males and females ($r=.14$), but it has no correlation with another construct of SMU($r<.1$). In this research, generally, Social Media Usage for all purposes has a high correlation with Technological Knowledge ($r=.53$), Technological Pedagogical Knowledge ($r=.58$), and TPACK ($r=.57$).

6. LIMITATION

We exclude some construct of TPACK that is not related to technology, including Content Knowledge (CK), Pedagogical Knowledge (PK), and the intersection, Pedagogical Content Knowledge (PCK). Thirdly, the items in the instrument to measure SMU in an academic context were the result of modification from SMU in an informal setting from previous researchers, but the modified items were not tested for validation due to time constraints to do the project.

7. RECOMMENDATION

1. Future research should investigate TPACK among in-service science teachers in Indonesia who enroll in Pendidikan Profesi Guru/PPG or Graduate Certificate for Teacher Profession. Some topics that can be explored are: (1) the effectiveness of professional development of technology and social media (Facebook, Twitter, YouTube) among in-service teachers in Indonesia to improve their TPACK competence (2) the effectiveness of Graduate Certificate for Teacher Profession in Indonesia to improve in-service teachers' competencies in technology integration.

2. The correlational research between SMU and TPACK in this research is only conducted in the context of Science Education, and the participants of this research are PSTs from the Department of Science Education and Biology education in one teacher education institution in Indonesia. Future investigation of TPACK should focus on other science domains such as physics and chemistry in more than one institution.

3. Future research can compare TPACK across cross-cultural contexts between Indonesia and other countries in South East Asia, such as Indonesia and Singapore, Malaysia, or even with countries in the different continents to identify the possibility of cultural differences. This is because most of the research is conducted in one country and a lack of research comparing PSTs' TPACK across different cultural backgrounds (Alqurashi, Gokbel, & Carbonara, 2017).

8. IMPLICATION

8.1 Implication for Practice

Since social media usage has a positive effect on PSTs' TK Self-efficacy and KTT, training focuses on the application of social media in teaching and learning should be integrated to improve their TPACK. In this research, we especially found that SMU for Professional Development correlates with all construct of TPACK

related to technology. Therefore, the lecturer can integrate professional development that is designed specifically for PSTs. For example, the introduction could be designed as an advanced program for guiding teachers to adopt adequate social media-based learning materials to learn new technological tools for teaching, to create learning media, to join distance learning workshops or online short courses. For example, advanced training programs could introduce and guide PSTs to utilize social media-related apps such as Facebook, YouTube, Twitter in their classroom. Students' motivation for learning Science might be further enhanced. Recently, science teachers who integrate social media such as YouTube (Blonder, Jonatan, Bar-Dov, Benny, Rap, & Sakhnini, 2013), Facebook forum (Blonder & Rap, 2017; Köseoglu & Mercan, 2016), Google docs, Skype, Social Networks and Wikis (Ahern, Feller & Nagle, 2016), to support students learning is found an increased efficacy towards TPACK. Therefore, integrating social media in teacher education institutions would be beneficial for PSTs.

Implication for Policy

The teacher education also needs to reconsider its design of ICT course through ICT course evaluations. Previous research suggested the implementation of a TPACK-based course or professional development program improves TPACK and self-efficacy (Blonder, Jonatan, Bar-Dov, Benny, Rap, & Sakhnini, 2013; Kafyulilo, Fisser, Pieters, & Voogt, 2015; Canbazoglu, Guzey, & Yamak, 2016).

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REFERENCES

Abbitt, J. T. (2011). An investigation of the relationship between self-efficacy beliefs about technology integration and technological pedagogical content knowledge (TPACK) among preservice teachers. *Journal of Digital Learning in Teacher Education*, *27*(4), 134-143. doi: https://doi.org/10.1080/21532974.2011.10784670

Abbitt, J. T., & Klett, M. D. (2007). Identifying influences on attitudes and self-efficacy beliefs towards technology integration among pre-service educators. *Electronic Journal for the integration of technology in Education*, *6*(1), 28-42. Retrieved from http://ejite.isu.edu/Volume6/Abbitt.pdf

Ahern, L., Feller, J., & Nagle, T. (2016). Social media as a support for learning in universities: an empirical study of Facebook Groups. *Journal of Decision Systems*, *25*(sup1), 35-49. doi: https://doi.org/10.1080/12460125.2016.1187421

Ahmed, Y. A., Ahmad, M. N., Ahmad, N., & Zakaria, N. H. (2018). Social media for knowledge-sharing: A systematic literature review. *Telematics and Informatics*. doi: https://doi.org/10.1016/j.tele.2018.01.015

Al-Daihani, S., Jumanah, S. A., & Sara, A. A. (2018). Use of social media by social science academics for scholarly communication. *Global Knowledge, Memory, and Communication, 67*(6), 412-424. doi: https://doi.org/10.1108/GKMC-11-2017-0091

Al-Rahmi, W. M., & Zeki, A. M. (2017). A model of using social media for collaborative learning to enhance learners' performance on learning. *Journal of King Saud University-Computer and Information Sciences*, *29*(4), 526-535. doi: http://dx.doi.org/10.1016/j.jksuci.2016.09.002

Ali, M., Yaacob, R. A. I. B. R., Endut, M. N. A. A. B., & Langove, N. U. (2016). Strengthening the academic usage of social media: An exploratory study. *Journal of King Saud University-Computer and Information Sciences*. doi: http://dx.doi.org/10.1016/j.jksuci.2016.10.002

Alqurashi, E., Gokbel, E. N., & Carbonara, D. (2017). Teachers' knowledge of content, pedagogy, and technology integration: A comparative analysis between teachers in Saudi Arabia and the United States. *British Journal of Educational Technology, 48*(6), 1414-1426. doi: http://dx.doi.org.10.1111/bjet.12514

Archambault, L., & Crippen, K. (2009). Examining TPACK among K-12 online distance educators in the United States. *Contemporary Issues in Technology and Teacher Education, 9*(1), 71-88. Retrieved from https://www.learntechlib.org/p/29332/

Arquero, J. L., & Esteban, R., (2013). Using social network sites in Higher education: an experience in business studies. *Journal of innovations in education and teaching international*. doi: 10.1080/14703297.2012.760772

Bal, E., & Bicen, H. (2017). The purpose of students' social media use and determining their perspectives on education. *Procedia Computer Science*, *120*, 177-181. doi: https://doi.org/10.1016/j.procs.2017.11.226

Balakrishnan, V., Teoh, K. K., Pourshafie, T., & Liew, T. K. (2017). Social media and their use in learning: A comparative analysis between Australia and Malaysia from the learners' perspectives. *Australasian Journal of Educational Technology*, *33*(1).

Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual review of psychology*, *52*(1), 1-26.

Bassell, K. (2010). Social media and the implications for nursing faculty mentoring: A review of the literature. *Teaching and Learning in Nursing*, *5*(4), 143-148. doi: https://doi.org/10.1016/j.teln.2010.07.007

Baturay, M. H., Gökçearslan, S., & Sahin, S. (2017). Associations among teachers' attitudes towards computer-assisted education and TPACK competencies. *Informatics in Education, 16*(1), 1-23.

Bilici, S. C., Yamak, H., Kavak, N., & Guzey, S. S. (2013). Technological pedagogical content knowledge self-efficacy scale (TPACK-SeS) for pre-service science teachers: Construction, validation, and reliability. *Eurasian Journal of Educational Research,* (52), 37-60. Retrieved from https://eric.ed.gov/?id=EJ1060363

Bingimlas, K. (2018). Investigating the level of teachers' knowledge in technology, pedagogy, and content (TPACK) in saudiarabia. *South African Journal of Education, 38*(3), 1-12.

Blonder, R., & Rap, S. (2017). I like Facebook: Exploring Israeli high school chemistry teachers' TPACK and self-efficacy beliefs. *Education and Information Technologies, 22*(2), 697-724. doi: 10.1007/s10639-015-9384-6

Blonder, R., Jonatan, M., Bar-Dov, Z., Benny, N., Rap, S., & Sakhnini, S. (2013). Can YouTube it? Providing chemistry teachers with technological tools and enhancing their self-efficacy beliefs. *Chemistry Education Research and Practice*, *14*(3), 269-285. doi: 10.1039/C3RP00001J

Buus, L. (2012). Scaffolding teachers integrate social media into a problem-based learning approach? Electronic Journal of e-

Learning, 10(1), 13-22. Retrieved from https://files.eric.ed.gov/fulltext/EJ969432.pdf

Callaghan, G., & Fribbance, I. (2016). The use of Facebook to build a community for distance learning students: A case study from the open university. *Open Learning, 31*(3), 260-272. doi: https://doi.org/10.1080/02680513.2016.1229176

Canbazoglu-Bilici, S., Guzey, S. S., & Yamak, H. (2016). Assessing pre-service science teachers' technological pedagogical content knowledge (TPACK) through observations and lesson plans. *Research in Science & Technological Education*, *34*(2), 237-251. doi: https://doi.org/10.1080/02635143.2016.1144050

Cansoy, R. (2017). Teachers' Professional Development: The Case of WhatsApp. *Journal of Education and Learning*, *6*(4), 285-293. doi: 10.5539/jel.v6n4p285

Carpenter, J. P., & Krutka, D. G. (2015). Engagement through microblogging: Educator professional development via Twitter. *Professional development in education*, *41*(4), 707-728.

Chai, C.S., Koh, J. H.L., & Tsai, C.C. (2013). A Review of technological pedagogical content knowledge. *Educational Technology & Society, 16*(2), 31–51. Retrieved from https://www.jstor.org/stable/jeductechsoci.16.2.31

Chuang, H. (2013). A case study of e-tutors' teaching practice: Does technology drive pedagogy? *International Journal of Education in Mathematics, Science and Technology, 1*(2), 75- 82. Retrieved from https://files.eric.ed.gov/fulltext/EJ1057552.pdf

Cohen, J. (1992). Quantitative methods in psychology: A power primer. Psychological Bulletin, 112(1), 155-159.

Creswell, J. (2008). *Educational research: Planning, conducting and evaluating quantitative and qualitative research (3rd ed.)*. Upper Saddle River, NJ: Pearson Prentice Hall.

Djenno, M., Insua, G. M., & Pho, A. (2015). From paper to pixels: using Google Forms for collaboration and assessment. *Library Hi Tech News*, *32*(4), 9-13.

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. doi: 10.1007/BF02504683

Eteokleous, N. (2008). Evaluating computer technology integration in a centralized school system. *Computers & Education*, *51*(2), 669-686. doi: https://doi.org/10.1016/j.compedu.2007.07.004

Gall, M. D., Gall, J. P., & Borg, W. (2003). Educational research: An introduction. Boston: Person Education.

Gupta, D. S. (2014). Social media for teachers of English: A hub for professional development. *Research Journal of English Language and Literature*, *2*(2), 34-38.

Handal, B., Campbell, C., Cavanagh, M., Petocz, P., & Kelly, N. (2013). Technological pedagogical content knowledge of secondary mathematics teachers. *Contemporary Issues in Technology and Teacher Education, 13*(1), 22-40.

Harris J.B., Mishra P., & Koehler M.J. (2007). Teachers' technological pedagogical content knowledge: curriculum-based technology integration reframed. *Journal of Research on Technology in Education,* 41, 393–416. doi: https://doi.org/10.1080/15391523.2009.10782536

Hew, K. F., & Brush, T. (2007). Integrating technology into K-12 teaching and learning: Current knowledge gaps and recommendations for future research. *Educational technology research and development*, *55*(3), 223-252. doi: 10.1007/s11423-006-9022-5

Hussain, I., Cakir, O., & Candeger, Ü. (2018). Social media as a learning technology for university students. *International Journal of Instruction, 11*(2), 281-296. doi: https://doi.org/10.12973/iji.2018.11219a

Inan, F. A., & Lowther, D. L. (2010). Factors affecting technology integration in K-12 classrooms: A path model. *Educational Technology Research and Development*, *58*(2), 137-154.

Kafyulilo, A., Fisser, P., Pieters, J., & Voogt, J. (2015). ICT use in science and mathematics teacher education in Tanzania: Developing technological pedagogical content knowledge. *Australasian Journal of Educational Technology, 31*(4), 381–394. Retrieved from https://ajet.org.au/index.php/AJET/article/viewFile/1240/1288

Kamulung, P. (2017). *Evaluasi Pengintegrasian Teknologi dalam Pembelajaran Sains di SMA Kristen Satya Wacana* [Evaluation of Technology Integration in Science Learning at Satya Wacana Christian High School] (Doctoral dissertation, Program Studi Pendidikan Teknologi Informasi dan Komputer FTI-UKSW). Retrieved from http://repository.uksw.edu/handle/123456789/14001

Kaplan, A. M., & Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of Social Media. *Business horizons*, *53*(1), 59-68.

Kavanoz, S., Yüksel, H. G., & Özcan, E. (2015). Pre-service teachers' self-efficacy perceptions on Web Pedagogical Content Knowledge. *Computers & Education*, *85*, 94-101. doi: https://doi.org/10.1016/j.compedu.2015.02.005

Kaya, Z., Kaya, O. N., & Emre, I. (2013). Adaptation of technological pedagogical content knowledge scale to Turkish. *Educational Sciences: Theory and Practice, 13*(4), 2367–2377. Retrieved from https://files.eric.ed.gov/fulltext/EJ1016741.pdf

Kazu, I. Y., & Erten, P. (2014). Teachers' technological pedagogical content knowledge self-efficacies. *Journal of Education and Training Studies, 2*(2), 126-144. doi: http://dx.doi.org/10.11114/jets.v2i2.261

Kivunja, C. (2013). Embedding digital pedagogy in pre-service higher education to better prepare teachers for the digital generation. *International Journal of Higher Education, 2*(4), 131-142. doi: http://dx.doi.org/10.5430/ijhe.v2n4p131

Koh, J. H. L., Chai, C. S., & Tsai, C. C. (2010). Examining the technological pedagogical content knowledge of Singapore pre-service teachers with a large-scale survey. *Journal of Computer Assisted Learning*, *26*(6), 563-573.

Köseoglu, P., & Mercan, G. (2016). The educational use of Facebook as a social networking site in animal physiology classes. *World Journal on Educational Technology: Current Issues*, *8*(3), 258-266. Retrieved from https://files.eric.ed.gov/fulltext/EJ1142257.pdf

Lau, W. W. (2018). Relationships between Pre-service Teachers' Social Media Usage in Informal Settings and Technological Pedagogical Content Knowledge. *EURASIA Journal of Mathematics, Science and Technology Education*, *14*, 12.

Lee, Y., & Lee, J. (2014). Enhancing pre-service teachers' self-efficacy beliefs for technology integration through lesson planning practice. *Computers & Education*, *73*, 121-128. doi: https://doi.org/10.1016/j.compedu.2014.01.001

Lin, T.-C., Tsai, C.-C., Chai, C. S., & Lee, M.-H. (2013). Identifying science teachers' perceptions of technological, pedagogical, and content knowledge (TPACK). *Journal of Science Education and Technology, 22*, 325–336. doi: 10.1007/s10956-012-9396-6

Maeng, J. L., Mulvey, B. K., Smetana, L. K., & Bell, R. L. (2013). Preservice teachers' TPACK: Using technology to support inquiry instruction. *Journal of Science Education and Technology*, *22*(6), 838-857. doi: 10.1007/s40299-016-0305-2

Mertens, D. M. (2016) Research and Evaluation in Education and Psychology (4thEd.). London: Sage.

Mishra, P., & Koehler, M.J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. Teachers College Record, 108(6), 1017-1054. doi: 10.1.1.523.3855

Mnkandla, E., & Minnaar, A. (2017). The use of social media in E-learning: A metasynthesis. *International Review of Research in Open and Distributed Learning, 18*(5), 227-248. doi: http://dx.doi.org/10.19173/irrodl.v18i5.3014

Mudaly, R., Morgan, K. P., van Laren, L., Singh, S., & Mitchell, C. (2015). Connecting with pre-service teachers' perspectives on the use of digital technologies and social media to teach socially relevant science. *Perspectives in Education*, *33*(4), 23-41.

Owusu-Ansah, C. M., Gontshi, V., Mutibwa, L., & Ukwuoma, S. (2015). Applications of social media and web 2.0 for research support in selected African academic institutions. *Journal of Balkan Libraries Union, 3*(1), 30-39.

Ozden, S. Y., Mouza, C., & Shinas, V. H. (2016). Teaching knowledge with curriculum-based technology: Development of a survey instrument for pre-service teachers. *Journal of Technology and Teacher Education, 24*(4), 471-499. Retrieved from https://www.learntechlib.org/p/172178/

Pamuk, S., Ergun, M., Cakir, R., Yilmaz, H. B., & Ayas, C. (2015). Exploring relationships among TPACK components and development of the TPACK instrument. *Education and Information Technologies, 20*(2), 241–263. doi: 10.1007/s10639-013-9278-4

Pitiporntapin, S., & Lankford, D. M. (2015). Using social media to promote pre-service science teachers' practices of socio-scientific issue (SSI) - based teaching.*Asia - Pacific Forum on Science Learning and Teaching, 16*(2), 1-28.

Robson, C., & McCartan, K. (2016). *Real world research*. New York: John Wiley & Sons.

Rosen, L. D., Whaling, K., Carrier, L. M., Cheever, N. A., & Rokkum, J. (2013). The media and technology usage and attitudes scale: An empirical investigation. *Computers in human behavior*, *29*(6), 2501-2511.

Sahin, I., Celik, I., Akturk, A. O., & Aydin, M. (2013). Analysis of relationships between technological pedagogical content knowledge and educational internet use. *Journal of Digital Learning in Teacher Education, 29*(4), 110-117. Retrieved from https://files.eric.ed.gov/fulltext/EJ1010761.pdf

Schmidt, D. A., Baran, E., Thompson, A. D., Mishra, P., Koehler, M. J., & Shin, T. S. (2009). Technological pedagogical content knowledge (TPACK): The development and validation of an assessment instrument for preservice teachers. Journal of Research on Technology in Education, 42(2), 123-149. doi: https://doi.org/10.1080/15391523.2009.10782544

Semiz, K., & Ince, M. L. (2012). Pre-service physical education teachers' technological pedagogical content knowledge, technology integration self-efficacy and instructional technology outcome expectations. *Australasian Journal of Educational Technology, 28*(7), 1248-1265.

Setiawan, H., Phillipson, S., & Isnaeni, W. (2019). Current trends in TPACK research in science education: a systematic review of literature from 2011 to 2017. *Journal of Physics: Conference Series*, 1317 (1), p. 012213. doi: 10.1088/1742-6596/1317/1/012213

Shirky, C. (2011). The political power of social media: Technology, the public sphere, and political change. *Foreign affairs*, 28-41. Retrieved from http://www.jstor.org/stable/25800379

Smeets, E. (2005). Does ICT contribute to powerful learning environments in primary education?. *Computers & Education*, *44*(3), 343-355. doi: 10.1016/j.compedu.2004.04.003

Styaningrum, A. (2016). *Analisis Hambatan Guru dalam Pengintegrasian Teknologi di SMPN 1 Grabag [Analysis of Teacher Obstacles in Technology Integration at Middle School Grabag 1]* (Doctoral dissertation, Program Studi Pendidikan Teknologi Informasi dan Komunikasi FTI-UKSW). Retrieved from http://repository.uksw.edu/handle/123456789/10781

Sumintono, B., Wibowo, S. A., Mislan, N., & Tiawa, D. H. (2012). Penggunaan Teknologi Informasi dan Komunikasi Dalam Pengajaran: Survei Pada Guru-Guru Sains SMP di Indonesia. *Jurnal Pengajaran MIPA*, *17*(1), 122-131. doi: http://dx.doi.org/10.18269/jpmipa.v17i1.251

Tomte, C., & Hatlevik, O. E. (2011). Gender-differences in self-efficacy ICT related to various ICT-user profiles in Finland and Norway. How do self-efficacy, gender and ICT-user profiles relate to findings from PISA 2006. *Computers & Education, 57*(1), 1416-1424. doi: http://dx.doi.org.ezproxy.lib.monash.edu.au/10.1016/j.compedu.2010.12.011

Uzun N., Ekici, G., & Saglam, N. (2010). A study on the primary school secondary level students' self-efficacy perception of their computer competence. *Kastamonu Education Journal, 18*(3), 775–788.

Wheeler, S., Yeomans, P., & Wheeler, D. (2008). The good, the bad and the wiki: Evaluating student-generated content for collaborative learning. *British journal of educational technology*, *39*(6), 987-995. doi: https://doi.org/10.1111/j.1467-8535.2007.00799.x