University of South Africa Supervisors' Knowledge of Technological Tools and ICTs for Postgraduate Supervision

Mishack. T. GUMBO
Department of Science & Technology Education, College of Education, University of South Africa, Pretoria, South Africa
gumbomt@unisa.ac.za

ABSTRACT
Postgraduate supervision is a complex and demanding task. The supervisors' knowledge and use of the available online technological tools and information and communication technology (ICTs) can however make their supervision effective and successful. The use of ICT is important in the context of University of South Africa (UNISA) considering its open and distance e-learning (ODeL) mode. The 21st-century educational environment is endowed with the technological and social media tools that can make the teaching staff's work easier and speed up throughput ultimately. The ODeL institutions in particular should take full advantage of the ubiquitousness of technologies. The researcher identified the available technological tools or ICTs and surveyed 129 supervisors' perceptions in the College of Education (CEDU) at UNISA to determine their supervision success alongside their knowledge of technological tools and/or ICTs for purposes of their supervision. The results show differentiated supervisors' supervision success and limited knowledge of the online technological tools and ICTs. The results also show that some supervisors need training in the use of the online technological tools and ICT, and that they are only knowledgeable about the "common" tools such as e-mail, MS Word and myUnisa than "newer" tools, especially social media tools.

KEYWORDS: supervisors, success, knowledge, technological tools, postgraduate students, information and communication technologies, technological pedagogical content knowledge

BACKGROUND

"Why be offline when you can be online?" I noticed this statement at an airport during my travel. The message was clear, i.e. it meant the convenience of online self-checking in, instead of standing in long queues. In this article, this statement means, "Why supervise offline when you can do it online?" The purpose of the study being reported in this article was to determine the supervisors' success regarding postgraduate student supervision alongside their knowledge of online technological tools and ICTs at UNISA. Postgraduate students in this article refers to the master's and doctoral degree students. The study targeted supervisors in CEDU. Not much has been researched about the role and use of online technological tools and ICTs for supervising research and higher degree students (McKavanagh, Bryant, Finger & Middleton, 2004; Valetsianos (2010). This study contributes towards filling this gap. Moreover, the use of the technological tools can help UNISA's realisation of its 2015 research strategic plan, part of which is to increase the postgraduate throughput. Also, as an ODeL university, UNISA should model leadership in the use of online technological tools and ICTs in its teaching and research operations. By implication, postgraduate supervision should take full advantage of the online technological tools and ICTs as one of the contributing factors to bolster success at the postgraduate. Research on the use of the online technological tools and ICTs for postgraduate supervision can show its importance in servicing students, dealing with the soaring student numbers and demands, and increasing throughput at postgraduate level. This study addressed the following research questions:

- What is the success rate of CEDU supervisors in their postgraduate student supervision?
- What are the online technological tools and ICTs which are available to the supervisors for their postgraduate supervision?
- What are supervisors' level of knowledge of these technological tools and ICT?
- Do supervisors consider the role that these technological tools and ICTs can play in the postgraduate supervision?

ICTs such as a computer or smart cellphone, connected to the internet, are endowed with the tools and social media platforms which can help transform the postgraduate supervision practices and improve throughput in the ODeL contexts. According to Wheeler (2010, p. 1), ICT encompass all of technological devices used to enhance teaching and learning. ICTs are widespread (Evans, Martin & Poatsy, 2010), so much that the 21st century teaching and learning are unthinkable without them. In fact, the use of ICTs is constantly changing the way people work and, more significantly performance and production (Mbangwana, 2008, p. 2), especially because

Copyright © The Turkish Online Journal of Educational Technology

these tools can be operated online when there is access to internet. Additionally, the ODeL teaching and research are increasingly taking place through a range of e-technologies, e.g. web-based resources, word processors and graphics tools, statistical and qualitative data analysis programmes (McKavanagh *et al.*, 2004). These tools can also be useful in the postgraduate supervision, which comprises the tasks of teaching and research. As part of this study, the relevant sections at UNISA were consulted to identify the tools which can be used for postgraduate supervision. Other tools especially social media tools which could be accessed by the supervisors on the internet platform were included in the list as well. The supervisors had to indicate their level of knowledge of these tools in the questionnaire which was designed later.

This study was rationalised from the fact that the author has worked in CEDU's Office of Graduate Studies and Research from 2010 to 2014, during which time he managed the postgraduate programme and research activities. He realised that the soaring student numbers were among the most challenging factors that caused the supervision problems and thus affected throughput. The use of ICTs is heralded as one of the possible solutions that can help speed up throughput since it provides a quicker way to manage and carry out supervision, more so if operated online. This is because postgraduate study is suited to a 'virtual' campus which is associated with the students who are often juggling work and family commitments and who find studying online much easier and often as satisfying than attending lectures on campus (Stacey in Stacey & Fountain, 2001, p. 519), thus parading ICTs as viable means to manage the remoteness of supervision. ICTs have been defined by their great potential to yield certain outcomes, namely, improve productivity, facilitate information management and communication, and transform research training into the thesis research. This claim is viewed in light of the fact that there is a range of factors that impede these outcomes – supervisors' competence, delayed feedback on students' work and students' lack of understanding of institutional processes (Lessing & Schulze, 2003; Abiddin, Ismail & Ismail, 2011; Roets, 2013). The conceptual framework followed in the study is discussed next.

Conceptual framework

The importance of ICTs in education has inspired a ground-breaking initiative by Mishra and Koehler (2006) and Koehler and Mishra (2008; 2009), which is referred to as technological pedagogical content knowledge (TPCK). TPCK was introduced to the field of educational research in order to understand the teacher knowledge required for effective technology integration (Mishra & Koehler, 2006). It was later renamed TPACK to form a more integrated whole for the three kinds of knowledge, i.e. technology, pedagogy and content. TPACK is regarded as one of the most important and influential 21st century conceptual developments in the area of technology (Koehler & Mishra, 2008), and teacher education is the development of the TPACK model for thinking about the knowledge, skills and dispositions which a teacher needs in order to successfully integrate the educational technologies into the classroom (McGrath, Karabas & Willis, 2011). In this article, the classroom is the virtual space in an ODeL context that is enabled by ICTs at the level of postgraduate teaching, learning and research.

TPACK builds onto Shulman's (1987) construct of pedagogical content knowledge (PCK) to include the technology knowledge component. Based on Shulman's construct, TPACK emerged as a useful frame for describing and understanding the goals for technology use in teacher education (Schmidt, Baran, Thompson, Mishra, Koehler & Shin, 2009, p. 123). Schmidt *et al.* (2009) conducted a pilot survey with the aim of designing a survey instrument to assess TPACK for teachers. Schmidt *et al.* sampled 124 pre-service teachers who participated in the study. They applied Cronbach's alpha statistics to analyse the data on the TPACK knowledge domains, and factor analysis for each domain. Their results suggested that when they modified and/or deleted 18 of the survey items, the survey was reliable and the designed instrument was, therefore, valid. They concluded that the instrument would help educators to design the longitudinal studies to assess pre-service teachers' development of TPACK.

Schmidt *et al*'s instrument would serve a good purpose in the current study (though this study is not a longitudinal study), but in the researcher's view it was not suitable as it did not include specific technological tools in its items. For example, the following items, copied from the instrument in the category of technology knowledge (Schmidt *et al*., 2009, p. 145), demonstrate this gap:

Strongly Disagree = SD; Disagree = D; Neither Agree/Disagree = N; Agree = A; Strongly Agree = SA

1. I know how to solve my own technical problems.	SD D N A SA
2. I can learn technology easily.	SD D N A SA
3. I keep up with important new technologies.	SD D N A SA
4. I frequently play around with the technology.	SD D N A SA
5. I know about a lot of different technologies.	SD D N A SA

Copyright © The Turkish Online Journal of Educational Technology

6. I have the technical skills I need to use technology. SD D N A SA
7. I have had sufficient opportunities to work with different technologies. SD D N A SA

In light of the above, the survey questionnaire did not specify the technologies that the teachers were asked about. The researcher consequently developed his own instrument. However, the researcher found Schmidt *et al*'s TPACK framework useful because it encapsulated the issues relevant to the use of online technology for postgraduate supervision. Even though the study was conducted at the pre-tertiary level, it was found applicable in the higher education context as well. As a matter of fact, Mishra's and Koehler's TPCK is not restricted to the school level.

There are seven knowledge types in the TPACK framework, which are briefly explained according to Cox's and Graham's classification (2009, pp. 62–64) as follows:

Technology knowledge (TK): TK refers to the knowledge of various technologies, which range from low technologies, e.g. pencil and paper to digital technologies, e.g. internet, digital videos, interactive whiteboards and software programs. TK is defined as the knowledge about how to use the emerging technologies.

Content knowledge (CK): CK is the subject matter knowledge. Teachers (in this case, supervisors) should know the content (packaged in literature sources) which they should present to and make students aware of in order to facilitate their (students') research. CK includes, for example, models of representations of a conceptual framework chosen for the supervised study in a person's field of specialisation. A supervisor can, for instance, operate via the TK in making use of ICTs to explain a conceptual framework to the students.

Pedagogical knowledge (PK): This refers to a teacher's knowledge of the general pedagogical activities which might be utilised. General activities may include the strategies to motivate, communicate with and present information to the students. This generalised knowledge allows the teachers to teach more effectively because they can draw from a pool of activities which can be used across the topics rather than create the unique activities for each topic. Through their TK, supervisors can actually take advantage of the technological tools to support their students, e.g. send an e-mail to encourage a student who is overwhelmed by the postgraduate work.

Pedagogical content knowledge (PCK): PCK refers to the CK which deals with the teaching process. PCK is different for various content areas since it blends both content and pedagogy to develop the better teaching practices in content areas. It combines the knowledge of activities with that of representations in order to facilitate student learning. The knowledge of pedagogical activities here is content-specific as dictated by the subject or topic concerned. The teachers' competence in PCK helps to promote student learning. Thus, a technologically knowledgeable supervisor may manoeuvre the available technologies to unlock the understanding of such research related principles and concepts to the students.

Technological content knowledge (TCK): This dimension refers to the knowledge about how technology can create new representations for a specific content. By using a specific technology, teachers can change the way students practice and understand concepts in a specific content area. Postgraduate students, for example, can manipulate the computer software to creatively represent the findings of their studies. The knowledge of these representations exists independent of the knowledge about their use in a pedagogical context. Supervisors may not be knowledgeable to a larger extent in training their students in the use of TCK; they could recommend training in this regard. Supervisors should however show a need to be trained in TCK so that they can make sense of the students' work which incorporates it in order to understand and comment appropriately on the students' work.

Technological pedagogical knowledge (TPK): TPK refers to the knowledge about how various technologies can be used in teaching, and to understand their use may change the way teachers teach. Therefore, TPK might include the knowledge about how to motivate or engage students in cooperative learning by using technology, e.g. create a blog in which they may discuss experiences about their studies. This suggests that supervisors should transform their PK into TPK by becoming interested in learning more about technology.

Technological pedagogical content knowledge (TPACK): This refers to the knowledge required by teachers for integrating technology into their teaching in any content area. It capacitates teachers in having an intuitive understanding of the complex interplay between CK, PK and TK, and to teach content using the appropriate pedagogical methods and technologies. In this regard a teacher can coordinate the use of subject-specific activities with topic-specific representations using the emerging technologies to facilitate student learning.

Copyright © The Turkish Online Journal of Educational Technology

RESEARCH METHODOLOGY

The researcher used a survey research design (Glasow, 2005) to gather the supervisors' perceptions regarding their use of online technological tools or ICTs for purposes of postgraduate supervision. Research design is the conceptual structure within which research is conducted (Kothari, 2004), and a plan that guides a researcher to connect empirical data to a study's initial research questions and eventually the answers of the questions (Yin, 2009).

A survey is used to select a representative sample from the entire population and to administer a questionnaire to describe the attitudes, opinions, behaviours or characteristics of the population (Creswell, 2009, p. 388). Among the population of supervisors at UNISA, this study targeted the 129 supervisors in CEDU based on their homogeneity (Glasow, 2005), i.e. their specialisation in education and teacher training. This sample excluded external supervisors since they fall under independent contracts, and their detachment from UNISA could cause them to not provide the required information. Owing to the demands of supervision in CEDU, almost all the academic staff members are required to supervise postgraduate students irrespective of their level of experience. Hence, the 129 supervisors included all academics who were attached to CEDU at the time of the inquiry, except very few who for special reasons such as ill-health were exonerated from the postgraduate supervision. Due processes were followed to obtain ethical clearance and permission to involve UNISA's staff in this study.

A questionnaire was designed with items related to technological tools and ICTs in accordance with TPACK and tailored on a four-point Likert scale. The first section of the questionnaire required supervisors' biographical information such as seniority, supervision experience in years, number of students supervised and number of students supervised at the time of the inquiry. This information was helpful in enhancing the researcher's understanding of supervisors' supervision success. This section dealt with the first research question. The next section contained a list of ICTs for supervisors to indicate their level of knowledge, i.e. 1: Thorough knowledge, 2: Good knowledge, 3: Basic knowledge, 4: No knowledge at all. Supervisors were asked to indicate the tools which were not mentioned and they knew about, and their level of knowledge of these tools. The questionnaire ended with an open-ended item, which asked supervisors if the tools in respect of which they responded to, played a role in the success of their supervision. These data addressed the second to the fourth research questions.

The questionnaire was pre-tested for content validity. As a result, 10 participants who participated in the pre-test were excluded from the main data collection. Minor structural modifications were effected in the questionnaire as a result of the pre-test. The main data were collected in two stages. In the first stage data were collected about the technological tools and ICTs. Specialised sections such as the ICT Department and Department of Curriculum and Learning Development at UNISA were consulted in this regard. Appointments were made with these sections to gather the information cited above. However, as stated above, the list of technological tools and ICTs in the questionnaire was not limited to UNISA only. The gathered information led to the second stage, i.e. gathering information about the supervisors' level of knowledge of technological tools and ICTs, and the use thereof in their postgraduate supervision. The questionnaire, together with clearly stated request and guidelines, was e-mailed to the supervisors to fill in.

IBM SPSS Statistics was used to carry out the statistical analysis. The reliability and validity of the instrument were assessed using Cronbach's alpha and exploratory factor analysis. Descriptive statistics (mean, standard deviation, proportions skewness and kurtosis) was used to describe the patterns and trends in the data. Cronbach's alpha was used to determine the internal consistency or average correlation of items in the instrument to gauge its reliability. "Reliability" means that a scale reflects the construct it is measuring (Field, 2006); it is the extent to which a variable or a set of variables is consistent in what it is intended to measure (Hair, Hult, Ringle & Sarstedt, 2014). Therefore, reliability means a variable or a set of variables which are consistent in performance or prediction (Salkind, 2012). According to Salkind (2012), internal consistency examines how unified the items are in a test of assessment. A "high" value of alpha is an indication that the items are measuring an underlying (or latent) construct. George and Mallery (2003, p. 231) provided a scale to determine reliability. A value greater than 0.9 is considered excellent, greater than 0.8 is considered good, greater than 0.7 is considered acceptable, greater than 0.6 is questionable, greater than 0.5 is considered poor and less than 0.5 is considered unacceptable. A Cronbach's alpha of 0.7 or more indicates a reliable scale, and a Cronbach value of 0.7 is normally used as the lower limit, although it may decrease to 0.6 in exploratory research (Hair *et al.*, 2014, p. 123). In this case, 0.7 was also used as an acceptable level. The reliability of the instrument used was obtained as shown in table 1.

Copyright © The Turkish Online Journal of Educational Technology

Table 1: Reliability results of the constructs			
Construct	**No. of items**	**Cronbach's alpha**	**Acceptable level**
Knowledge of tools	34	0.935	Excellent
Issues concerning ICT tools utilisation and supervision	16	0.959	Excellent
Total	***50***	***0.938***	***Excellent***

All the other dimensions had a reliability scale of more than 0.7. The reliability of the whole instrument was 0.938, which was excellent, and the overall instrument was, therefore, very reliable.

RESULTS

Characteristics of participants regarding their supervision of students

The response rate was 51 academic staff, comprising lecturers, senior lecturers, associate professors and full professors who were involved in the supervision of MEd (Master's in Education) and DEd (Doctor of Education) students in CEDU. The respondents were asked to indicate the number of years they have supervised the MEd and DEd students. Supervisors' experience in this regard ranged from 1 year to 32 years, giving a range of 31 years (see table 2).

Table 2: Summary statistics for number of years spent supervising MEd and DEd students	
Summary statistics	**Value**
Mean	8.775
Median	6.000
Mode	1.000[a]
Standard deviation	7.927
Skewness	1.124
Kurtosis	0.549
Maximum	32.00
Minimum	1.00
Range	31.00
Coefficient of variation	90.34%

The mean experience is 8.77 with a standard deviation of 7.93. Therefore, on average supervisors had 9 years of experience. One can conclude that supervisors had a lot of experience in supervising students and were familiar with the matters involving supervision of the students. The median value is 6 years. This means that 50% of the respondents had at least 6 years of experience. The coefficient of variation is 90.34%. This shows that there was a lot of variability, as evidenced by its departure from zero. The distribution and variability of the variable are shown in figure 1.

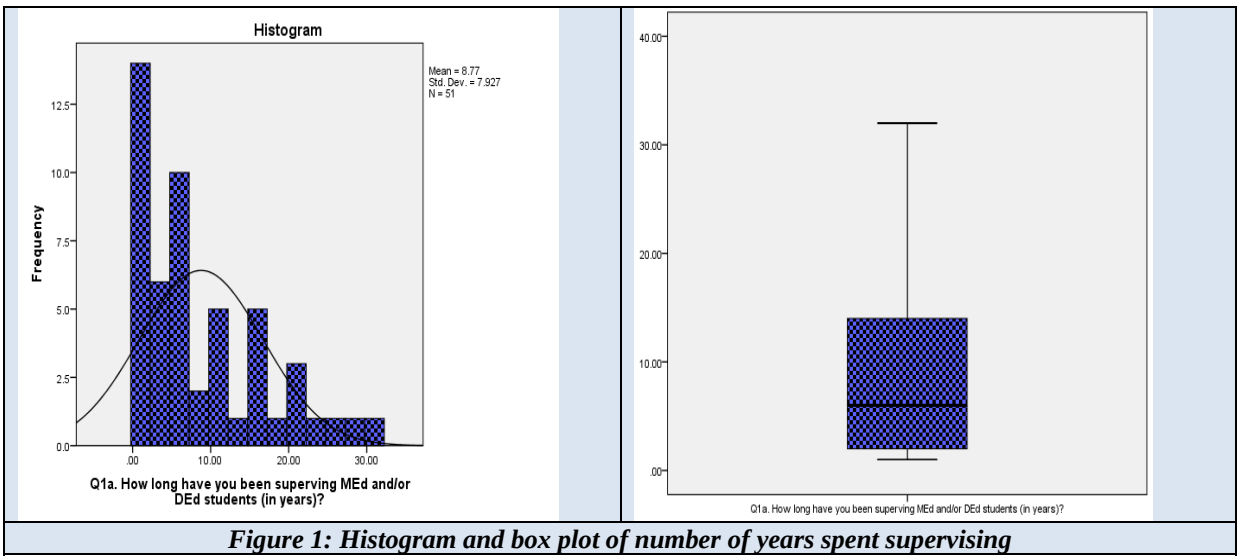

Figure 1: Histogram and box plot of number of years spent supervising

The modal value is one year. Therefore, the highest proportion of supervisors had one year experience, as evidenced by the highest peak at one in the histogram. The histogram shows that the data were positively skewed,

Copyright © The Turkish Online Journal of Educational Technology

which is also evidenced by the box plot that has a longer tail to the right. One can conclude that the years of experience are not normally distributed. A proper test of normality was done using the Shapiro Wilk test. The hypothesis to be tested was as follows:

- H_0: The data are from the normal distribution
- H_1: The data are not from the normal distribution

The 5% level of significance was used and a p-value of less than 0.05 led to the rejection of the null hypothesis. The Shapiro Wilk test gave a p-value of 0.000. The p-value is less than 0.05, leading to the rejection of the null hypothesis of normality; it is highly significant. Therefore, the data were not normally distributed. There were supervisors who had a lot of experience compared to the others.

In respect of whether the supervisors had received training in the use of online technology for supervisory work, about 25.5% (n=13) had received training while 75.5% (n=38) had not. Therefore, only a quarter had received training in the use of online technology.

The respondents were asked to indicate the number of MEd students that they had successfully supervised. There were 45 valid responses. The values ranged from 0 to 45. This means that some supervisors' students had not passed their dissertations or that some supervisors had not supervised a dissertation to completion (see table 3 for the summary statistics of the variable).

Table 3: Summary statistics for number of MEd students successfully supervised

Summary statistics	Value
Mean	6.70
Median	4.00
Mode	0.00
Standard deviation	8.715
Skewness	2.450
Kurtosis	7.791
Maximum	45.00
Minimum	0.00
Range	45.00
Coefficient of variation	130.07%

On average, supervisors had supervised 6.70, i.e. 7 students who had successfully completed their dissertations. The standard deviation is 8.715 years, with a coefficient of variation of 130.07%. There is a large variability with respect to the success of supervision of MEd students, as evidenced by how far the coefficient of variation deviates from 0% (no variability). The histogram and the box plot are shown in figure 2.

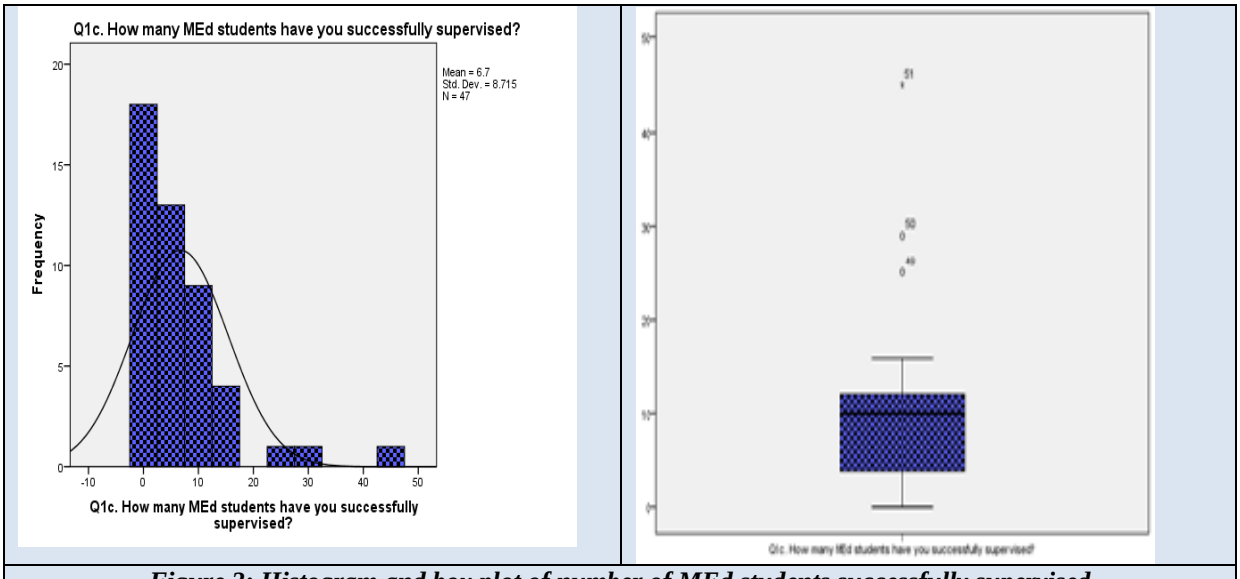

Figure 2: Histogram and box plot of number of MEd students successfully supervised

Copyright © The Turkish Online Journal of Educational Technology

The modal value is 0. With reference to the histogram, quite a number of supervisors did not record successes in MEd supervision. The descriptive statistics showed that 26.7% (n-12) had not supervised students who successfully completed their dissertations. However, 20.0% (n=9) of them had not supervised a student to completion. The data were positively skewed, as evidenced by the box plot. Two supervisors have respectively supervised 29 and 45 students who successfully completed their dissertations. The Shapiro Wilk test of normality gave a p-value = .001, leading to the rejection of the null hypothesis that the data were normally distributed. Therefore, the data were not normally distributed.

A total of 47 respondents indicated supervisors' success with the supervision of DEd students. Close to 50% (51%; n=24) of the supervisors did not record successes and 23 (48.9%) had not supervised a DEd student to completion. The values range from 0 to 21, giving a range of 21, as indicated in table 4.

Table 4: Summary statistics for DEd students successfully supervised

Summary statistics	Value
Mean	2.83
Median	0.00
Mode	0.00
Standard deviation	4.797
Skewness	2.148
Kurtosis	4.508
Maximum	21.00
Minimum	0.00
Range	21.00
Coefficient of variation	169.51%

An average number of 2.83 DEd students, that is, approximately three students per supervisor, were supervised to completion. The standard deviation is 4.797, with a coefficient of variation of 169.51%. Therefore, there is a large variability with respect to the number of DEd students who were successfully supervised. The median and modal values were 0. Therefore, at least 50% of the supervisors did not record successes in respect of DEd supervision. The distribution and the variability of the variable are shown in figure 3.

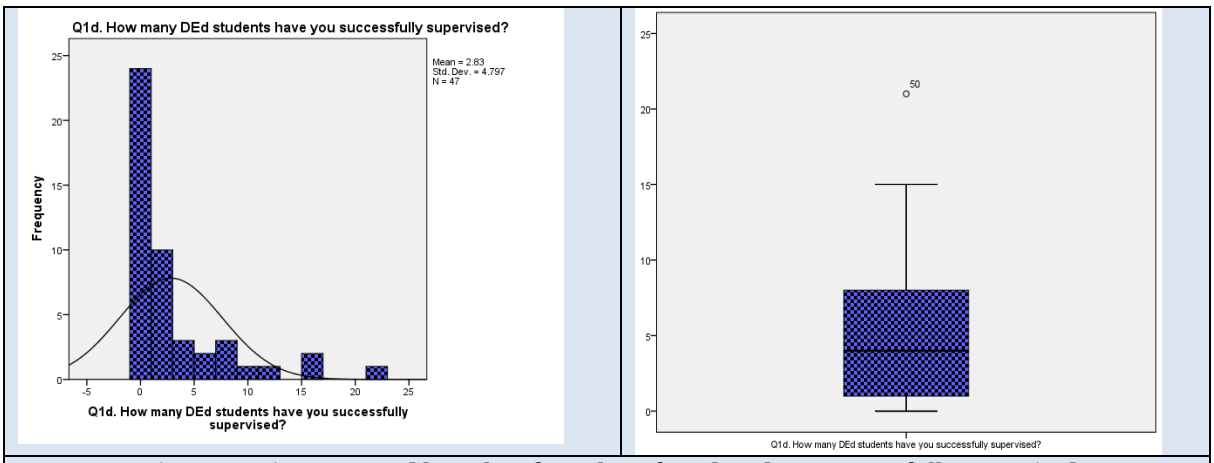

Figure 3: Histogram and box plot of number of DEd students successfully supervised

The histogram shows that the data were positively skewed. This is supported by the box plot which has a longer tail to the right, with outliers to the right. The test of normality gave a p-value of 0.002. The p-value is less than 0.05, leading to the rejection of the null hypothesis of normality. It is highly significant. Therefore, the data were not normally distributed. Some of the supervisors had successfully supervised more DEd students compared to the others.

A total of 45 supervisors indicated the number of MEd students they had unsuccessfully supervised. A total of 30 (66.7%) supervisors indicated that there were zero MEd students whom they had unsuccessfully supervised. Out of the 30, only 8 had never supervised an MEd student to completion. One can conclude that 53.3% (24) of the supervisors did not record failures in respect of supervising MEd students (see the summary statistics shown in table 5).

Copyright © The Turkish Online Journal of Educational Technology

Table 5: Summary statistics for MEd students unsuccessfully supervised	
Summary statistics	**Value**
Mean	0.96
Median	0
Mode	0
Standard deviation	1.731
Skewness	2.188
Kurtosis	4.955
Maximum	7
Minimum	0
Range	7
Coefficient of variation	180.31%

The average failure rate in respect of the supervision of the MEd students is approximately one student per supervisor, as evidenced by an average of 0.96. The standard deviation is 1.731, with a coefficient of the variation of 180.31%. Therefore, there is a large variability because the coefficient of variation is far from zero (no variability). The distribution and the variability of the variable are shown in figure 4.

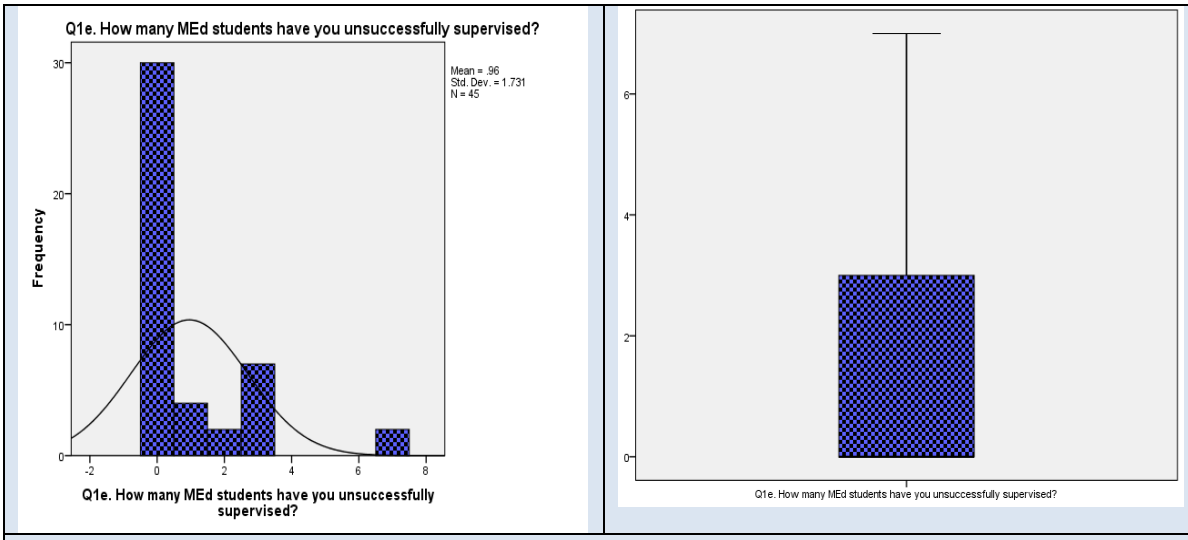

Figure 4: Histogram and box plot of number of MEd students unsuccessfully supervised

The highest proportion of supervisors had supervised zero MEd students, as evidenced by the highest peak at zero in the histogram. The histogram and the box plot show that the data were positively skewed, with outliers to the right. This is further supported by the Shapiro Wilk test, which gave a p-value of 0.000. The p-value is less than 0.05, leading to the rejection of the null hypothesis of normality; it is highly significant. Therefore, the data were not normally distributed.

In respect of the number of DEd students unsuccessfully supervised, there were 45 valid responses. Thirty-seven (82.2%) supervisors indicated a zero, i.e. either they had not supervised a student to completion, or had not had students who unsuccessfully completed their dissertations. In this case, 24 of them had not supervised students who completed their theses for submission, which means that 28.9% (n=13) had not had any DEd students who unsuccessfully completed their theses. These supervisors had a 100% success rate (see the summary statistics shown in table 6).

Table 6: Summary statistics for DEd students unsuccessfully supervised	
Summary statistics	**Value**
Mean	0.51
Median	0
Mode	0[a]
Standard deviation	1.456
Skewness	3.516
Kurtosis	12.628

Copyright © The Turkish Online Journal of Educational Technology

Table 6: Summary statistics for DEd students unsuccessfully supervised	
Maximum	7.00
Minimum	0
Range	7.00
Coefficient of variation	285.49%

The mean number of DEd students who were unsuccessfully supervised is 0.51, i.e. approximately one student per supervisor, with a standard deviation of 1.456. The coefficient of variation is 285.49%, which deviates far from zero. Therefore, there is a large variability, as evidenced by its departure from zero. The median and modal values are 0, which means that 50% of the respondents indicated a zero success. The distribution and the variability of the variable are shown in figure 5.

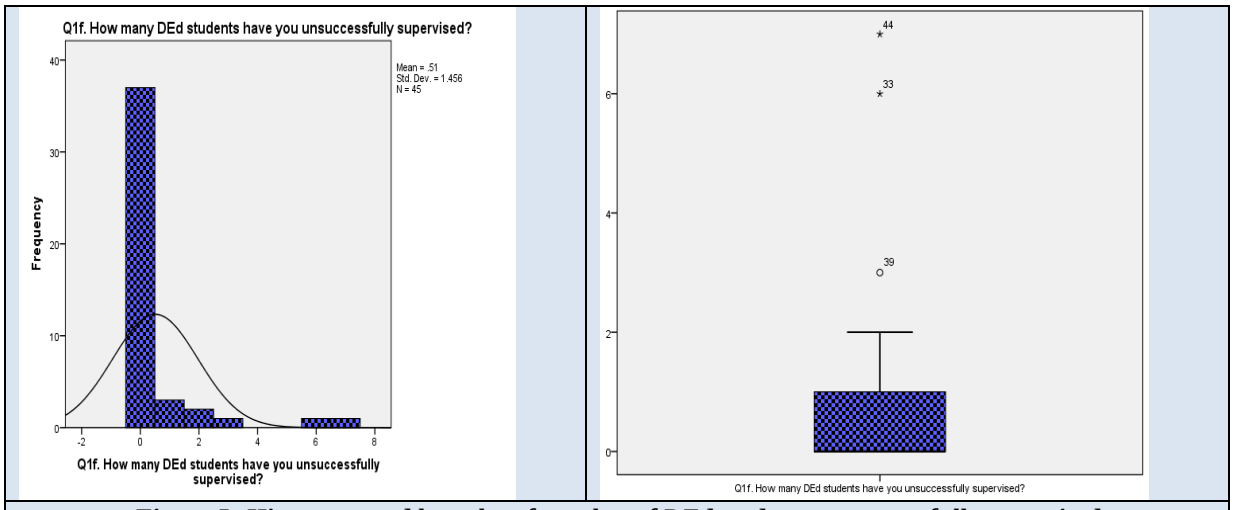

Figure 5: Histogram and box plot of number of DEd students unsuccessfully supervised

On the basis of the histogram, one can conclude that the data were positively skewed. This is supported by the box plot that has outliers to the right. A Shapiro Wilk test of normality gave a p-value of 0.000. Since 0.000<0.05, the null hypothesis of normality is rejected; the data were not normally distributed.

New variables were computed to determine the success rate of the supervision of students as a percentage. In respect of MEd students' supervision success rate, there were 36 valid responses. Therefore, out of the 51 academic staff who participated in the study, 36 had submitted the students' dissertations and recorded either successes or failures (see the summary statistics shown in table 6).

Table 6: Summary statistics for success rate of supervision of MEd students	
Summary statistics	**Value**
Mean	81.23
Median	100
Mode	100
Standard deviation	29.8609
Skewness	-1.783
Kurtosis	2.525
Maximum	100
Minimum	0
Range	100
Coefficient of variation	36.76%

The average success rate of the supervision of MEd students is 81.23%, with a standard deviation of 29.8609 and a coefficient of variation of 36.76%. Therefore, out of every 5 MEd students supervised, on average 4 successfully completed an MEd thesis. The variability is not large, since 36.76% is not far from zero (no variability). The histogram and box plot that indicate the distribution of the success rate of the supervision of MEd students and the variability of the variable are shown in figure 6.

Copyright © The Turkish Online Journal of Educational Technology

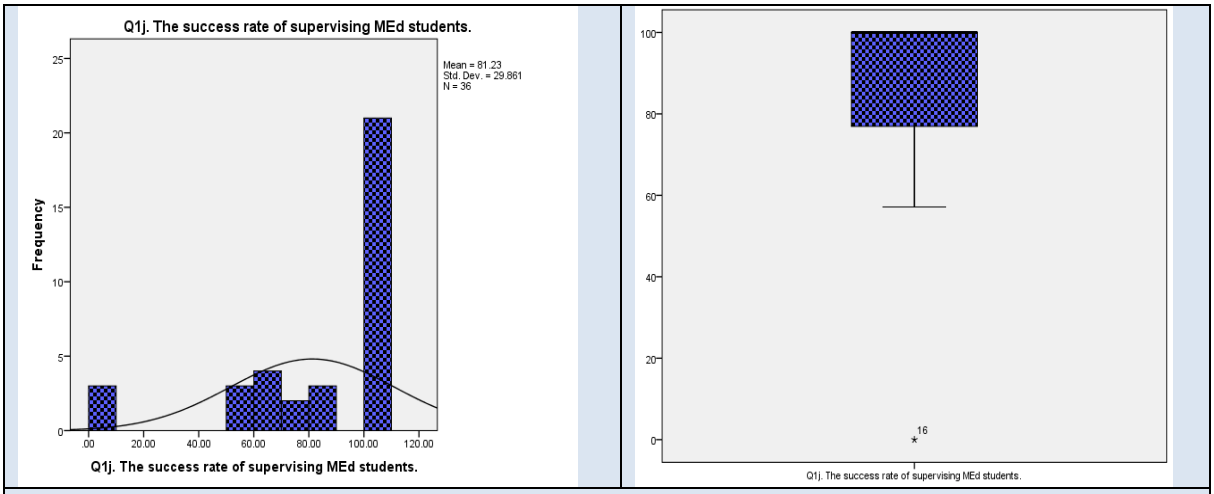

Figure 6: Histogram and box plot of success rate of supervision of MEd students

The highest proportion of supervisors had a 100% success rate. The histogram and box plot show that the data were negatively skewed. This is further supported by the Shapiro Wilk test, which gave a p-value of 0.000. The p-value is less than 0.05, leading to the rejection of the null hypothesis of normality; it is highly significant. Therefore, the data were not normally distributed.

In respect of the success rate of the supervision of DEd students, there were 22 valid responses. Therefore, only 22 supervisors supervised DEd students to completion. Out of these supervisors, 14 (63.6%) had a 100% success rate. Only 4.5% (n=1) of the supervisors had a 0% success rate (see summary statistics shown in table 7).

Table 7: Summary statistics for success rate of supervision of DEd students

Summary statistics	Value
Mean	82.90
Median	100
Mode	100[a]
Standard deviation	30.1083
Skewness	-1.778
Kurtosis	2.085
Maximum	100.00
Minimum	0
Range	100.00
Coefficient of variation	36.32%

The mean success rate of the supervision of DEd students is 82.90%. Therefore, out of every 5 DEd students supervised, on average 4 successfully completed their theses. The median and modal values are at 100%. The coefficient of variation is 36.32%, which does not deviate far from zero. This shows that there is not much variability, as evidenced by its departure from zero. The ratio of the standard deviation to the mean is 36:1. The distribution and the variability of the variable are shown in figure 7.

Copyright © The Turkish Online Journal of Educational Technology

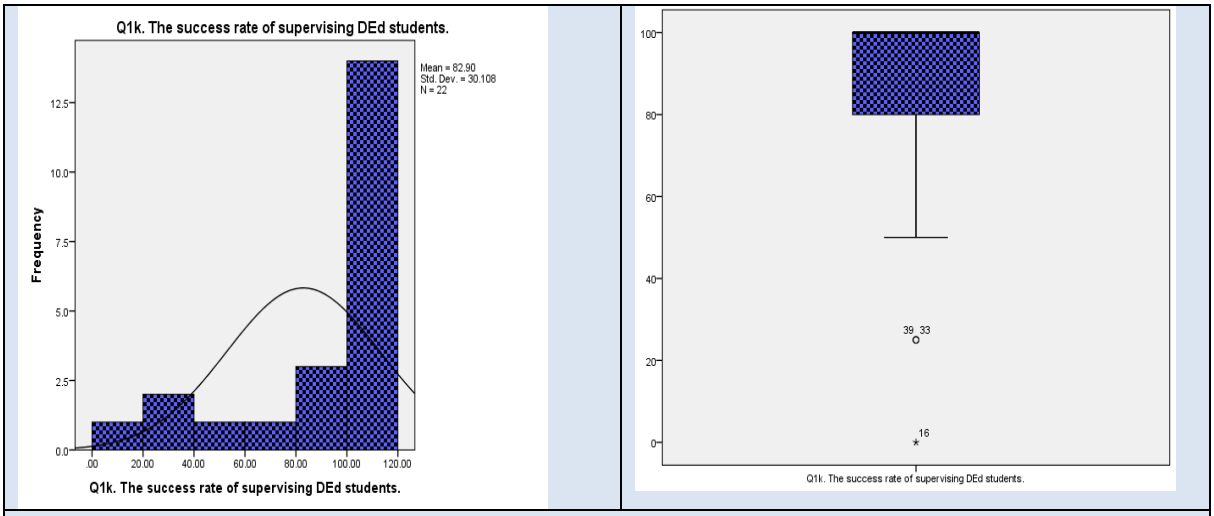

Figure 7: Histogram and box plot of success rate of supervision of DEd students

On the basis of the histogram, one can conclude that the data were negatively skewed, which is supported by the box plot that has outliers to the left. A Shapiro Wilk test of normality gave a p-value of 0.000. Since 0.000<0.05, the null hypothesis of normality is rejected; the data were not normally distributed.

KNOWLEDGE OF TECHNOLOGICAL TOOLS AND ICT

The respondents were asked to rate their level of knowledge about technological tools and ICTs. The rating was based on a 4-point scale ranging from no knowledge at all to thorough knowledge. The respondents' level of knowledge was measured by combining the categories "good knowledge" and "thorough knowledge". Table 8 reflects the respondents' level of knowledge of technological tools and ICTs.

Table 8: Knowledge level of technological applications/tools and ICT

ICTs/technological tools	Level of knowledge				Rank
	Thorough knowledge	Good knowledge	Basic knowledge	No knowledge at all	
SMS	68.0% (34)	22.0% (11)	6.0% (3)	4.0% (2)	1
E-mail (Outlook)	64.0% (32)	26.0% (13)	6.0% (3)	4.0% (2)	1
MS Word	56.9% (29)	31.4% (16)	7.8% (4)	3.9% (2)	3
Computer	45.1% (23)	43.1% (22)	11.8% (6)	-	3
Laptop	43.1% (22)	45.1% (23)	9.8% (5)	2.0% (1)	3
PowerPoint	49.0% (24)	32.7% (16)	12.2% (6)	6.1% (3)	6
myUnisa	35.3% (18)	45.1% (23)	15.7% (8)	3.9% (2)	7
WhatsApp	44.9% (22)	30.6% (15)	16.3% (8)	8.2% (4)	8
Data projector	37.3% (19)	33.3% (17)	19.6% (10)	9.8% (5)	9
Bulk SMSs	37.5% (18)	27.1% (13)	20.8% (10)	14.6% (7)	10
Discussion forum	42.0% (21)	22.0% (11)	16.0% (8)	20.0% (10)	11
Search engines	26.0% (13)	38.0% (19)	22.0% (11)	14.0% (7)	11
Whiteboard	30.6% (15)	28.6% (14)	12.2% (6)	28.6% (14)	13

Copyright © The Turkish Online Journal of Educational Technology

Table 8: Knowledge level of technological applications/tools and ICT					
ICTs/technological tools	**Level of knowledge**				**Rank**
	Thorough knowledge	**Good knowledge**	**Basic knowledge**	**No knowledge at all**	
Video conferencing	15.7% (8)	27.5% (14)	27.5% (14)	29.4% (15)	14
Skype	17.0% (8)	25.5% (12)	29.8% (14)	27.7% (13)	15
Facebook	16.3% (8)	22.4% (11)	32.7% (16)	28.6% (14)	16
BBM	27.3% (12)	11.4% (5)	20.5% (9)	40.9% (18)	17
Excel	16.0% (8)	20.0% (10)	40.0% (20)	24.0% (12)	18
Dropbox	17.4% (8)	17.4% (8)	30.4% (14)	34.8% (16)	19
Google Drive	24.5% (12)	8.2% (4)	34.7% (17)	32.7% 916)	20
Blog	8.5% (4)	23.4% (11)	23.4% (11)	44.7% (21)	21
Twitter	8.3% (4)	18.8% (9)	25.0% (12)	47.9% (23)	22
Sign-up	12.8% (6)	10.6% (5)	27.7% (13)	48.9% (23)	23
E-reader	8.5% (4)	14.9% (7)	27.7% (13)	48.9% (23)	24
Podcast	6.1% (3)	16.3% (8)	30.6% (15)	46.9% (23)	25
WeChat	8.7% (4)	13.0% (6)	23.9% (11)	54.3% (25)	26
Wikis	10.6% (5)	10.6% (5)	14.9% (7)	63.8% (30)	27
ooVoo	12.8% (6)	4.3% (2)	6.4% (3)	76.6% (36)	28
RSS	6.7% (3)	8.9% (4)	13.3% (6)	71.1% (3)	29
Mendeley	6.3% (3)	6.3% (3)	12.5% (6)	75.0% (36)	30
Social bookmaking	2.1% 91)	8.5% (4)	12.8% (6)	76.6% (36)	31
Screen	2.2% (1)	4.4% (2)	11.1% (5)	82.2% (37)	32
Syndication	2.1% (1)	2.1% (1)	12.8% (6)	83.0% (39)	33
Tag-based folksonomies	2.1% (1)	2.1% (1)	10.6% (5)	85.1% (40)	33

The technological tools and ICTs about which the respondents had a level of knowledge above 70% are sms (90%), e-mail – outlook (90%), MS Word (88.2%), computer (88.2%), laptop (88.2%), powerpoint (81.6%), myUnisa (80.4%), WhatsApp (75.5%) and data projector (70.6%).

They are the tools that the supervisors are the most knowledgeable about in respect of usage. The tools that more than 70% of the supervisors are not knowledgeable about at all are tag-based folksonomies (85.1%), syndication (83.0%), screen (82.2%), ooVoo (76.6%), social bookmaking (76.6%), mendeley (75.0%) and RSS (71.1%). These are the tools that the majority of the supervisors are not knowledgeable about at all.

Copyright © The Turkish Online Journal of Educational Technology

The respondents were asked to indicate the tools that were not mentioned but which they were knowledgeable about. Table 9 indicates the tools mentioned and the level of knowledge; the number of respondents who mentioned the tool is indicated in brackets.

Table 9: Tools not mentioned in respect of which respondents indicated a level of knowledgeability

Thorough knowledge	Good knowledge	Basic knowledge	No knowledge at all
Viber (2) Google Scholar (1) LinkedIn (1) Turnitin (1) Kik (1) EView tools (1) FaceTime (1)	SMART Board (1) MS Access (1) Chatrooms (1) e-Resources (1) e-Journals (1) Unisa institutional repository (1) Linkedin (1) Turnitin (1) Moodle (1) Vimeo (1)	Google Scholar (1) Turnitin (1) J-Router (1)	MiIT (2) Marking tool (1)

Role of technological tools and ICTs in supervisors' successful supervision of students

Supervisors responded positively to the open-ended question about whether technological tools and ICTs played a role in their successful supervision of students. There were only a few exceptions where supervisors did not respond to the question or expressed indecision. A few selected responses in this regard are given thus:

- "ICT and online technology improved communication between supervisor and student, broadened the students' intellectual horizons and provided better access to sources. It made feedback quicker and more effective."
- "Yes. There was progress reported while using the ICT tools."
- "Yes, it made communication easier and to respond to students' needs much quicker."
- "Yes, using track changes in MS Word helps with providing guidance on argumentation, formulation, logic etc of text. I assist students in locating appropriate and relevant sources through doing searchers on the internet and providing the student with the URLs. I forward interesting articles and websites through email."
- "Yes. Timeous feedback; quick analysis; better guidance re literature search."
- "Yes, I use mainly email as an ICT tool to communicate with my students and that has been fruitful as most of the students have access to email and internet. My knowledge of using a computer and accessing the internet has assisted me in successful supervision as that is the tool that I mainly rely on to help my students."
- "Yes, definitely as I can get information to them and from them very quickly."

DISCUSSION

Though the results show that supervisors who participated in the study had a lot of supervisory experience, some were more experienced than others. Seeing that they work in an ODeL context, one would have expected them to be equipped to supervise via technological tools and ICTs. Yet, only a quarter of the supervisors claimed to have received training on supervising students online. A good number of supervisors had supervised MEd students who did not pass their dissertations, or had not supervised a dissertation to completion. The fact that more junior staff members are also expected to supervise students owing to the demands posed by high student numbers partly explains this situation.

Two supervisors, in particular, had successfully supervised 29 and 45 MEd students respectively. About 50% of the supervisors had not supervised DEd students to completion and the results show that, on average, three students per supervisor were successfully supervised. The results take into account the supervisors who either had not supervised MEd or DEd students or had not supervised them successfully. In both these categories, the supervision success rate is above 80%. This success rate does not necessarily mean a spread-across-supervisors picture. The reality in CEDU is that much fewer supervisors account for this success rate, regardless of whether technological tools and ICTs are used or not. It seems that the level of experience and other factors such as those mentioned in the introduction weigh more than the use of technological tools and ICTs. The supervisors had good to thorough knowledge about the common technological tools and ICTs such as e-mail, MS Word and laptops, but basic to no knowledge about the social media tools and other additional tools that they mentioned. They attested to the fact that technological tools and ICTs did help them to achieve success in their supervision of

Copyright © The Turkish Online Journal of Educational Technology

students. The question is, how could they appreciate the value of technological tools and ICTs when only a quarter of them had received training in the use of technological tools and ICTs? It is however possible that they were self-taught. In line with Mbangwana's (2008) findings, the use of technological tools and ICTs can transform practice in so far as the supervision of students is concerned, thus enabling supervisors to achieve success, that is, to supervise students until they have successfully completed their dissertations and theses. Supervisors can, therefore, benefit a great deal from enhancing their knowledge of TPACK in the seven domains explained by Mishra and Koehler (2006) and Schmidt *et al.* (2009).

CONCLUSION AND RECOMMENDATIONS

Supervising postgraduate students through technological tools and ICTs can help alleviate the challenges surrounding this task and thus contribute towards successful supervision. The study shows that supervisors are knowledgeable about the so-called ubiquitous tools but are not very knowledgeable about newer ones, especially the social media tools. Nonetheless, most importantly in this study, is the fact that supervisors attested to the contribution that ICTs and, by implication, online supervision make to the task of supervising students. The limitation of the study is that it does not directly link the use of technological tools and ICTs to specific supervisors, even though the majority of the supervisors attested to the usefulness of technological tools and ICTs. The following recommendations are made on the basis of the results:

- Supervisors should be made aware of the wealth of the available technological tools and ICTs which they can use in their supervision of students.
- Supervisors should be trained and exposed to more technological tools and ICTs which can benefit their supervision of students.
- Experienced supervisors, especially those who have seen the benefits of using technological tools and ICTs in their supervision of students should mentor inexperienced supervisors.
- More research should be conducted by engaging multi-method studies, which will confirm or refute the effectiveness of the use of technological tools and ICTs in the supervision of students.

With this taken care of, supervisors can conveniently supervise their students online.

REFERENCES

Abiddin, N.Z., Ismail, A., & Ismail, A. (2011). Effective supervisory approach in enhancing postgraduate research studies. *International Journal of Humanities and Social Science, 1*(2), 206-217.

Cox, S., & Graham, C.R. (2009). Diagramming TPACK in practice: Using an elaborated model of the TPACK framework to analyze and depict teacher knowledge. *TechTrends, 53*(5), 60-69.

Creswell, J.W. (2009). *Research design: Qualitative, quantitative and mixed methods approaches*. Third edition. Los Angeles: Sage.

Evans, A., Martin, K., & Poatsy, M.N. (2010). *Technology in action*. Sixth edition. New Jersey: Pearson Prentice Hall.

Field, A.P. (2006). The behavioural inhibition system and the verbal information pathway to children's fears. *Journal of Abnormal Psychology, 115*(4), 742-752.

Glasow, P.A. (2005). *Fundamentals of survey research methodology*. McLean: MITRE.

George, D., & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference 11.0 update.* Fourth edition. Bpston: Allyn & Bacon.

Hair, J.F., Hult, G.T.M., Ringle, C.M., & Sarstedt, M. (2014). *A primer on partial least squares structural equation modelling (PLS-SEM)*. Thousand Oaks: Sage.

Koehler, M.J., & Mishra, P. (2009). What is technological pedagogical content knowledge? Contemporary issues in technology and teacher education. Retrieved from http://www.citejournal.org/vol9/iss1/general/article1.cfm

Koehler, M.J., & Mishra, P. (2008). Introducing TPACK. In AACTE Committee on Innovation and Technology (Ed.). *Handbook of technological pedagogical content knowledge (TPACK) for educators* (pp. 3-29). New York: Routledge.

Kothari, C.R. (2004). *Research methodology: Methods and techniques*. New Delhi: New Age International Ltd.

Lessing, A.C., & Schulze, S. (2003). Lecturers' experience of postgraduate supervision in a distance education context. *South African Journal of Higher Education, 17*(2), 159-168.

Mbangwana, M.A. (2008). *Introduction of ICT in schools and classrooms in Cameroon*. Retrieved from http://www.rocare.org/changingMindsets/pdf/ch09-I

McGrath, J., Karabas, G., & Willis, J. (2011). From TPACK concept to TPACK practice: An analysis of the suitability and usefulness of the concept as a guide in the real world of teacher development. *International Journal of Technology in Teaching and Learning, 7*(1), 1-23.

Copyright © The Turkish Online Journal of Educational Technology

McKavanagh, C., Bryant, K., Finger, G., & Middleton, H. (2004). *Information and communication technologies and higher degree research supervision*. Paper presented at the Annual International HERDSA Conference. Miri, Sarawak, Malaysia.

Mishra, P., & Koehler, M.J. (2006). Technological pedagogical content knowledge: A framework for integrating technology in teachers' knowledge. *Teachers College Record*, *108*(6), 1017-1054.

Roets, L. (2013). Learning through reflection: Supervising DRC master's degree students within the open distance and learning context. *Journal of Nursing Education and Practice*, *3*(10), 139-149.

Salkind, N.J. (2012). *Exploring research.* Eighth edition. New York: Pearson.

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.

Shulman, L.S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, *57*(1), 1-21.

Stacey, E. & Fountain, W. (2001). *Student and supervisor perspectives in a computer-mediated research relationship*. Paper presented at the 18th Annual Conference of the Australian Society for Computers in Learning in Tertiary Education (ASCILITE). Melbourne, Australia.

Valetsianos, G. (Ed.). (2010). *Emerging technologies in distance education*. AU Press: Athabasca University.

Wheeler, S. (2010). *What is so innovative about ICT?* Retrieved from http://steve-wheeler.blogspot.com/2010/04/whats-so-innovative-about-ict.html

Yin, R. (2009). *Case study research: Design and methods.* Fourth edition. Thousand Oaks, CA: Sage.

Copyright © The Turkish Online Journal of Educational Technology