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Full Length Research Paper

Educator's pedagogy influencing the effective use of computers for teaching purposes in classrooms: Lessons learned from secondary schools in South Africa

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The use of computers in the classroom could allow both educators and learners to achieve new capabilities. There are underlying factors, however, that are obstructing the adoption rate of computer use for instructional purposes in schools. This research focused on these problems with a view to determining which critical success factors promote a higher adoption rate of computer usage in education. To investigate the secondary school educator's perceptions of the use of computers for teaching purposes and to analyse the effect of these strategies on their teaching pedagogies in the present environment. The nature of the study required a mixed methods approach to be employed, making use of both quantitative and qualitative data. Two questionnaires, one for the educators and one for the principals of the schools were hand-delivered to 60 secondary schools. Exploratory factor analysis and various internal consistency measures were used to assess and analyse the data. The analyses of the data indicated that educator pedagogies were the highest predictors on the use of computers in the classroom. Although the quantitative analyses for educator support, training and attitude were the lowest predictors on the use of computers, the qualitative analysis, nevertheless, found sufficient support for it. Educationists and policy-makers must include all principals and educators when technological innovations are introduced into schools. All these role-players need to be cognisant of the implications if innovations are not appropriately implemented. Including the use of computers in educator training programs is important so that pre-service educators can see the benefits of using the computer in their own teaching. Educator pedagogy, theories and beliefs and access to computers were the highest predictors of using computers, hence a model was developed. The model aims to strengthen the educators' initiatives to increase the likelihood that would result in enhanced teaching and learning when using computers.

Key words: Computers, educator attitude, educator pedagogy, educator support, educator-computer access, educator theories and beliefs, secondary schools, educator-computer training, adoption.

INTRODUCTION

The use of computers for teaching purposes continues to create pedagogical and didactic problems in South Africa (Hodgkinson-Williams, 2005). During the last seven years (2001-2008), the provincial government of the Western Cape in South Africa has provided core funding for the Khanya project, amounting currently to R104 million; while donor organisations and corporate sponsors have donated another R20 million to bring computers into schools (Khanya, 2006). A large portion of the allocation went to the improvement of the existing infrastructure and the procurement of hardware and software. The hope that a substantial disbursement of funds would lead to a change in the way educators teach has not yet been fully realised (Miller et al., 2006a). The Department of Education in (DoE) policy document stipulates that: "Every South African learner will be information and communication technology (ICT) capable by 2013" (DoE 2003, p. 17). Although technology, on its own, will not change the teaching and learning processes, computer use and the acquisition of computer skills should be able to assist learners and educators to improve them (Infodev, 2005). The Department of Education (2003), furthermore, believes that computers will be able to improve on how educators teach and learners learn. Evidence from the literature surveyed shows that mobilising educators to use computers in their teaching is a slow and tedious process. Those who use computers can participate in the information society, by resorting to enquiry-based learning and developing higher-level thinking skills (DoE, 2003).

The realisation of DoE policy goals thus requires the integration of computers in teaching and learning. Therefore, the use of computers in teaching and learning is to be strongly encouraged. With the shortage of educators and the huge dropout of learners in South Africa, a radical approach to propel the educational system forward is urgently required. This is achievable through the widespread application of computer use (Dugmore, 2004). Learners need to understand that when they enter the real world, they will need to be productive. They must be able to use computers to produce new intellectual and creative work that will add value to society. More importantly, they will require computer skills to provide and communicate new knowledge. Many of the secondary school computer studies deal with sophisticated educational programs and computer resources, but give inadequate attention to the reasons why educators are not using computers in their teaching. The reason for this could be that most of the literature on computers and education is to be found in developed countries, where computer resources are not as limited as they are in most South African schools. Consequently, this research has the potential to add to the literature in a manner that could enhance the use of computers in secondary schools throughout the civilised world.

Weakness in the literature

The most conspicuous void in the literature is the paucity of empirical research in South African schools regarding educators' use of computers in secondary schools. Although the results of international studies may possibly be extrapolated to predict educators' use of computers in South Africa, it is critical that high-quality locally based research be conducted on the use of computers in secondary schools. Secondly, the process of encouraging educators and schools to use computers for lesson delivery in the classrooms should be seen as comprising two separate issues namely: educator motivation and whole school drive to use computers. Thirdly, the literature is parsimonious regarding the role that computers are playing in schools confronted by huge problems, such as funding, incompetent leaders in schools, ageing staff, and computer-illiterate educators. It would be amiss to believe that training alone will solve some of these problems; they are too complex for facile solutions.

Research problem and research question

The legacy of apartheid in education is persistent and there is strong evidence that South Africa is behind other developing countries in terms of the quality of its educational outputs (Strydom et al., 2005; SACE, 2005). Therefore, research involving curricula innovations and successful implementations for progressive educational reform are critically necessary to improve the quality of teaching outputs. Thus, the research problem centres on the need for secondary school educators in the Western Cape central metropolis to harness the power of the computer to teach in their classrooms. The primary research question that directs this research is: What are the contributing factors in the use or non-use by secondary school educators of computers as instructional tools in their classrooms? Having articulated the issues that educators encounter with computers in education, the following subsidiary question can be formulated that will guide this research. Do computers have any effect on the educators' pedagogies?

Literature review

The use of computers is complex especially on the pedagogical roles of educators, and a rationale for using computers in schools is their catalytic effect in transforming the teaching and learning process (Hawkridge, 1990). Therefore, educators' pedagogical beliefs and theories play a critical part in moulding computer-learning opportunities in classrooms. Carnoy (2004, p.14) argues that most educators are arriving at the old conclusion that it is becoming increasingly difficult for them to improve teaching and "learning in schools by whatever means without improving teachers' knowledge of subject matter including ICT skills". He states that educators are unable to develop higher-order thinking skills in learners, when they themselves have not acquired these skills. Moreover, he suggests that the use of computers for lesson delivery will always depend on the type of training the educator has received congruent to their skills. It is therefore imperative that during the designing of new technologies, the expertise of educators must be included. A disconcerting observation by Williamson (2003) is that most educational design practices, from usability through to co-operative inquiry, are conducted in the absence of educators. Moreover, he laments the fact that this behaviour is improper, as it is the educators who have to incorporate computer technology into their teaching plans. By precluding educators from the designing of educational technology, there is a chance of developing computer innovations that will fall outside any pedagogical requirements. The mere introduction of technology alone will not be able to change the teaching and learning process. The use of computers, however, will enable educators to change their teaching styles. Computers are used in education to support existing pedagogical practices (e.g. educator-centric, rote learning), as well as learner-centric (e.g. constructivist) learning models (Infodev, 2005). The use of computers, however, has become more effective when it assists in learner-centric pedagogies. However, Niess (2005) states that in order for technology to become an essential component for teaching and learning, educators must develop an overarching concept of their teaching material, and what it entails to teach, when using computers. The survey by Strydom and others (2005) considered factors that influence the way in which educators impart knowledge and how students learn. Their study found that after educators were trained on the Intel® Teach to the Future program, 80% of their computer activity was related to administrative work. Hence, this finding indicates that educators are merely "using computers primarily as a representational tool" (Strydom et al., 2005, p.82).

An important aspect of educator training is not only to train them in how to use computers effectively, but to ensure that educators are knowledgeable when using computers to prepare their lessons (Jones, 2004). Retrospectively, equipping educators with computer skills does not necessarily mean that educators will use computers to improve their lesson instruction in classrooms. At the same time, Koc (2005) found the lack of pedagogy in computer training to be inefficient as regards any initial educator training. In addition, trainee-educators bemoaned the fact that their instructors failed to address the key aspects associated with the pedagogical use of computers (Koc, 2005). Evidence from educational studies has been documented which shows that some educators are now starting to use computer technology to change their pedagogy and curricula (Schofield and Davidson, 2002; Means et al., 2001). In the past, educators used to impart knowledge through teacher-centric methods. Now, using computers, educators prepare projects, allow access to the appropriate resources and create structures and support systems that assist students in succeeding (Kozma, 2003; Martin et al., 2004). Thus, students are now empowered to tackle complex and more difficult problems by themselves. Sadly, education in South Africa, especially in black communities, is devoid of resources and any relevant pedagogy, and some educators are still imparting knowledge through a 'chalk and talk' mode (Hayman, 1999; Infodev, 2005).

A study by Preston and others (2000) has shown that educator pedagogies will always influence the learners' use of computers. This approach provides an authentic context for learning. Bransford et al. (2000) suggest that when educators empower students to learn by using computers, the emphasis moves away from the idea of learning by the rote memorisation of facts, towards learning as a process of knowledge creation. Research studies have also begun to document the fact that many educators view computers as a resource to assist them in teaching the prescribed curriculum (Schofield and Davidson, 2002), while a few educators view computers as a way to change what is being taught, and how the learning of learners is assessed. Accordingly, educator beliefs, computer resources and the ability of the educator to integrate computers into their lessons have changed the perceptions of educators' use of computers and technology in teaching (Cox et al., 2004).

In an international study of Technology and Classroom Practices by Kozma (2003), the conclusion was reached that educators in many countries are starting to use computers to assist changes in classroom teaching and to integrate computer technology into the curriculum. According to Kozma (2003), educators are now utilising computers to change their role from the main source of information to one where they provide students with advice monitor their progress and assess their performance. Becta (2004) advocated that when educators have to implement new instructional strategies, the educators must be able to absorb new knowledge about computers and incorporate this new knowledge into the existing curriculum and existing pedagogies. However, it seems that some educators have used computers as a tool for teaching purposes instead of using them in the formation of a new integrated pedagogy. The computer and pedagogy literature suggests that educators are currently developing higher levels of pedagogic repertoires as a result of using computers in their lessons; and they are prudently incorporating computer technologies into methods that are concomitant with their teaching plans. Educator-training programs ought to prepare and provide support to educators and, in addition, challenge educators' beliefs regarding the way they teach their subjects and how the use of computers can enhance the way in which students learn (Cox and Marshall, 2007).

Educators must be convinced of the value of computer technology as a supplement to enhance teaching and learning practices in the classrooms. Wozney et al. (2006), postulate that computers must be systematically integrated into the curriculum, and not just added on. Moreover, by implementing computers in this organised manner, it could be a trump card through which sceptical educators may develop positive beliefs on how computers can be used as a tool for teaching and learning (Wozney et al., 2006).

Generation of hypothesis

Evidence in the literature suggests that the use of computers in classrooms has some interactive relationship with different pedagogical styles. In examining the computer and education literature, it became evident that some educators develop a more constructivist pedagogy through working jointly with other educators who face similar challenges (Solvie and Kloek, 2007; Chien-Sing, 1999). For this study, the prospect that the use of computers could have contributed to educators changing their pedagogical style is important. For example, increased student involvement with computers can improve student learning and satisfaction.

A few authors Mueller, Wood, Willoughby, Ross, and Specht, 2008 and Smarkola 2008, argue that with their use, computers can increase the depth and breadth of educator beliefs on learning and other pedagogical topics Mavaresh (1996, cited in Clarkson, 2002) believed that until educators learn to use technology better, they must inevitably endure a short-term drop in self-confidence, even though they might expect a rise in skills and personal competencies at a later stage. This depiction explains why educators are unwilling to start their personal change process, irrespective of its duration. Some scholars believe that these transitions in pedagogy may take several years or they may happen within a year Richardson and Anders (1994, cited in Clarkson, 2002). Therefore, the Hypothesis states: There is a significant correlation between computer utilisation for teaching purposes by secondary school educators in the Western Cape central metropole and educators' pedagogy.

METHODOLOGY

Observation was conducted in a few schools, while educators were conducting their daily classroom lessons. Preliminary information gathering was conducted by informally talking to several educators so that the researcher could get a 'feeling' for what was transpiring in the actual situation. Two questionnaires were adopted and then adapted from previously validated studies to collect data determining the use of computers in secondary schools. In the data analysis step, data were statistically analysed to investigate which variables influenced the use of computers in secondary schools. Neuman (2000, p. 250) states, "survey research is often called correlational." Following a rigorous evaluation of the various research methodologies, a survey-correlational study was found to be the most appropriate method for this research since this method is frequently used in research on information technology and computer use. In this research, the unit of analysis is the individual educator in secondary schools of the Western Cape central metropole. Hussey and Hussey (1997, p. 122) states that it is best to select a unit of analysis at "as low a level as possible," as it is at that level that decisions are made. During the preliminary phase of the research, exploratory interviews were conducted to collect preliminary information, as suggested by Hussey and Hussey (1997).

The interviews were conducted using a face-to-face interviewing technique with open-ended questions. School district managers, secondary school educators and school principals were targeted. Simple random sampling was used to select the individuals to be interviewed. Two structured questionnaires, the educator questionnaire (EQ) and the Principal Questionnaire (PQ), were used as the research instruments in the present study. A covering letter was attached to the questionnaire to explain the survey objectives to respondents. The letter also indicated that all information obtained would be subject to anonymity and confidentiality and would be used only for the purposes of the present study. The Principal Questionnaire (PQ) was developed to gather data in support of what educators receive in using computers for their lesson delivery, the type of resources in the schools, barriers in the implementation of computer innovations in schools, the funding of computers, and in-service and pre-service educators' training and attitudes towards using computers. The pilot survey was conducted by a personal visit to a secondary school where the educators were not connected to the sample group proper. The school secretary was requested to distribute the questionnaire to the respondents with a short explanation of the survey. In addition, a contact number from each respondent was requested as a follow-up to the survey. In total, 47 questionnaires were distributed. The time taken to answer all the questions in the pilot survey was between 15 and 20 min. After two days, a follow-up was done, and the response rate was 20%. This was insufficient to perform any meaningful corrections to the questionnaires. After two weeks of follow-up, 35 out of the 47 questionnaires, which had been administered, were completed. This amounted to a response rate of 75%. Each of the completed pilot questionnaires was individually scrutinised, as suggested by (Saunders et al., 2003).

The scrutinising of the pilot questionnaire procedure was done to determine whether any of the respondents had difficulties in interpreting or answering the questions - whether the instructions were clearly understood, and to take note of any criticisms and comments made by the respondents. A few changes were made to the questionnaire design, such as the formatting of the questionnaire in order to improve the understanding. Changes were made to negatively worded items and the respondents' feedback was acknowledged. Special care was taken to re-test the questionnaire where items had been re-worded or changed. Cronbach's alpha was used to test for inter-item consistency. According to de Vaus (2007, p. 21), "…of the internal consistency measures Cronbach's alpha is the most widely used and is the most suitable". This scholar maintains that it examines how a group of variables is related to other groups of variables. According to de Vaus (2007), reliabilities in the 0.8 range is good and those in the 0.7 range is still acceptable. This study used both content and face validity by asking a few school principals (excluded from the study) to provide their opinions and criticisms of the questionnaire. Based on their suggestions and recommendations some changes were made to the wording and the layout of some of the questions. There are 1816 (n=1816) secondary school educators and 60 (n=60) principals teaching in 60 schools in the Western Cape central metropole (WCED, 2009). The research did not include secondary school educators and principals in the Western Cape, North, South and East educational metropoles, due to lack of funding, time, logistics and travelling constraints.

This study made use of a convenience sampling technique (Sekaran and Bougie, 2010). In this study the population was 1816 (n=1816) secondary school educators. In some studies, the entire population is surveyed, providing it is of a manageable size. All (n=60) principals were selected for the sample. Therefore, the original intention was to survey all the educators in the Western Cape central metropole. However, due to the unwillingness of administrators at seven schools, no educators from those schools could be included in the study. Amongst educators from the remaining 53 schools, only 812 out of approximately 1528 responded, to give an overall response rate of 53%. The 812 respondents might be considered a convenience sample from the Western Cape central metropole. The initial intention was not to take a 'convenience sample', although, the outcome of the process functionally resulted in this option. There were serious concerns about the response rate, as there is generally a very low response rate in many surveys in South Africa. The researcher telephoned the secretaries of all 60 schools informing them to expect a fax on the purpose of the researcher's visit to their school regarding the survey.

The first letter informed the principal about the nature of the research and the second letter was from the Western Cape Education Department, granting permission for the research to be conducted in that particular school. In addition, the fax and e-mail details of the school were telephonically verified. Two days later the researcher drove to all 60 schools over a ten-day period to personally hand-deliver the questionnaires to the principals in order to avoid a low response rate. In many instances, the researcher was requested to deal with the school secretary or with the deputy principal. After identifying the relevant staff members, the researcher requested that the secretary complete a control form with the school stamp for questionnaire follow-ups. While at the school, the researcher enquired whether the principal was available for a short interview of 15 minutes. Thirty-five principals agreed to be interviewed by the researcher. In order to receive a good response, the researcher made 500 telephone calls to all 60 schools enquiring whether the educators had completed the questionnaire. Three school secretaries had mislaid the batch of questionnaires given to them, and thus the questionnaires were hand-delivered to these schools a second time. Two school secretaries complained that only three out of their 35 educators (8%) had completed the questionnaire. With permission from the principal, the researcher personally visited these three schools and spoke to educators about the importance of the survey. This may have helped in receiving a better response rate, but it did not help much, because most of the educators complained about their workloads.

Three trips were made to all the schools in the sample. Seven schools rejected outright the invitation to be part of the survey. This amounted to 288 educators (16%) out of the (n=1816) secondary school educators in the Western Cape central metropole who did not participate in the survey. The researcher collected 820 questionnaires from 53 schools in the Western Cape central metropole. Eight questionnaires were considered unusable since they were incomplete and were subsequently excluded from the sample. The result for the educator questionnaire was 812 usable responses out of 1528 that were administered, making this a 53% response rate. After the data-collection stage, each questionnaire was checked for errors, legibility and consistency in order to ensure completeness and the readability of the data. Thereafter, the data were captured into SPSS software version 17.0 for Windows. To ensure that the data were accurately captured "frequency distribution" in SPSS was run. A few errors were encountered; therefore screening and cleaning of the data had to be undertaken before any further analysis of the data could take place.

Data analysis and techniques

The data analysis methods employed in this study are both quantitative and qualitative. After editing, screening and cleaning of the survey results, the database file was incorporated into SPSS. The researcher began analysing the data by computing the basic descriptive statistics for all items on the questionnaire. According to de Vaus (2007), the researcher could then summarise patterns in the responses from the sample by using frequency tables, means, standard deviations and measures of skewness. Before describing the characteristics of the sample (that is, mean, standard deviation and skewness), it is advisable to determine the quality of the measuring instrument to be used. To investigate this quality, two procedures can be used, namely: exploratory factor analysis and reliability analysis. According to Field (2005), Exploratory factor analysis provides an indication as to the number of possible dimensions underlying the variable (that is, latent construct). To calculate how many dimensions need to be evaluated, Parallel Analysis can be used. Once the possible dimensions underlying each variable have been determined, it is important to determine the reliability of each dimension and variable. To determine the latter, Cronbach's coefficient alpha can be used. After conducting both Exploratory Factor Analysis and Reliability Analysis, the study can continue reporting both descriptive and inferential statistical results, without any fear of the impact of poorly measured constructs.

Pearson's r is used to provide the degree to which two variables covary. Stepwise multiple regressions are used in this study. Standard multiple regressions include all independent variables simultaneously into the multiple regression equation and determine each independent variable's contribution to the prediction of the dependent variable. According to de Vaus (2007), the most appropriate statistical technique to use when comparing two means with one another is the t-test. When two different groups are being compared, an independent t-test is used. The independent t-test is another technique that is used in this study. The t-statistic together with the degrees of freedom associated with the comparison is used to determine if the two groups differ significantly from each other. By comparing the means of the two groups, it is possible to determine whether or not they differ significantly from each other (Field, 2005; Tredoux and Durrheim, 2002). According to Field (2005), exploratory factor analysis is a technique that is used to reduce data to smaller sets of variables and to explore the underlining theoretical structure of the phenomena. Byrne (2005) concurs that EFA when properly used provides links between the observed variables and their underlying factors - even though these may be unknown. ANOVA provides an indication of whether the model is a statistically significant fit with the data used for the multiple regression analysis (Sekaran and Bougie, 2010). In the ANOVA model, p values of less than 0.05 ($p<0.05$) indicate statistically significant differences between the sub-groups. Analysis of variance assumes that the variance of scores is the same in all groups. A post hoc comparison test was used to test for homogeneity of the variances. The pattern matrix produced by the oblique rotation assists in identifying an understandable and interpretable factor structure associated with each of the variables in this study. The goal of the rotation was to simplify and clarify the data structure (Field, 2005).

Parallel analysis can be considered as one of the most-promising methods to determine the number of principal components or factors to retain. In parallel analysis, the focus is on the number of factors that account for more variance than the factors derived from random data. O'Connor (2005), states that problems may arise when non-optimal numbers of factors are extracted. O'Connor (2005) is of the view that these two highly popular decision rules are problematic. According to Zwick and Velicer (1986), the Eigenvalues greater-than-one rule typically overestimates, and sometimes underestimates, the number of factors. Cattell and Vogelmann (1977) believe that the scree test has been a strongly promoted alternative rule-of-thumb; however, it involves subjective (eyeball) searches of plots for sharp demarcations between the eigenvalues for major and minor factors. In practice, such demarcations do not always exist, or there may be more than one demarcation point. It is not surprising that the reliability of scree plot interpretations is considered low among experts (Crawford and Koopman, 1979; Streiner, 1998). The parallel analysis procedure is statistically based, rather than being a mechanical rule-of-thumb. The procedure used in this study for deciding on the number of factors involves extracting eigenvalues from random data sets that parallel the actual data set with regard to the number of cases and variables. The Eigen values derived from the actual data are then compared with the eigenvalues derived from the random data. For this study, items that have a factor loading of below 0.30 are to be excluded from the factor structures of the variables (Hair et al., 2006). These items were deleted because they had no significant factor loadings. Each of the dimensions was analysed and tested for uni-dimensional or multi-dimensional factors. Parallel analysis was conducted when required through the EFA results. Confirmatory Factor Analysis was used as a tool to compare the variables as to which variable provided a better fit. The reason why two or three dimensions were chosen was based on the results from the Parallel Analysis Test. To evaluate the quality of the independent variable measurements regarding the data obtained, confirmatory factor analysis (CFA) was conducted.

Table 1. KMO-statistic and Bartlett's test for educator pedagogy.

KMO and Bartlett's test		
Kaiser-Meyer-Olkin measure of sampling adequacy		0.927
Bartlett's test of sphericity	Approx. chi-square	11940.859
	df	190
	Sig.	0.000

Confirmatory Factor Analysis focuses on a measurement model (Field, 2005). In this research, confirmatory factor analysis (CFA) was used for the following reasons: (a) To determine the number of factors that must be used; (b) which items reflect the identified factors; and (c) whether these factors are correlated. The difference between confirmatory factor analysis and exploratory factor analysis is that in CFA all factors affect the measured items. This is done by calculating the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy. As a guideline, this statistic should be higher than 0.6 (Field, 2005). Bartlett's test of sphericity is used to test whether group variances are the same - and the result should be significant (that is, < 0.05). In addition, the Principal Axis method of extraction is used in this study. In this study, the following goodness-of-fit statistics are used. Chi-square S-B ($\chi 2$), df (degrees of freedom) ratio, standardised root mean square residual (SRMR), root mean square error of approximation (RMSEA), Normed Fit Index (NFI), Item parcelling and comparative fit index (CFI). Item parcelling can be defined as the combining or adding of items into parcels that represent the factor. Item parcelling results in better-fitting solutions than measured by goodness-of-fit indices (Field, 2005). The reason for this improved fit is that when using parcelling it can be attributed to the fact that parcels represent more normally distributed characteristics than items do. In order to confirm the obtained structures of the dimensions of the questionnaire, CFA was used. Before conducting CFA, it is necessary to determine whether or not the data deviate from multivariate normality. If the data deviate from multivariate normality then robust estimation techniques must be used during CFA. As the data were treated as continuous, the Robust maximum likelihood method of estimation was used (Byrne, 2005).

Psychometric properties for educator pedagogy

Three sub-dimensions were constructed for this variable. Educator pedagogy in totality was measured using 20 items. Exploratory Factor Analysis suggested three distinct factors; hence, no Parallel Analysis testing was necessary for the variable pedagogy. Seven items were used to measure pedagogy importance and yielded a Cronbach's Alpha of 0.897. Eight items measured pedagogy confidence and yielded a Cronbach's Alpha of 0.954. Five items measured pedagogy productivity and yielded a Cronbach's Alpha of 0.838. Based on the item-total correlations, no negatively worded items were found; and in addition, no items were removed. Before deciding on how many factors can be extracted, it is essential to determine whether the variables can be factor-analysed.

As illustrated in Table 1 the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy score is above 0.6 and the Bartlett's test of sphericity is significant at ($p< 0.000$). From Table 1 it is evident that the educator pedagogy construct can be factor analysed due to the appropriate statistical levels. The factor analysis is presented in Table 2. As can be seen in Table 2, it is suggested that a three-factor solution could be used due to the extraction sum of squared loadings of the Eigen values being greater than one. Table 3 reports on the results of the EFA for a three-factor solution for the questionnaire that was used in this study. Only pattern-matrix results are reported; and these resulted in a three-factor solution for the educator pedagogy construct. The detailed analysis is available on request. Because an oblique rotation technique was used during the exploratory factor analysis, a pattern matrix should be interpreted to identify the factor structure. The results from Table 4 of the confirmatory factor analysis suggest that all of the revalidated measures provided better-fit statistics than the original measurements. In terms of gender, Table 5 illustrates that there were 812 responses to the survey. The majority of the staff members in 53 secondary schools in the Western Cape central metropole are females who represent 58% (n=471) of the sample, while males represent only 42% (n=341).

As illustrated in Table 6, the majority of secondary school educators (39.4%) fall into the 40-49 year-age group. The 20-30 year-age group constitutes 35.5% of the sample and 25.1% is made up by the 50-year and above age group. This analysis determined that two age groups (20-39 and 40-49) provided the highest level of representation in the sample. As depicted in Table 7, the description of the educators' highest qualification reveals that 2.3% of educators have certificates (n=19), while 29.2% of the educators have a teaching diploma (n=237), and 59.6% of the educators have a Bachelor's degree (n=484). Only 6.3% of the educators have a Master's degree (n=51), and a mere 2.6% of the educators have some other form of teaching qualification (n=21). These statistics are indicative of the fact that the majority of educators in this sample have Bachelor's degrees. As depicted in Table 8, the description of the educators' teaching experience reveals that 14.4% of the educators have been teaching between 11-15 years (n=117), while 33.3% of the educators have been teaching for over 21 years and more (n=270). These statistics illustrate that the majority of secondary school educators in the Western Cape central metropole have been in the teaching profession for more than 21 years. As depicted in Table 9, these statistics illustrate that 55.1% of the secondary school educators have used computers in their instruction for 1-6 years (n=448). As depicted in Table 10, the description for the educators' instructional method reveals that 19.1% of the educators used a largely teacher-directed discussion in their classroom (n=155), while 27.7% of these educators used a more teacher-directed than student-centred learning strategy in the classroom (n=225), and 41.6% of the educators had an even-balance between being teacher-directed and student-centred in their activities (n=338). Only 7.1% of these educators employed a more student-centred than teacher-directed teaching style (n=58). Finally, a mere 4.4% of the educators used a largely student-centred teaching method to conduct lessons in their classroom (n=36). These statistics indicate that educators employed an even-balance between being teacher-directed and student-centred in their instructional method in this sample.

As depicted in Table 11, the description of the educators' level of computer usage reveals that a mere 1.4% of the educators had had no experience with computer technologies (n=11), while 6.3% of these educators had attempted to use computer technologies, but still required help on a regular basis (n=51). Only 15.1% of these educators were able to perform basic functions in a limited number of computer applications (n=123); and 49.6% of these educators

Table 2. Total variance explained and Eigen values.

Total variance explained							
Factor	Initial eigen values			Extraction sums of squared loadings			Rotation sums of squared loading sa
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total
1	8.023	40.116	40.116	7.678	38.389	38.389	6.491
2	4.040	20.200	60.316	3.687	18.437	56.826	5.643
3	1.516	7.582	67.898	1.078	5.391	62.217	4.882
4	0.991	4.957	72.855				
5	0.682	3.411	76.266				
6	0.570	2.852	79.118				
7	0.483	2.413	81.530				
8	0.469	2.346	83.877				
9	0.423	2.115	85.991				
10	0.376	1.879	87.870				
11	0.355	1.773	89.643				
12	0.308	1.541	91.184				
13	0.272	1.362	92.547				
14	0.271	1.357	93.903				
15	0.250	1.252	95.155				
16	0.242	1.212	96.368				
17	0.212	1.062	97.430				
18	0.189	0.946	98.376				
19	0.178	0.892	99.267				
20	0.147	0.733	100.000				

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

could demonstrate a general competency in a number of computer applications (n=403). Only 23.6% of the educators had acquired the ability to competently use a broad spectrum of computer technologies; and finally, 3.9% of these educators were extremely proficient in using a wide variety of computer technologies. These statistics indicate that most educators in the Western Cape central metropole could demonstrate a general competency in a number of computer applications. Next follows a discussion on regression and correlation analysis that was computed for this study. The procedure involves analysing the correlation between the dependent and independent variables, and including, one-by-one, those independent variables that best explain the variation in the dependent variable, into the regression model (Field, 2005). From Table 12 it is evident that educator theories and beliefs, educator pedagogy and access to computers, are all significant predictors of computer utilisation for teaching (the dependent variable). It is clear that this model is significant and accounts for 32.9% of the variance in the dependent variable.

The One-Way ANOVA, Correlations and Post Hoc Multiple Comparison tests that were used in this study are presented here. ANOVA can only identity whether there are any significant differences in groups by the indication of a large "F" statistic. However, ANOVA is unable to identify which groups differ from each other (Field, 2005). In addition, ANOVA cannot identify where the differences are and how many differences there are in terms of magnitude. Hence, the Post Hoc test is used to overcome these shortcomings. Post Hoc tests involve comparing the means of all combination pairs. The one-way ANOVA statistic relationships for the dimension age are illustrated in Table 13. According to Table 13, there are significant differences between educators in the age group 20-39 years when compared with educators in the age group 50 years and above regarding educator pedagogy ($p<0.05$). In addition, there seems to be a strong negative relationship between educators in the age group 50 years and above when compared with educators in the 20-39 year age group ($p<0.05$). Table 14 portrays the difference among the educators' ages' groups and their pedagogical confidence in using computers in the classrooms. According to Table 14, there are significant differences between educators in the age group 20-39 years when compared with educators in the age group 50 years and above regarding educator confidence ($p<0.05$). In addition, there seems to be a strong negative relationship between educators in the age group 50 years and above when compared with educators in the 20-39 year age group ($p<0.05$).

It is reported in Table 15 that when confidence in educator pedagogy is compared with the years of teaching experience educators have in secondary schools, the scores indicate that there are significant differences between the highlighted variables. The significant difference is between educators who have 1-5 years of teaching experience compared with educators who have 21 years or more of teaching experience ($p<0.05$). In addition, there seems to be a strong negative relationship between educators who have 21 years or more teaching experience when compared with educators who have only between 1-5 years of teaching experience ($p<0.05$). It is reported in Table 16 that when educator pedagogy is compared with the educators' level of computer expertise, the scores indicate that there are significant differences between the highlighted variables. The significant difference is between educators who rated themselves as advanced computer users with respect to the various levels of computer usage compared with

Table 3. Pattern matrix for educators' pedagogy.

Pattern matrixa			
Questions	**Factor 1**	**Factor 2**	**Factor 3**
Q 15.7	0.898		
Q 15.5	0.884		
Q 15.8	0.868		
Q 15.6	0.857		
Q 15.3	0.850		
Q 15.2	0.828		
Q 15.4	0.809		
Q 15.1	0.798		
Q 14.4		0.856	
Q 14.3		0.830	
Q 14.5		0.815	
Q 14.6		0.780	
Q 14.7		0.703	
Q 14.1		0.616	
Q 14.2		0.603	
Q 16.3			0.819
Q 16.4			0.792
Q 16.1			0.654
Q 16.2			0.654
Q 16.5			0.607

Extraction method: Principal axis factoring. Rotation method: Oblimin with Kaiser Normalization. a. Rotation converged in 6 iterations.

Table 4. Model comparisons for pedagogy.

	Unidimensional (All items RML)	**Three-dimensional: Items (All items) RML**
S-Bx^2	8302.09	958.35
df	172	167
RMSEA	0.24 (0.24:0.25)	0.07 (0.072; 0.81)
CFI	0.69	0.97
NFI	0.69	0.96
SRMR	0.23	0.047

Table 5. Descriptive statistics for the gender of secondary school educators.

Gender	**Frequency**	**Percent**	**Valid percent**	**Cumulative percent**
Male	341	42.0	42.0	42.0
Female	471	58.0	58.0	100.0
Total	812	100.0	100.0	

educators who rated themselves as beginners in computer usage ($p<0.05$). In addition, there seems to be a strong negative relationship between educators who have rated themselves as beginners in computer usage when compared with educators who have rated themselves as advanced computer users ($p<0.05$). It is reported in Table 17 that when the importance of educator pedagogy is compared with the educators' level of computer expertise, the scores indicate that there are significant differences between the highlighted variables. The significant difference is between educators who rated themselves as advanced computer users with respect to the various levels of computer usage compared with those educators who rated themselves as beginners in computer usage ($p<0.05$). In addition, there seems to be a strong negative relationship between educators who have rated themselves as beginners in computer usage when compared with educators who have rated themselves as advanced computer

Table 6. Descriptive statistics for age of educators.

Recoded age	Frequency	Percent	Valid percent	Cumulative percent
20-39 years	288	35.5	35.5	35.5
40-49 years	320	39.4	39.4	74.9
50 and above	204	25.1	25.1	100.0
Total	812	100.0	100.0	

Table 7. Descriptive statistics for educator's highest qualification.

Qualification	Frequency	Percent	Valid percent	Cumulative percent
Certificate	19	2.3	2.3	2.3
Diploma	237	29.2	29.2	31.5
Bachelor's degree	484	59.6	59.6	91.1
Master's degree	51	6.3	6.3	97.4
Other	21	2.6	2.6	100.0
Total	812	100.0	100.0	

Table 8. Descriptive statistics for educators' teaching experience.

Teaching experience	Frequency	Percent	Valid percent	Cumulative percent
1 - 5	165	20.3	20.3	20.3
6 - 10	137	16.9	16.9	37.2
11 - 15	117	14.4	14.4	51.6
16 - 20	123	15.1	15.1	66.7
21 years or more	270	33.3	33.3	100.0
Total	812	100.0	100.0	

Table 9. Descriptive statistics for educators' computer use in teaching.

Computer experience	Frequency	Percent	Valid percent	Cumulative percent
Less than 1	178	21.9	21.9	21.9
1 - 3	243	29.9	29.9	51.8
4 - 6	205	25.2	25.2	77.1
7 - 10	98	12.1	12.1	89.2
11 years or more	88	10.8	10.8	100.0
Total	812	100.0	100.0	

users ($p<0.05$).

It is reported in Table 18 that when the confidence of educator pedagogy is compared with the educators' level of computer expertise, the scores indicate that there are significant differences between the highlighted variables. The significant difference is between educators who rated themselves as advanced computer users with respect to the various levels of computer usage compared with educators who rated themselves as beginners in computer usage ($p<0.05$). In addition, there seems to be a strong negative relationship between educators who have rated themselves as beginners in computer usage when compared with educators who have rated themselves as advanced computer users ($p<0.05$). It is reported in Table 19 that when the productivity of educator pedagogy is compared with the educators' level of computer expertise, the scores indicate that there are significant differences between the highlighted variables. The only significant difference is between educators who rated themselves as advanced computer users with respect to the various levels in computer usage compared with educators who rated themselves as beginners in computer usage ($p<0.05$). In addition, there seems to be a strong negative relationship between educators who have rated themselves as beginners in computer usage when compared

Table 10. Descriptive statistics for educators' instructional method.

Instructional method	Frequency	Percent	Valid percent	Cumulative percent
Largely teacher-directed (e.g., teacher-led discussion, lecture)	155	19.1	19.1	19.1
More teacher-directed than student-centred (e.g., co-operative learning, discovery learning)	225	27.7	27.7	46.8
Even-balance between teacher-directed and student-centred activities	338	41.6	41.6	88.4
More student-centred than teacher-directed	58	7.1	7.1	95.6
Largely student-centred	36	4.4	4.4	100.0
Total	812	100.0	100.0	

Table 11. Descriptive statistics for educators' level of computer usage.

Level of computer usage	Frequency	Percent	Valid percent	Cumulative percent
Unfamiliar	11	1.4	1.4	1.4
Newcomer	51	6.3	6.3	7.6
Beginner	123	15.1	15.1	22.8
Average	403	49.6	49.6	72.4
Advanced	192	23.6	23.6	96.1
Expert	32	3.9	3.9	100.0
Total	812	100.0	100.0	

Table 12. Model summary of the three independent variables.

Model summary					
Model	Variables entered	R	R square	Adjusted R square	Std. error of the estimate
1	Educator pedagogy (total)	0.477a	0.227	0.226	11.67512
2	Educator theories and beliefs (total)	0.553b	0.306	0.304	11.07389
3	Access (total)	0.573c	0.329	0.326	10.89686

a. Predictors: (Constant), Educator Pedagogy (Total).
b. Predictors: (Constant), Educator Pedagogy (Total), Educator Theories and Beliefs (Total).
c. Predictors: (Constant), Educator Pedagogy (Total), Educator Theories and Beliefs (Total), Access (Total).

Table 13. Educator pedagogy and age.

Dependent variable	(I) Recode age	(J) Recode age	Mean diff (I-J)	Std. error	Sig.	95% confidence interval lower bound	95% confidence interval upper bound
Educator pedagogy (total)	20-39 years	40-49 years	0.84410	.92825	0.662	-1.4322	3.1204
		50 and above	4.52247*	1.04581	0.000	1.9578	7.0871
	40-49 years	20-39 years	-.84410	.92825	0.662	-3.1204	1.4322
		50 and above	3.67837*	1.02390	0.002	1.1675	6.1893
	50 and above	20-39 years	-4.52247*	1.04581	0.000	-7.0871	-1.9578
		40-49 years	-3.67837*	1.02390	0.002	-6.1893	-1.1675

Table 14. Differences among age groups in terms of pedagogy confidence.

Dependent variable	(I) Age	(J) Age	Mean diff.(I-J)	Std. error	Sig.	95% Confidence interval	95% Confidence interval
Educator pedagogy factor2 confidence	20-39 Years	40-49 Years	1.48750*	0.56795	0.033	0.0947	2.8803
		50 and above	3.62316*	0.63988	0.000	2.0540	5.1923
	40-49 Years	20-39 Years	-1.48750*	0.56795	0.033	-2.8803	-.0947
		50 and above	2.13566*	0.62648	0.003	0.5994	3.6720
	50 and above	20-39 Years	-3.62316*	0.63988	0.000	-5.1923	-2.0540
		40-49 Years	-2.13566*	.62648	.003	-3.6720	-.5994

*. The mean difference is significant at the 0.05 level.

Table 15. Differences among years of teaching experience in terms of pedagogy confidence.

Dependent variable	(I) years of teaching experience	(J) years of teaching experience	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval lower bound	95% Confidence interval upper bound
Educator pedagogy Factor 2 confidence	1 - 5	6 - 10	2.02451	0.81212	0.185	-.4828	4.5318
		11 - 15	1.49852	0.84920	0.539	-1.1233	4.1203
		16 - 20	2.71574*	0.83699	0.033	.1316	5.2998
		21 >	3.41448*	0.69429	0.000	1.2710	5.5580
	16 - 20	1 - 5	-2.71574*	0.83699	0.033	-5.2998	-.1316
		6 - 10	-.69123	0.87275	0.960	-3.3858	2.0033
		11 - 15	-1.21722	0.90736	0.773	-4.0186	1.5841
		21 >	.69874	0.76433	0.934	-1.6610	3.0585
	21 years or more	1 - 5	-3.41448*	0.69429	0.000	-5.5580	-1.2710
		6 - 10	-1.38997	0.73701	0.470	-3.6654	.8855
		11 - 15	-1.91595	0.77768	0.195	-4.3169	.4850
		16 - 20	-.69874	0.76433	0.934	-3.0585	1.6610

*.The mean difference is significant at the 0.05 level.

with educators who have rated themselves as advanced computer users ($p<0.05$). It is reported in Table 20 that when the confidence of educator pedagogy is compared with the educators' instructional method used in the classroom, the scores indicate that there is a significant difference between the highlighted variables. The significant difference is evenly balanced between teacher-directed and student-centred activities when these are compared with largely teacher-directed instruction ($p<0.05$). In summary, the Multiple Comparisons between the variables have provided evidence that there are significant differences in the groups being compared. In order to examine whether there are any differences between genders and the independent variables, t-test statistics were calculated with the group means, group standard deviations, t-values and significance (p) values. The results of these analyses are illustrated in Table 21.

DISCUSSION ON FINDINGS AND CONCLUSIONS

The questionnaire asked the educators 20 questions regarding educator pedagogy. The multiple-regression analysis found that pedagogy was the highest predictor of computer utilisation. Three factors, namely: importance, confidence and productivity emanated from the exploratory-factor analysis (Table 2). Contrary to the review of the literature, this study found that the educator pedagogy variable produced the highest prediction to the utilisation of computers in classrooms (Table 12). Pedagogical ideas are developed from theories on how people learn, and the introduction of OBE in South African schools may have had an influence on the methods educators use to teach. Vygotsky (cited in Barlett and Burton, 2009), believed that in order to take the learner forward, new ideas and concepts must be used during the dissemination of knowledge. A large percentage of educators (78.1%) regarded the use of computers to search for new teaching material and

Table 16. Differences regarding educators' computer expertise in terms of educator pedagogy

Dependent variable	(I) Recode level of expertise	(J) Recode level of expertise	Mean difference (I-J)	Std. error	Sig.	95% confidence interval lower bound	95% confidence interval upper bound
Educator pedagogy (total)	Beginner	Average	-5.05230*	0.96534	0.000	-7.4196	-2.6850
		Advanced	-11.10876*	1.07990	0.000	-13.7570	-8.4605
	Average	Beginner	5.05230*	0.96534	0.000	2.6850	7.4196
		Advanced	-6.05646*	0.90592	0.000	-8.2780	-3.8349
	Advanced	Beginner	11.10876*	1.07990	0.000	8.4605	13.7570
		Average	6.05646*	0.90592	0.000	3.8349	8.2780

* The mean difference is significant at the 0.05 level.

Table 17. Differences regarding educators' computer expertise in terms of pedagogy importance.

Dependent variable	(I) Recode level of expertise	(J) Recode level of expertise	Mean difference (I-J)	Std. error	Sig.	95% confidence interval lower bound	95% confidence interval upper bound
Educator pedagogy factor 1 (importance)	Beginner	Average	-.61423	0.44054	0.379	-1.6946	0.4661
		Advanced	-1.47604*	0.49282	0.012	-2.6846	-0.2675
	Advanced	Beginner	1.47604*	0.49282	0.012	0.2675	2.6846
		Average	0.86181	0.41342	0.115	-0.1520	1.8756

*.The mean difference is significant at the 0.05 level.

practices as being "very important" and "extremely important". This implies that educators are committed to changing the art of teaching, thus providing better dissemination of information to their learners.

During some of the principals' interviews on educator pedagogy, principals reported that the educators in their schools are predominantly using the computers for finding new ideas in their specific subject areas. Many principals supported this notion and believed that the information that was included in educator teaching materials became outdated to soon. In addition, principals believed that educators enjoyed using computers in their instruction, because previously stored information was easily retrievable and accurate. On how educators use computers to teach in their classrooms, a minority of 17.6% indicated that it was not important to use computers to enhance the learners' communication skills. This implies that most of the educators were of the view that the use of computers is an important teaching aid when imparting knowledge to the learner. The latter finding supports the statement that educators (81.5%) "agreed" and "strongly agreed" that the use of computers during their lessons stimulates the creativity of the learners. Educators (85.3%) indicated that they used computers to prepare their lessons, which in turn increased the educators' productivity in the classroom. This finding means that well-prepared lessons enable educators to demonstrate their capabilities in using computers effectively in classrooms and not to be embarrassed by learners being more knowledgeable than they (the educators) were in certain computer skills. It is therefore imperative for educators to use the computer carefully when conducting research for lesson preparations.

During the assessment of the literature, it

Table 18. Differences regarding educators' computer expertise in terms of pedagogy confidence.

Dependent variable	(I) Recode level of expertise	(J) Recode level of expertise	Mean difference (I-J)	Std. error	Sig.	95% confidence interval lower bound	95% confidence interval upper bound
Educator pedagogy factor 2 (confidence)	Beginner	Average	-3.98923*	0.56989	0.000	-5.3868	-2.5917
		Advanced	-8.70924*	0.63752	0.000	-10.2726	-7.1459
	Average	Beginner	3.98923*	0.56989	0.000	2.5917	5.3868
		Advanced	-4.72001*	0.53481	0.000	-6.0315	-3.4085
	Advanced	Beginner	8.70924*	0.63752	0.000	7.1459	10.2726
		Average	4.72001*	0.53481	0.000	3.4085	6.0315

*.The mean difference is significant at the 0.05 level.

Table 19. Differences regarding educators' computer expertise in terms of pedagogy productivity.

Dependent variable	(I) recode level of expertise	(J) recode level of expertise	Mean difference (I-J)	Std. error	Sig.	95% confidence interval lower bound	95% confidence interval upper bound
Educator pedagogy factor 3 (productivity)	Beginner	Average	-.44884	0.25341	0.209	-1.0703	0.1726
		Advanced	-.92348*	0.28348	0.005	-1.6187	-0.2283
	Advanced	Beginner	0.92348*	0.28348	0.005	.2283	1.6187
		Average	0.47464	0.23781	0.137	-.1085	1.0578

*The mean difference is significant at the 0.05 level.

Table 20. Differences among instructional methods used in terms of pedagogy confidence.

Dependent variable	Instructional method used (I)	Instructional method used (J)	Mean difference (I-J)	Std. error	Sig.	95% confidence interval lower bound	95% confidence interval upper bound
Educator pedagogy (confidence)	Largely teacher-directed (e.g., teacher-led discussion, lecture)	Even-balance between teacher-directed and student-centred activities	-2.04268*	.68248	.012	-3.7167	-.3686
	Even-balance between teacher-directed and student-centred activities	Largely teacher-directed (e.g., teacher-led discussion, lecture)	2.04268*	.68248	.012	.3686	3.7167

* The mean difference is significant at the 0.05 level.

was evident that different types of computer usage require the educator to have a broad understanding of various computer skills. Moreover, the literature stated that educators should be able to harness these skills in order to extend the educators' pedagogical knowledge, so that they can use computers effectively in all their teachings. The findings of this study support the literature in that educators (92.2%) strongly supported the fact that "computers can be useful instructional aides in all subject areas". Furthermore, principals reported that educators used computers because they provide a huge selection of learning material, and in addition can act as a tutor in the classroom. When it comes to slow learners, educators can use the computer for remedial work, thereby allowing these learners to work at their own pace. The findings indicate that despite educators (36.7%) seldom having access to resources at school, they do have a good understanding of the particular resources,

Table 21. T-test comparing independent variables with gender.

Variable	Gender	N	Mean	Std. Dev	t value	Sig. (2-tailed)
Educator pedagogy (total)	Male	341	72.4135	11.69046	1.517	0.130
	Female	471	71.1677	11.44234		
Educator pedagogy_F1 (importance)	Male	341	26.6716	5.11952	-0.118	0.906
	Female	471	26.7134	4.88687		
Educator pedagogy_F2 (confidence)	Male	341	24.6070	7.20362	2.596	0.010
	Female	471	23.2972	7.01676		
Educator pedagogy_F3 (productivity)	Male	341	21.1349	2.74815	-0.109	913
	Female	471	21.1571	2.95584		

which are available to them - for example the internet. Conversely, there are some educators (42.5%) who are lacking a wide spread of knowledge regarding the present bouquet of computer programs now being offered in education. If the educator has a lack of computer knowledge, inadvertently this will have an impact on the students, because students will suffer the loss of learning opportunities, which computer technology could have provided. Another important pedagogical factor considered in this study was how educators were using computers to reflect on their teaching practices. The findings indicated that educators (70.3%) found it “important” and “very important” to do so periodically. An important aspect of educators’ pedagogies is in the planning, preparation and follow-up of lessons. Educators believe that the use of computers produces a significant improvement in the learners’ results if used correctly. There is a basic misunderstanding by many educators on how to incorporate computers into their teaching program. It is therefore recommended that educators should periodically reflect on their pedagogical practices. It has been argued in the literature that the educators’ own pedagogical beliefs contribute an important component in determining technology-mediated learning opportunities (Mueller et al., 2008).

A concerned finding in this study was that some educators (32.6%) were “not very knowledgeable” and “not at all knowledgeable” on how the use of computers could support their pedagogical professional development. Accordingly, there seems to be a void in knowledge - even among many of the innovative educators regarding the potential of other computer uses, which could enhance the learners’ progress. Therefore, educators need to evaluate their present knowledge and pedagogies regarding computers. It is heartening to note that it is across the three pedagogical factors, namely: importance, confidence and productivity that most of the educators strongly agreed that computers were beneficial to educators, learners and the principals, because they introduced a change in methods in the educators’ pedagogy. Furthermore, principals profess that using computers in teaching breaks the boredom in the classroom.

Educator pedagogy and age

This study has examined the differences among the different age groups in terms of educator pedagogy. Significant differences (mean difference=4.52247*) were found between educators aged 20-39 years, when compared with educators aged 50 and above. This implies that the younger educators have different approaches to educator pedagogical beliefs when compared with the older educators due to their more recent training and development in educational pedagogy. Educator pedagogical experience assists the educator when relating to new situations and to investigating new approaches to learning. This situation is commonly found in circumstances where newly appointed educators are assigned to teach in areas with which they are unfamiliar (Eteokleous, 2008; Smarkola 2008; Ward and Parr, 2010; Martin et al., 2004). Younger educators in this study were keen to learn new pedagogical techniques and to use the computer in their instruction. They received most of their assistance from their peers and tended to attach themselves to a supportive environment where older and more experienced educators who had used computers extensively could guide them. The literature seems to suggest that younger educators have more positive attitudes in changing their teaching styles and utilising the advantages of computer technology as well as to become change agents in their schools.

Finally, the findings indicated that approaches to educator training should be better related to the notion of information sharing and peer learning. In addition, educators should be able to improve their computer skills and gain more pedagogical knowledge. Accordingly, if educators experiment with computers every day, it should increase their pedagogical competence. Given the fact that the majority of the pedagogy variables were significantly correlated, there is sufficient evidence for the support of the Hypothesis, which stated that there is a significant correlation between computer utilisation for teaching purposes by secondary school educators in the Western Cape central metropole and educators' pedagogy.

RECOMMENDATIONS

The findings from this study have clearly shown that educators' pedagogy provides the highest prediction indicator of the improved or enhanced use of computers in secondary schools. The advent of OBE in the present South African educational curriculum has forced educators to make learning more meaningful - instead of just imparting knowledge. Certain innovative practices - such as the use of computers - have provided some solutions to the teaching profession. However, the use of computers has placed an extra burden on some educators, since not all of them are equally computer literate. In this study, it was found that computers assist many educators to change their practices in the classrooms. Furthermore, it was found that educators with student-centred pedagogical approaches were more successful in using computers in their lessons. Therefore, this study strongly suggests that in order to harness the educator pedagogies so that they can be used to increase the use of computers in schools, the following recommendations should be taken into consideration:

1. Educators need to understand that computer technology is continually evolving, and that they need to change the manner in which the subject is presented to the learners;
2. Educators need to know how to prepare and plan lessons where computers are used, so that the lessons challenge the learners' understanding and stimulate reflection and thinking; and
3. In order to improve the innovation of classroom activities, the educators' philosophy of teaching approach should be continuously reviewed.

REFERENCES

Bransford J, Brown A, Cocking R (2000). How people learn: Brain, mind, experience, and school. Washington DC: National Academic Press.
Bartlett S, Burton D (2009). Introduction to Education Studies. 2nd edition. London: Sage Publications.
Becta (2004). An investigation of the research evidence relating to ICT pedagogy. King's College: London.
Byrne BM (2005). Factor Analytic Models: Viewing the Structure of an Assessment Instrument from Three Perspectives. J. Pers. Assess., 85(1): 17-32.
Cattell RB, Vogelmann S (1977). A comprehensive trial of the scree and KG criteria for determining the number of factors. Multivar. Behav. Res., 12: 289-325.
Canoy M (2004). ICT in Education: Possibilities and Challenges. In: Inaugural Lecture of the UOC 2004-2005 Academic Year (2004: Barcelona) [Online].Available at: http://www.uoc.edu/inaugural04/dt/eng0carnoy1004.pdf.
Chien-Sing L (1999). Problem solving in a Constructivist Environment. Educ. Technol. Soc., 2(4): 137-145.
Clarkson B (2002). Teachers, teams and technology: Investigating a team approach for supporting teacher's uptake of ICT. Unpublished doctoral dissertation. Australia: Edith Conwan University.
Crawford CB, Koopman P (1979). Inter-rater reliability of scree test and mean square ratio test of number of factors. Percept. Mot. Skills, 49: 223-226.
Cox M, Marshall G (2007). Effects of ICT: Do we know what we should know? Educ. Inf. Technol., 12: 59-70.
Cox M, Abbott C, Webb M, Blakeley B, Beauchamp T, Rhodes V (2004). ICT and attainment: A review of the research literature ICT in Schools Research and Evaluation Series – No.17. DfES-Becta. [Online]. Available at: http://www.becta.org.uk/page_documents/research/ict_attainment_summary.pdf.
Department of Education (2003). White Paper on e-Education. Transforming Learning and Teaching through Information and Communication Technologies. South Africa: Department of Education.
De Vaus DA (2007). Analyzing social science data. London: Sage Publications.
Dugmore C (2004). On celebrating the matrics of 2004 and charting the way forward, 29 December 2004, Leeuwenhof, Cape Town. [Online]. Available at: http://www.capegateway.gove.za/eng/pubs/speeches/2004/dec/95221.
Eteokleous N (2008). Evaluating computer technology integration in a centralised school system. Educational Technology, Frederick Institute of Technology, Cyprus. Comput. Educ., 51: 669-686.
Field A (2005). Discovering Statistics Using SPSS. 2nd edition. London: Sage Publications.
Hair JF, Black B, Babin B, Anderson RE, Tatham RL (2006). Multivariate Data Analysis. 6th edition. Upper Saddle River: Prentice Hall.
Hawkridge D (1990). Computers in Third World Schools. The example of China. Br. J. Educ. Technol., 21(1): 4-20.
Hayman G (1999). Academics fear what they do not know. Mail and Guardian. May 20 - June 3, no. 45.
Hodgkinson-Williams CA (2005). Dust on the keyboards. Policy gaps in the integration of ICT into the South African curriculum. Proceedings from the 8th World Conference on Computers in Education (WCCE), Stellenbosch, 4-7 July 2005.
HSRC and EPC (2005). Emerging Voices. A Report on Education in South African Rural Communities. Researched for the Nelson Mandela Foundation. Pretoria: HSRC.
Hussey J, Hussey R (1997). Business research: A practical guide for undergraduate and postgraduate students. London: Macmillan Press.
Infodev (2005). Monitoring and Evaluating of ICT in Education Projects: A Handbook for Developing Countries. Washington DC: Worldbank.
Jones A (2004). A review of the research literature on barriers to the uptake of ICT by teachers. [Online]. Available at: http://www.becta.org.uk/page_documents/research/barriers.pdf
Khanya (2006). The Khanya Project. [Online]. Available at: http://www.khanya.co.za.
Koc M (2005). Implications of learning theories for effective technology integration and pre-service teacher training: A critical literature review. J. Turk. Sci. Educ., 29(1): 1-18.
Kozma RB (2003). Technology and classroom practices: An international study. J. Res. Technol. Educ., 36(1): 1-14.
Martin W, Mandinach E, Kanaya T, Culp K (2004). Intel International Interim Report. 12 January 2004. Education Development Center. Center for children and Technology. New York: Intel.
Means B, Penuel W, Padilla C (2001). The connected school: Technology and learning in high school. San Francisco: Jossey-Bass.
Miller L, Naidoo M, Van Belle JP, Chigona W (2006). School-level ICT Adoption Factors in the Western Cape Schools. Department of Information Systems, University of Cape Town. Proceedings of

Fourth IEEE International Workshop on Technology for Education in Developing Countries, 10-12 July, Iringa Tanzania, pp. 57 – 61.
Mueller J, Wood E, Willoughby T, Ross C, Specht J (2008). Identifying discriminating variables between teachers who fully integrate computers and teachers with limited integration. Comput. Educ., 51: 1523-1537.
Niess ML (2005). Preparing teachers to teach science and mathematics with technology: Developing a technology pedagogical knowledge. Teach. Teach. Educ., 21: 509-523.
Neuman WL (2000). Social Research Methods, Qualitative and Quantitative Approaches. 4th edition. Boston: Allyn and Bacon.
O'Conner BP (2005). SPSS and SAS programs for determining the number of components using parallel analysis and Velicer's MAP test. Behav. Res. Methods, Instrum. Comput., 32(3): 396-402.
SACE (2005). The State of Teacher Professionalism in South Africa. Paper prepared for the South African Council for Educators (SACE) by the Wits Education Policy Unit. South Africa: Schoolnet.
Saunders M, Lewis P, Thornhill A (2003). Research methods for business students. 3rd edition. Essex: Pearson.
Schofield J, Davidson A (2002). Bringing the Internet to school: Lessons from an urban district. San Francisco: Jossey-Bass.
Sekaran U, Bougie R (2010). Research methods for business: a skill-building approach. 5th edition. West Sussex: John Wiley and Sons.
Smarkola C (2008). Efficacy of a planned behaviour model: Beliefs that contribute to computer usage intentions of student teachers and experienced teachers. Comput. Hum. Behav., 24:1196-1215.
Solvie P, Kloek M (2007). Using Technology Tools to Engage Students with Multiple Learning Styles in a Constructivist Learning Environment. Contemp. Issues Technol. Teach. Educ., 7(2): 7-27.
Strydom M, Thomson J, Williams C (2005). Understanding ICT integration in South African classrooms. Perspect. Educ., 23(4):71-85.
Streiner DL (1998). Factors affecting reliability of interpretations of scree plots. Psychol. Reports, 83: 687-694.
Tredoux C, Durrheim K (2002). Numbers, hypothesis and conclusions: A course in statistics for the social sciences. Cape Town: UCT Press
WCED (2009). WCED Knowledge management. [Online]. Available at: http://wcedemis.wcape.gov.za/wced/findaschool.html.
Williamson B (2003). The participation of Children in the Design of New Technology: Futurelab, a discussion paper. [Online]. Available at: http:// www. futurelab.org.uk.
Wozney L, Venkatesh V, Abrami PC (2006). Implementing Computer Technologies: Teachers' Perceptions and Practices. J. Technol. Teach. Educ., 14(1): 173-207.
Ward L, Parr J (2010). Revisiting and reframing use: Implications for the integration of ICT. Comput. Educ., 54: 113-122.
Zwick WR, Velicer WF (1986). Comparison of five rules for determining the number of components to retain. Psychol. Bull., 99: 432-442.