Undergraduate Student Perceptions Regarding the Use of Educational Technology – A Case Study in a Statistics Service Course

Verena T. Nolan
Vaal University of Technology, SOUTH AFRICA

Arthur J. Swart
Central University of Technology, SOUTH AFRICA

Integrating theory with practice has become a mandatory requirement for universities of technology. Using educational technology to supplement traditional pedagogical approaches has contributed significantly to achieving this mandate. However, which educational technologies could help improve the educational experience of students in a statistical service course? This research uses an exploratory design, where one large group of undergraduate students were polled using a questionnaire as the main data collection tool. Microsoft Excel and PowerPoint presentations were viewed as a very good supplemental educational tool, while YouTube clips, myVUT (institutional learning management system using Sakai) and the business/financial calculator were not fully utilised by the students. However, the majority of students selected the prescribed textbook as the most useful educational tool in understanding first year statistics, as it was a locally published textbook with many native examples. A blend of all these educational technologies helped to enrich student understanding and satisfaction in learning statistical concepts.

Keywords: Educational technologies, computer-based learning, perceptions, blended approach

INTRODUCTION

"Statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write" – HG Wells (Shaw, 2001). These words well convey the importance of educating the masses in the art of statistical thinking; an education which may be just as vital as helping the illiterate to read and write. This really amounts to integrating theory with practice, which is a mandatory requirement for universities of technology

(New Zealand Parliament, 2006). Almost all of the programmes at these universities include at least one module in statistics, being offered as a service module, where the objective is to equip students with basic statistical methods for their everyday use (Zewotir & North, 2011). There exist a plethora of pedagogies and educational philosophies in educating the masses to read and write, and this is also the case in statistical education. One of these philosophies entails using educational technology in furthering the teaching and learning process.

Recent work has shown that educational technology has improved the educational experience of students within electrical engineering (Nickola & Swart, 2013; A.J. Swart, 2014) and mathematics (Mutanga, 2013). However, a major problem which stills exists in many colleges and universities is that there are faculty

Correspondence to: Arthur J. Swart,
Private Bag X20539, Bloemfontein,
South Africa, 9300
Phone: +27 51 507 3709
E-mail: drjamesswart@gmail.com
doi: 10.12973/eurasia.2015.1355a

State of the literature

- Students in higher education have difficulty in grasping statistical principles and concepts
- Computer-based learning has been effectively used in a number of disciplines to enhance the teaching and learning process
- Educational technology encompasses computer based-learning which may be used to supplement traditional hard copy material in an effort to help students acquire needed practical skills to reinforce their theoretical knowledge of statistics

Contribution of this paper to the literature

- Perceptions of undergraduate African students are presented regarding the use of a wide variety of educational technologies, which includes using a locally produced prescribed textbook that provides practical native examples which are easy to understand
- The use of Microsoft Excel has helped many students to better understand descriptive statistics while the use of Microsoft PowerPoint has proved effective in helping students to grasp different visual displays of data types
- The use of YouTube clips was rated as the lowest educational technology in terms of helping students to better understand statistical concepts

members who resist using educational technology in teaching, communication and research (Khalil, 2013). Furthermore, educators have found that students had difficulties in learning statistics at the university level (Garfield, 1995). Onwuegbuzie (2003) pointed out that even graduate students have experienced difficulty and have felt highly anxious when trying to understand statistical concepts introduced in statistics classrooms, with these two reactions being correlated to low academic achievement. Lin (2011) proposed the use of an effective computer-supported collaborative problem-solving model for statistics education, while Frith et al. (2004) described a study of learning where students effectively used interactive spread sheet-based computer tutorials in a mathematical literacy course. Computer-based learning has also been effectively used in a number of other disciplines to enhance the teaching and learning process (Pietzner, 2014; A.J. Swart, 2012b). The use of a wide variety of educational technologies may therefore prove useful in enhancing student understanding of statistical concepts.

The research question therefore arises as: "Which educational technologies could help improve the educational experience of students in a statistical service course, as perceived by the students themselves?" The purpose of this article is to present a case study where

an academic endeavoured to improve the educational experience of students in a statistics service course by using various educational technologies suited to the learning outcomes of the module. North and Zewotir (2006) advocate that the focus should be on how to use statistics via educational technology (like calculators and computers) so that students can see the values of statistics and eventually appreciate its role in society. The various forms of educational technology that were used are defined in this article, and are then aligned to the learning outcomes stipulated in the curriculum of the statistical service course termed Statistics 1.1. A brief questionnaire survey was used as the main data collection tool to ascertain student perceptions of using educational technology within this module. Primarily quantitative data is presented.

EDUCATIONAL TECHNOLOGY DEFINED

The term 'educational technology' carries a wide meaning. It cannot be confined to the use of audio-visual aids, software packages and hardware equipment, nor be limited to the use of psychological principles and instructional theories for improving the process of teaching learning (Singhal, 2013). It encompasses any technologically based technique which may be used to complement or enhance – not replace – traditional teaching and learning techniques in an attempt to improve student achievement (Perez & Normore, 2004). The Commission on Instructional Technology (1970) in the USA added a different dimension to the definition of educational technology, defining it as "a systematic way of designing, implementing and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning and communication and employing a combination of human and non-human resources to bring about more effective instruction". Noteworthy are the statements "specific objectives", and "non-human resources to bring about more effective instruction". Education in South Africa has changed radically since 1970, with current emphasis being placed on outcome-based education in higher institutions. This means that the current curriculum must be designed in such a way that students can easily identify the learning outcomes, or "specific objectives". These learning outcomes must be assessed with specific criteria in mind and with specific assessment tools, including "non-human resources to bring about more effective instruction", as academics strive to integrate theory with practice.

Integrating theory with practice is vital in any curriculum (A.J. Swart & Sutherland, 2007), as it serves to reinforce the value of the theoretical knowledge, helping students to become adept at doing rather than only knowing. Students must also be helped to see where the theoretical knowledge can be applied so that

they may start to associate it with the bigger picture. This entails not regarding theory as only small pockets of knowledge, but seeing it in relation to an entire curriculum and, ultimately, the course for which they have enrolled.

Educational technology therefore provides rich opportunities for teaching and learning and for extending and connecting the spaces and places of students (Kumpulainen, Mikkola, & Jaatinen, 2013). Equal amounts of learning are often accomplished in less time using educational technology and is preferred by students when compared to traditional instruction (Mwaka, Wambua, Syomwene, & Kitainge, 2013). The use of educational technology also appeals to a wide range of learning styles of undergraduate students. For example, the use of computer-based software packages such as Microsoft Excel involves inductive, sequential and active learning, as students are required to input specific data in a certain order and interpret the results. Using Microsoft PowerPoint and YouTube clips appeal to students who prefer visual learning, while looking through examples and reading from a prescribed textbook often involves visual and auditory learning. Lecturers need to adjust their preferred teaching styles to accommodate the diverse learning styles of students (Felder & Silverman, 1988), and to understand the connection between particular forms of educational technology and their effects on learning and teaching styles (Grasha & Yangarber-Hicks, 2000).

In this article, educational technology encompasses computer based-learning, which is used to supplement traditional hard copy material in an effort to help students acquire needed practical skills to reinforce their theoretical knowledge. Computer-based learning includes the use of Microsoft Excel and PowerPoint, YouTube clips, myVUT and a financial calculator. Traditional hard copy material refers to the the official, locally-produced prescribed textbook, from which a number of specific learning outcomes are formulated.

STATISTICAL SERVICE MODULE DESCRIBED ALONG WITH ITS ASSOCIATED LEARNING OUTCOMES

Statistics 1.1 is a service module which must be taken by students enrolled for national diplomas in cost and management accounting, internal auditing and financial information systems. These national diplomas usually comprise a minimum of eighteen subjects, which full-time students may complete within a three-year period. Statistics 1.1 is offered over a semester period (usually fourteen weeks in duration) and comprises five formative assessments (a combination of computer-based and written class tests) and one main summative assessment (a written classroom examination).

The curriculum for Statistics 1.1 primarily covers descriptive statistics and probability, where students need to be able to calculate, analyse, sketch and interpret descriptive statistics and probability through the use of a financial calculator and Microsoft Excel. These verbs involve higher order learning which is fundamental in developing logical and critical thinking (A. J. Swart, 2010). Software must be used for computations and not for teaching, where the capabilities of the software would help the student to practice computation skills, conduct data analysis and perform tests in specific topics (North & Zewotir, 2006). Important statistical concepts that students need to grasp in Statistics 1.1 are covered in the prescribed textbook by Wegner (2012).

These statistical concepts are learning outcomes which must be met by all students enrolled for this course, and are aligned to specific educational technologies used in this statistical service course (see Table 1 where the words in bold are relevant to the results section of this article). It is important to note that students may personally use some of the educational technologies themselves to demonstrate achievement of a specific learning outcome (such as the use of Microsoft Excel to display frequency graphs), while at other times the lecturer may use educational technology to demonstrate to the student what is required (using Microsoft PowerPoint to describe the different probability distributions, for example). The perceptions of students regarding the usefulness of these educational technologies where obtained by using an exploratory design which is explained in the following section.

RESEARCH METHODOLOGY

This research paper uses an exploratory design, where an exploratory design may set the stage for future research and usually involves only a single group of respondents (De Vos, Strydom, Fouché, & Delport, 2005). The target population was restricted to all undergraduate students enrolled for the Statistics 1.1 course during the first semester of 2013 (fourteen week period from February to May). In this research paper, one single group of students (n=150) from the VUT was polled using a questionnaire as the main data collection tool. The study focused on six educational technologies, namely:

- Microsoft Excel (a computer package that enables students to actively participate in statistical analysis);
- YouTube clips (visual demonstrations of the real-life application of statistical concepts);

Table 1. Learning Outcomes for Statistics 1.1 and the Associated Educational Technology

Learning outcomes: Students must be able to	Educational technology used
Interpret findings and summarise both categorical and numerical data types into frequency distributions	MS PowerPoint / Textbook
Visually display and interpret categorical and numerical data types, using appropriate graphs	
Explain and identify the measures of central and non-central location and the measure of dispersion and skewness for different data types	
Explain how outliers influence the choice of valid descriptive statistical measures	
Describe and recognise three common probability distributions (Poisson, Binomial and Normal distributions) using graphs	
Sketch frequency tables and graphs based on given data	MS Excel
Calculate the measures of central and non-central location	
Calculate the measures of dispersion and skewness	
Calculate and evaluate Poisson, Binomial and Normal probability distributions	
Calculate the arithmetic mean and standard deviation of specific data	MS Excel / Calculator
Demonstrate how statistics is used in the real world	YouTube / MS PowerPoint
Distinguish between different types of data (quantitative vs. qualitative) and explain the importance of data types in choosing a data analysis technique	
Differentiate between different graphs associated with various data types	
Complete an online assessment involving descriptive statistics and probability questions	myVUT
Access and download lecturing notes, solutions to exercises and additional learning resources for this course	

- the prescribed textbook (hard copy of statistical outcomes that need to be reached);
- myVUT (e-learning platform for posting different kinds of teaching materials);
- Microsoft PowerPoint (technological mediator of teaching); and
- a financial calculator (reduce errors in statistical calculations).

Data was also collected with regard to the information technology (IT) experience of the students, as a lack of exposure to IT may explain a perceived lack of usefulness of various educational technologies. The questionnaire included some demographic questions relating to school background, language, gender and age. Six close-ended questions were asked to ascertain student perceptions of the different types of educational technologies which were used in Statistics 1.1, and are based on previous research studies. For example, Baxi et al. (2009) polled medical students with regard to learning aids that helped them to better understand statistical concepts, learning aids that captured and held their attention, and learning aids which could be used again at home or in the workplace. Previous research has also sought answers to the questions of whether educational technology adds value to the learning experience (Sorensen, 2013), whether it should be used more often in the classroom (A.J. Swart, 2012a) and

whether it is not stimulating to use at times (Maghami, 2010). For each close-ended question, students could only choose two of their preferred educational technologies. Open-ended questions focused on which educational technologies were beneficial in achieving the learning outcomes of the service module. This gives rise to both quantitative and qualitative data and analysis. Descriptive statistics was used to analyse the six different educational technologies most preferred by students and was interpreted with regard to the African undergraduate students in the sample.

RESULTS

The sample consisted of 72 (48%) male students and 78 (51%) female students, all with an average age of 21.6 years. The majority of the students completed high school at a public school (58%) in a developed city (68%). The home languages of the students are shown in Figure 1, highlighting that the majority of students come from KwaZulu-Natal and Mpumalanga (commonly Zulu speakers), the Free State (commonly Sotho speakers) and from Limpopo (commonly Sepedi and Venda speakers). Figure 2 highlights the final grade results of students enrolled for the Statistics 1.1 course during 2013, along with their individual final grade results for an IT course which they completed in 2012 before enrolling for the statistical service course.
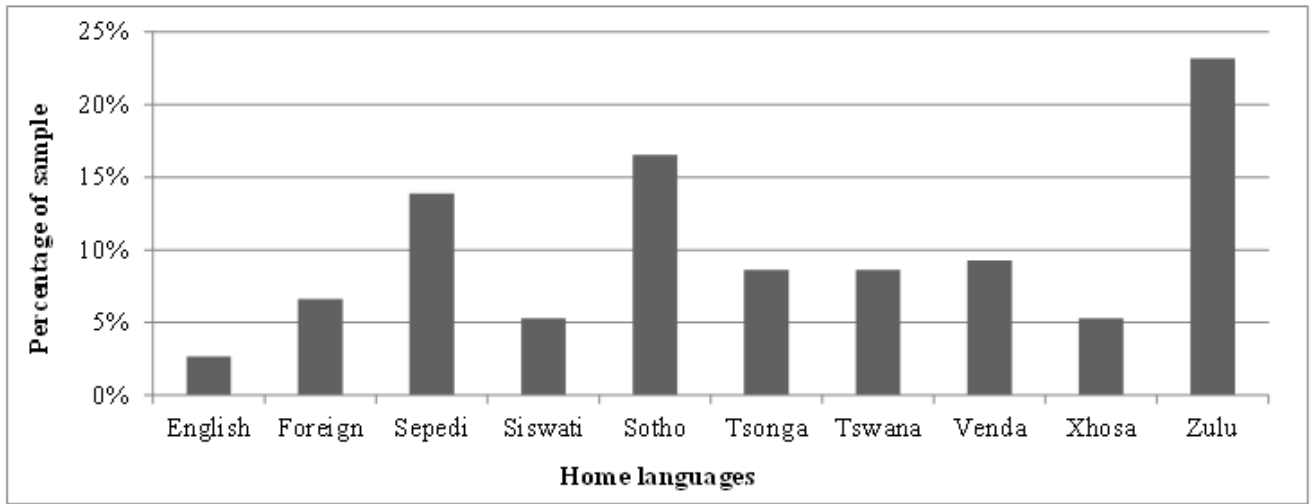
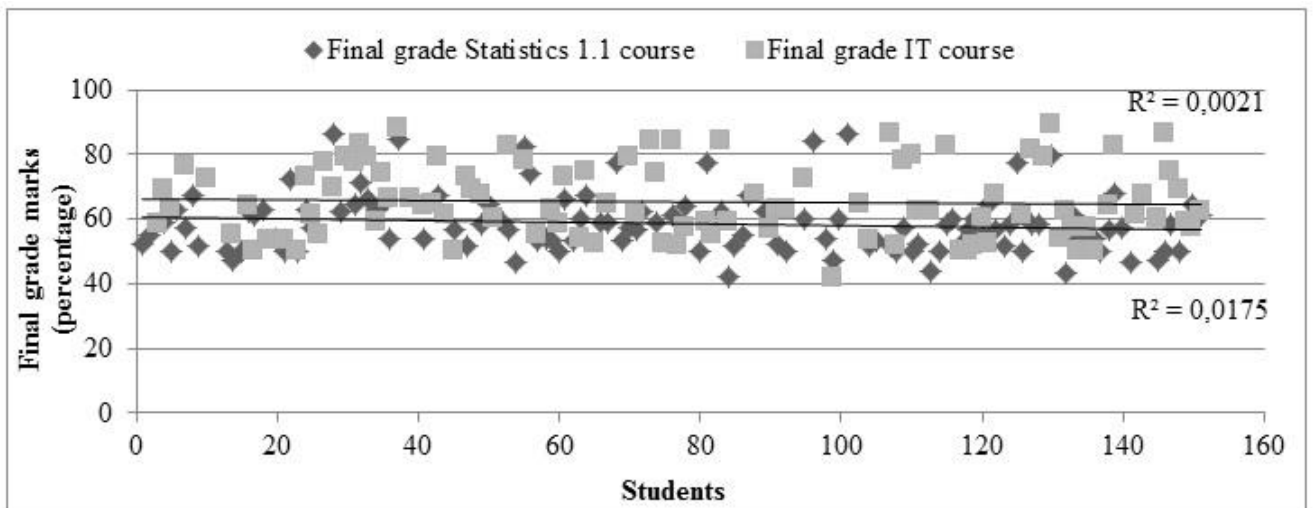**Figure 1**. Home languages of the respondents (n=150)

Figure 2. Final grade results of students enrolled for the statistical service course during 2013 and for an IT course during 2012
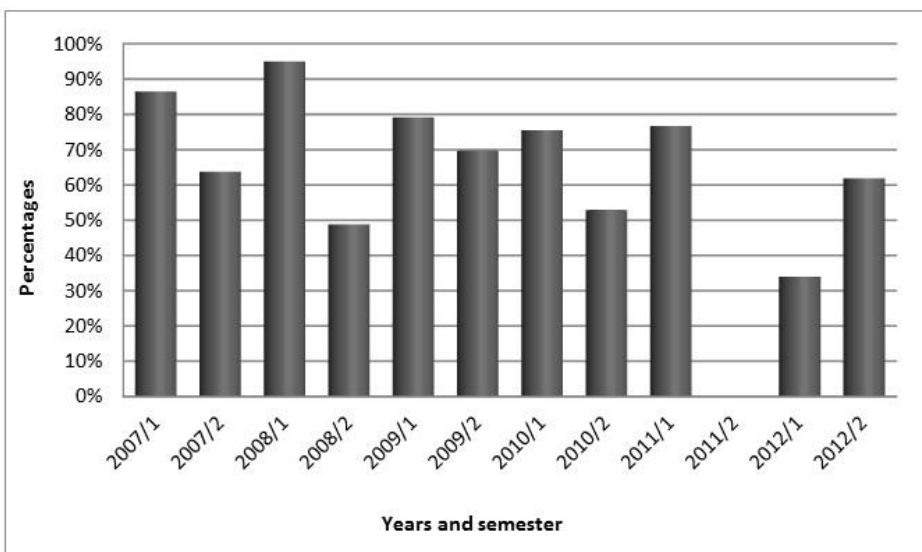

Figure 3. Throughput rates for the statistical service course over the past six years

These results show that the majority of students successfully completed the IT course, and would therefore be in a position to make use of the educational technologies incorporated into this statistical service course. A significant statistical relationship (p-value = 0.000) was also established between the two marks of the respective students. Figure 3 presents the throughput rate for this statistics service course for the past six years. The throughput rate is primarily used in South Africa to describe the percentage of students completing the course in relation to those who registered for the course. These results indicate a concern in that the throughput rate does not remain relatively constant, but fluctuates considerable between 30-90%. This supports research by Garfield (1995), which stated that students have difficulties in learning statistics at the university level, although only certain semester groups within this statistics service course experienced this difficulty. Table 2 presents the perception of students regarding the six educational technologies used in Statistics 1.1. Please bear in mind that for these close-ended question, students were encouraged to select at least two of their preferred educational technologies.

The responses of the students, shown in Table 2, give rise to the following ranking of the educational technologies when considering this statistics service course:

- The most preferred educational technology was a locally-produced prescribed textbook. This helped 66.2% of the students to better understand statistical concepts, while 59.6% of the students indicated that it should be used more often in the classroom. This educational technology also helped to capture the attention of a number of students (49.7%) who further felt that it was a valuable learning experience (56.3%) and could be used again in the future (51.0%).

- Microsoft PowerPoint slides are ranked second and it helped 35.1% of the students better understand statistical concepts, while 44.4% of students indicated that it should be used more often in Statistics 1.1.

- Microsoft Excel is ranked third, with 30.5% of students indicating that it helped them better understand statistical concepts. A total of 32.5% said it should be used more often in the statistics classroom. Many students (55.6%) felt that it could be used again at home or in the workplace, and that it was a valuable learning experience (41.7%). However, a discrepancy can be seen in the fact that 35.8% of students indicated that it was a boring learning aid.

- The financial calculator ranks fourth, with 28.5% of students indicating that this educational technology added value to their learning experience.

- The myVUT platform ranks fifth. Only 10.6% of the students indicated that it helped them to better understand statistical concepts and should be used more often in the classroom.

- YouTube clips ranks last as the lowest rated educational technology (6.6%) in terms of helping students to better understand statistical concepts, although 19.2% said that it should be used more often in the classroom. It was also rated as a boring learning aid by 33.8% of the students.

Open-ended questions focused on which educational technologies were beneficial in achieving the

Table 2. Student Perceptions Regarding Different Educational Technologies

	Excel	YouTube clips	Prescribed textbook	myVUT	PowerPoint slides	Financial calculator
P1_Which of the following learning aids helped you to better understand statistical concepts?	30.5%	6.6%	66.2%	10.6%	35.1%	12.6%
P2_Which of the following learning aids captured your attention and held it?	32.5%	18.5%	49.7%	18.5%	44.4%	20.5%
P3_Which of the following learning aids should be used more in the Statistics 1.1 classroom?	32.5%	19.2%	59.6%	10.6%	44.4%	21.2%
P4_Which of the following learning aids were boring to use?	35.8%	33.8%	28.5%	21.9%	23.8%	25.8%
P5_Which of the following learning aids could you use again at home / workplace?	55.6%	11.3%	51.0%	15.2%	35.8%	27.8%
P6_Which of the following learning aids added value to your learning experience?	41.7%	13.9%	56.3%	19.9%	33.1%	28.5%

learning outcomes of the service module and which helped students to understand statistical concepts. Student responses to these open-ended questions were limited, with only 74 out of the 151 students providing their own written comments. The overall student perception regarding the use of educational technologies in Statistics 1.1 was positive, with students indicating that they were satisfied with the use of the various educational technologies in the classroom. A few positive comments from students included (the number of times a comment was made is shown in brackets):

> The learning aids that are provided in Statistics 1.1 are well advanced and easy to access, which makes it easier to learn the subject. (8)
> The learning aids that we used added more value to our learning, because it makes us to have knowledge in new technologies used today in most various working place [sic]. (7)
> Current learning aids used are good, because we gain different things every time and it keeps us from boredom in class. (9)

One out of every six students indicated that Microsoft Excel helped them to better understand descriptive statistics (mean, standard deviation, skewness, etc.), and helped them in reducing calculation errors associated with the financial calculator. This means that these students were able to achieve the four specific learning outcomes (see Table 1) relating to calculations using this educational technology. A practical example used by the lecturer focused on data obtained from a questionnaire which gathered client perceptions of a local restaurant in the VUT area. The statistics students were asked to calculate specific descriptive statistics of data relating to the overall experience of the clients in the restaurant, the gender of the clients, the total waiting time for the main course, and data concerning whether a client ate dessert or not. The majority of students were able to process, calculate and evaluate this data correctly using Microsoft Excel. However, one student stated: "I would believe that it is best that Excel be cancelled from the syllabus as we are not aimed at becoming statisticians but we would just like the basics to doing statistics [sic]". Minority comments such as these suggest that certain students only want to get the bare minimum out of a course with the least amount of effort. However, the majority of students were able to process, calculate and evaluate this data correctly using Microsoft Excel.

A smaller percentage of students (7%) commented on the usefulness of Microsoft PowerPoint in helping them effectively learn about the visual displays of different data types. Four specific learning outcomes relating to graphs (see Table 1) were subsequently achieved by these students using this educational technology. Practical examples used by the lecturer involved numerous bar graphs (e.g. favourite fruits of

students at VUT), histograms (e.g. the scores obtained by students in a statistics course) and pie charts (e.g. reasons why a policeman would switch on their car's lights). However, one student did state that: "The PowerPoint slides are not helping that much as they are just the summary of the prescribed book". It is therefore important to note that not all students will benefit equally from the use of educational technology.

The prescribed book was cited by seven students (4% of the sample) as being very beneficial in providing practical day-to-day examples which were easy to understand. An example of this relates to probability. Students are informed that it normally takes around fifteen minutes (with a standard deviation of three minutes) to walk from VUT's main hostel complex to the statistics classroom at VUT's main campus. Students were then asked what the probability would be that a randomly selected student will take at most ten minutes, when the walking time of students is assumed to be normally distributed. The majority of students could answer this question correctly using the guidelines given in the prescribed textbook. One student did, however, comment "If only we could not force the textbook so much but rather do the homework during normal class time", suggesting that not all the students were eager to always use the prescribed textbook in the classroom.

DISCUSSIONS

Students selected the prescribed textbook as the most useful educational technology in helping them to better understanding Statistics 1.1. A local prescribed textbook, instead of a foreign one, overcomes the challenge of presenting foreign examples that students often do not relate to (Steffens, 1998). The advantage of a prescribed textbook is that it demonstrates the procedure and application of statistical concepts via formulas and illustrative examples, providing students with much needed exercises.

This study indicated that students do value Microsoft PowerPoint slides in the classroom, as two out of five students indicated that it should be used more often in the classroom. Craig and Amernic (2006) reported that Microsoft PowerPoint slides should be recognised as a communication medium that is fundamentally changing the nature and dynamic of how lecturers teach, and that it affects how students are exposed to a curriculum. The advantage of Microsoft PowerPoint is that you can present to students many more accurately sketched graphs of different data types than would be possible with a traditional blackboard and chalk.

The majority of students noted that they could use Microsoft Excel at home for statistical calculations, which is favoured over SPSS due to licensing costs. Basturk (2005) showed that the use of computer-

assisted instruction is a useful tool for teaching an introductory statistics course. The main advantage associated with this technology is that students may increase the time they spend on statistical calculations at their own pace, time that may lead to them not achieving the desired academic success (Arthur James Swart, Lombard, & de Jager, 2010).

Students acknowledged that they can make use of the calculator at home and that it could improve their understanding of certain statistical concepts. Dolvin et al. (2006) found that students do associate the use of financial calculators with a higher quality of education and satisfaction. Advantages of a financial calculator include ease of use and the lack of formula memorisation.

The advantages of myVUT and YouTube clips were not fully realised or utilised by the students in this study. Only 56% of the registered students visited the myVUT platform from February to May, with many indicating that they could not use it at home. Dolvin et al. (2006) suggests that lecturers avoid online lecture notes as the only methods employed for disseminating and discussing information.

CONCLUSIONS

Traditional lectures in Statistics 1.1 were replaced by a more blended learning approach which combines different teaching styles (such as formal lectures and computer-aided learning). The results of this approach indicated that specific educational technologies helped certain students achieve more than half of the learning outcomes for this service module. The prescribed textbook, Microsoft PowerPoint slides and Microsoft Excel were perceived by the polled students as good educational technologies that could help them in calculating different descriptive statistics and in sketching and understanding certain graphs. Students did not perceive the financial calculator, myVUT and YouTube clips to be of great value to their educational experience. However, a blend of educational technologies has helped to improve the educational experience of students in a statistical service course, as perceived by the students themselves.

Using educational technology to enhance the teaching and learning process in statistics is dependent on the lecturer, the availability of facilities, and the support of management to provide facilities to students to enhance the learning process. Changing lecturer perceptions towards the use of educational technology may be achieved when considering the perceptions of students in this regard – perceptions that have been shown in this article to favour educational technology in adding value to students' educational experiences (see Table 2). Indeed, the successful integration of learning technologies in education primarily demands that lecturers' and students' adequacy and perceptions of such technology be determined (Ozdamli & Uzunboylu, 2014). Moreover, the use of educational technology may even pave the way for statistical thinking to become as common in efficient citizenship as the ability to read and write.

REFERENCES

Basturk, R. (2005). The Effectiveness Of Computer-Assisted Instruction In Teaching Introductory Statistics. *Educational Technology & Society, 8*(2), 170-178.

Baxi, S. S., Shah, C. J., Parmar, R. D., Parmar, D., & Tripathi, C. B. (2009). Students' perception of different teaching aids in a medical college. *AJHPE, 1*(1), 15-16.

Craig, R. J., & Amernic, J. H. (2006). Powerpoint Presentation Technology And The Dynamics Of Teaching. *nnovative Higher Education, 31*, 147-160.

De Vos, A. S., Strydom, H., Fouché, C. B., & Delport, C. S. L. (2005). *Research at Grass roots: for the Social Sciences and Human Service Professions* (3rd ed.). Pretoria: Van Schaik Publishers.

Dolvin, S. D., Morgan, J. M., & Pyles, M. (2006). The Effect Of Instructional Technologies On The Finance Classroom. *Journal Of Economics And Financial Education, 5*(2), 33-42.

Felder, R. M., & Silverman, L. K. (1988). Learning and teaching styles in engineering education. *Engineering education, 78*(7), 674-681.

Frith, V., Jaftha, J., & Prince, R. (2004). Evaluating the effectiveness of interactive computer tutorials for an undergraduate mathematical literacy course. *British Journal of Educational Technology, 35*(2), 159-171.

Garfield, J. (1995). How students learn statistics. *International Statistical Review, 63*(1), 25-34.

Grasha, A. F., & Yangarber-Hicks, N. (2000). Integrating teaching styles and learning styles with instructional technology. *College Teaching, 48*(1), 2-10.

Khalil, S. M. (2013). From resistance to acceptance and use of technology in academia. *Open Praxis, 5*(2), 151-163.

Kumpulainen, K., Mikkola, A., & Jaatinen, A.-M. (2013). The chronotopes of technology-mediated creative learning practices in an elementary school community. *Learning, Media and Technology*(ahead-of-print), 1-22.

Lin, G.-Y. (2011). Designing a web-based collaborative-learning module for statistical problem solving. *British Journal of Educational Technology, 42*(3), E54-E57.

Maghami, H. R. (2010). Inspecting Obstacles In The Way Of Using Educational Technology In University Instructing From The Viewpoint Of The Instructors Of Ahvaz Shahid Chamran University And Medical Sciences University. *Journal Of Research In Educational Systems, 4*(8), 83-107.

Mutanga, A. (2013). *ICT tools and Mathematics pedagogy: Troubling the possibilities*. Paper presented at the UNISA ODL Conference.

Mwaka, M., Wambua, B. K., Syomwene, A., & Kitainge, K. (2013). Monitoring of educational technology progress to enhance the quality of graduate teachers from the Kenyan universities. *European Scientific Journal, 9*(10).

Education (Establishment of Universities of Technology), New Zealand Parliament(2006).

Nickola, L., & Swart, A. J. (2013). *Technology enhanced learning in electrical engineering education*. Paper presented at the UNISA ODL Conference.

North, D., & Zewotir, T. (2006). Teaching statistics to social science students: making it valuable. *South African Journal for Higher Education, 20*(4), 503-514.

Onwuegbuzie, A. J. (2003). Modeling statistics achievement among graduate students. *Psychological Measuremen, 63*(6), 1020-1038.

Ozdamli, F., & Uzunboylu, H. (2014). M-learning adequacy and perceptions of students and teachers in secondary schools. *British Journal of Educational Technology*, DOI: 10.1111/bjet.12136.

Perez, M., & Normore, A. H. (2004). *Technology Integration and School Leadership*. Paper presented at the Proceedings of the Third Annual College of Education Conference, Miami, Florida.

Pietzner, V. (2014). Computer-based learning in chemistry classes. *Eurasia Journal of Mathematics, Science & Technology Education, 10*(4), 297-311.

Shaw, J. E. H. (2001). Some Quotable Quotes for Statistics. Retrieved 8 November, 2012, from http://www.ewartshaw.co.uk/

Singhal, P. (2013). Educational Technology - Presenting the art of teaching in a new fashion. *Indian Streams Research Journal, 3*(2), 1-4.

Sorensen, E. (2013). Implementation and student perception of e-assessment in a Chemical Engineering module. *European Journal of Engineering Education, 38*(2), 172-185.

Steffens, F. E. (1998). *Statistical Education In The African Region: Private Experiences In South Africa And Namibia*. Paper presented at the Proceedings Of The Fifth International Conference On The Teaching Of Statistics.

Swart, A. J. (2010). Evaluation of Final Examination Papers in Engineering: A Case Study Using Bloom's Taxonomy. *IEEE Transactions on Education, 53*(2), 257-264.

Swart, A. J. (2012a). Advancement in On-line Education: Exploring the best practices. Volume 2. In Q. Lin (Ed.), *African student perceptions of on-line assessments* (Vol. 2, pp. 139-153). New York: Nova Science Publishers.

Swart, A. J. (2012b). Enhancing students' perception of single-sideband suppressed-carrier principles by using cooperative and computer-based learning. *CAEE, Computer Applications in Engineering Education, 20*(2), 332-338.

Swart, A. J. (2014). Using problem-based learning to stimulate entrepreneurial awareness among senior African undergraduate students. *EJMSTE, Eurasia Journal of Mathematics, Science and Technology Education, 10*(2), 125-134.

Swart, A. J., Lombard, K., & de Jager, H. (2010). Exploring the relationship between time management skills and the academic achievement of African engineering students - A case study. *EJEE, European Journal of Engineering Education, 35*(1), 79 - 89.

Swart, A. J., & Sutherland, T. (2007). *Fusing theory and practical in a curriculum for engineering students - A case study*. Paper presented at the AFRICON 2007 international conference.

Wegner, T. (2012). *Applied Business Statistics: Methods And Excel-Based Applications*. Cape Town: Juta.

Zewotir, T., & North, D. (2011). Opportunities and challenges for statistics education in South Africa. *Pythagoras, 32*(2), 1-5.

❖ ❖ ❖