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**THE USE OF TECHNOLOGY TO SUPPORT STUDENT
LEARNING**

Norhayati Baharun and Anne Porter

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Centre for Statistical & Survey Methodology, University of Wollongong, Wollongong NSW 2522. Phone +61 2 4221 5435, Fax +61 2 4221 4845. Email: anica@uow.edu.au

THE USE OF TECHNOLOGY TO SUPPORT STUDENT LEARNING

¹Norhayati Baharun and ²Anne Porter

School of Mathematics and Applied Statistics, University of Wollongong, NSW 2522 Australia

email: ¹nbb470@uow.edu.au ²alp@uow.edu.au

Abstract. *This paper presents the results of a case study investigating the use of technology i.e. video resources in teaching statistics to 40 Health Informatics post-graduate students at the University of Wollongong. The purpose of the study is to investigate if the use of such technology has some impact on student learning outcomes in terms of their understanding of topics and level of anxiety in learning the subject. The findings from the study reveal that students were concerned about their learning of the subject and they found that the use of videos as teaching and learning tools in the subject was helpful in increasing their understanding of topics covered and reducing their anxiety in learning it. At the end of the academic session, majority of the students were confident in most topic areas covered and they were also comfortable in taking the subject. There were several issues identified by the students and one of them is the improvement of video resources particularly technological issues such as downloading and accessing the videos.*

1 Introduction

Research has shown that statistics anxiety is prevalent among students as almost all students need to take Statistics as part of their academic program, for instance students in social and behavioral sciences (Onwuegbuzie, 2000; Onwuegbuzie & Daley, 1999; Pan & Tang, 2004; Walsh & Ugumba-Agwunobi, 2002; Zeidner, 1991), education (D'Andrea & Waters, 2002; Murtonen & Lehtinen, 2003; Onwuegbuzie, 2000; Onwuegbuzie & Daley, 1999; Pan & Tang, 2005; Papanastasiou & Zembylas, 2008), psychology (Hanna, Shevlin et al., 2008; Onwuegbuzie, 2004; Piotrowski, Bagui et al., 2002) sociology (Murtonen & Lehtinen, 2003), and sports (Lane, Dale et al., 2006). Furthermore, up to 80% of graduate students experience uncomfortable levels of statistic anxiety (Onwuegbuzie, Slate et al., 2000; Onwuegbuzie & Wilson, 2003). Consequently, it negatively affects students' performance (Lalonde & Gardner, 1993; Onwuegbuzie & Seaman, 1995; Zeidner, 1991) and according to Huntley, Schneider and Aronson (2000) doing statistics is frequently rated as the lowest skill in academic for many students. Indeed, it is important for educators to investigate ways on helping students to overcome and deal with statistic anxiety as to make them understand and learn statistics more effectively.

There are several ways or effort to reduce students' anxiety about statistics in the literature such as incorporating humorous cartoon examples (Rodarte-Luna & Sherry, 2008; Schacht & Stewart, 1990), journal writing (Onwuegbuzie, Daros et al., 1997; Sgoutas-Emch & Johnson, 1998; Smith, Miller et al., 1992), incorporating computer usage, real-world applications, humour, statistical language practice, and group learning principles (Forte, 1995), creating a collaborative environment in which active learning strategies were used as the primary teaching method (Dolinsky, 2001; Rodarte-Luna & Sherry, 2008), combining application-oriented teaching methods with instructors' attentiveness to students' anxiety (Pan & Tang, 2004), and using multidimensional instructional methods and instructor's being attentiveness to students' anxiety (Pan & Tang, 2005). According to Song and Slate (2006), the use of technology also helped to scaffold student learning and improved student motivation which it can be designed to address different "learning styles" (Onwuegbuzie, 1998) that may also reduce statistics anxiety. Recently, Song and Slate (2006) found that teaching statistics using online syllabus, online instructional technologies, and the instructor's characteristics can reduce students' anxieties and maximize the students' motivation in statistics subject. However, only a few researchers have investigated ways of reducing anxiety among students in learning statistics (Onwuegbuzie & Wilson, 2003; Pan & Tang, 2004; Pan & Tang, 2005; Song & Slate, 2006).

In this study, many students had written their comments in the e-Learning forum about the study of statistics and the use of learning resources that were provided to them in the e-Learning system. With permission given by students, the analysis of comments made in the forum and data gathered from the e-Learning survey were used as a means of achieving the aim of this study which was to identify the impact of learning resources in particular video resources on student learning outcomes which are students' understanding of topics covered and their anxiety in learning statistics. More specifically, the purpose of this study was to determine ways on how to improve the resources in creating a comfortable learning environment for students. There were a cohort of 66 on-campus and 20 distance-learning mode students registered for the subject. The results from the study showed that a majority of the students were concerned about their learning of statistics and claimed that the use of resources proven to be helpful in understanding the subject better and reducing their anxiety in learning it.

2 Methods

2.1 Participants

Though there were 86 students registered for Statistics in Health Research subject offered by the School of Mathematics and Applied Statistics at the University of Wollongong, only 40 of them took part in the survey. They consisted of 13 distance-learning mode and 27 on-campus students, out of which 17 were males, 21 females while the other two students did not provide any gender information. In terms of nationality, 21 were international students, 17 domestic while one student did not provide any information on his or her nationality.

2.2 Instruments

An e-Learning survey questionnaire was used to collect the information on students' background, usefulness of learning resources, accessing and playing the video resources, students' perceived competency with the statistic topics, changes in perspective after completing the subject, impact of video resources, and suggestions for the improvement of the subject. Responses on the usefulness of learning resources were obtained on a 4-point scale ranging from 1 (not applicable or rarely used) to 4 (extremely useful), perceived competency with the statistic topics obtained on a 4-point scale ranging from 1 (not at all) to 4 (could do this), changes in perspective after completing the subject obtained on a 5-point scale ranging from 1 (much more anxious) to 5 (much more comfortable), and the impact of video resources obtained on a 6-point scale ranging from 1 (no videos to help) to 6 (much more comfortable). This study reported a reliability coefficient of 0.96 for the 51-item scales and nine open-ended questions were also included in the instrument.

2.3 Procedures

In the first week of lectures, prompts were put in the e-Learning forum by the lecturer on the study of statistics and the use of video resources. Students were encouraged to give their comments on the prompts given in the e-Learning forum. In week three, video resources were made available to all students on some topics of the subject. At the end of the final examination weeks, students were asked to volunteer to fill out a set of questionnaire via online in the e-Learning website. The approach of using an online survey has been shown to increase disclosure (Locke & Gilbert, 1995; Rodarte-Luna & Sherry, 2008; Turner, Ku et al., 1998) and could produce a higher response rate. In this study, the response rate was forty-seven percent. The students were initially informed about the purpose of the study through an information sheet delivered via email. If they agreed to participate, they were asked to give their consent through email or an online permission slip. In the consent form, they were told that their participation was voluntary and that they were free to refuse to participate and to withdraw from the study at any time. Besides, they were also informed that they would not be penalised for not participating in the study and the outcome of the study they involved in would be beneficial for future students.

3 Results

3.1 Responses to the prompts

Ten students responded to the prompts which majority of them expressed their concerns about studying statistics in the beginning of the semester. Interestingly, most of them were hoping on being able to pass the subject rather to deepen their understanding in statistics. Many students were anxious as a result of having low mathematical skills and had such unpleasant experiences of taking statistics subject in their previous study programs. Several examples of their comments made were as follows:

“I have to say I’m always daunted by stats..”

“Statistics scares the hell out of me - numbers are not my thing”

“I find statistics rather daunting as I was never really good at maths subjects”

“I am (hopefully) looking forward to passing this course and never having to do Stat again..I am also looking forward to never having to do stats again after this..I have absolutely no intention of going anywhere near a job that needs stats!”

“I am also daunted by statistics...Stat’s isn’t a strong point of mine”

“I’m most concerned about the maths involved because this is my weakest subject and I genuinely cannot remember numbers”

“I did stats in my undergrad, as many of you have also mentioned (and it was torture)..My concern is about being able to pass this subject whilst doing it by distance”

“I have the same problem that Stats are not my strong point...this is my last subject so I can graduate in December and I want to pass”

In relation to the use of video resources, 10 students responded that the videos were useful in helping them to learn and understand the subject. Examples of comments made by the students were as follows:

“I really enjoyed the videos. They make things clearer than they once were.”

“The video itself is very helpful..”

“I find video support very useful. It reminds me of the important points out of the lectures and labs.”

“The videos are great. Very helpful. The recorded lecture was also very helpful. It is reassuring to hear what has gone on in the lecture.”

“I found the videos for JMP extremely helpful..”

“It provides a really good explanation of what is required in the meaningful paragraph”

“I just want to say how great these new videos are they are helping me so much.”

3.2 Anxieties while learning the subject

When the students asked to comment on in what way their anxieties for this course have either increased or decreased throughout the semester, fifty percent of the students responded that their anxieties had decreased towards the end of semester in varieties of ways. Some of their responses were as follows:

Lab tests and/or solutions

“Anxieties decreased due to increased knowledge, practice, ability and confidence. The lab tests and solutions were very helpful and the fortnightly tests were extremely helpful for a distance student to keep me on track. The videos were also fantastic.”

“As I went through the semester anxiety always decreased, as I completed my lab tests.”

Teaching methods and materials

“The methods and materials used during this course was really wonderful, I am more comfortable with statistics now.”

“My anxiety decreased because I utilized all the useful lecture notes, JMP notes, Lab work and exams output and especially the videos. They really helped me to understand the essence of statistics in health research and be prepared for the final exam.”

Exams, tests and quizzes

“The last few days before exams were the time when we studied stats the most. The lab test and the video support were much more useful to learn the subject. The teacher was also interesting and cooperative to help us solve our anxiety.”

“Regular quizzes and lab work eased my anxiety as the semester progressed.”

Statistical skills

“In explaining statistical findings and formulating and testing hypotheses, interpreting meaningful and so on, my anxieties have decreased gradually during the semester.”

“I am comfortable with maths, but now have a greater understanding of statistical methods in analysing data.”

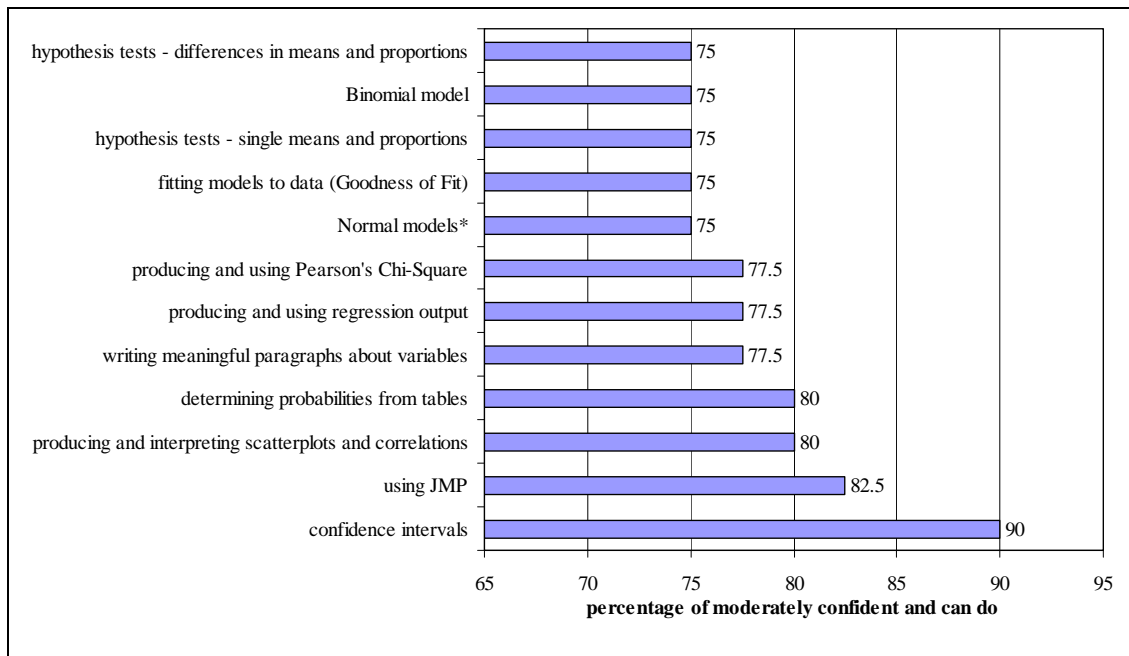
Others

“Calculations were the things I feared before starting this course and I am pretty comfortable now after completion this course. It was a good experience overall and I am happy that I worked hard for it and am satisfied.”

“My anxieties for this course decreased during this semester.”

3.3 Perceived competency in topics

At the end of semester, the students were asked to indicate how confident they were in relation to topics that are covered in the subject. In regards to student perceived comfort with statistics topics, majority of the students were confident in most topics particularly in determining confidence intervals, using JMP, producing and interpreting scatter plots and correlations, and determining probabilities from tables (see Figure 1).



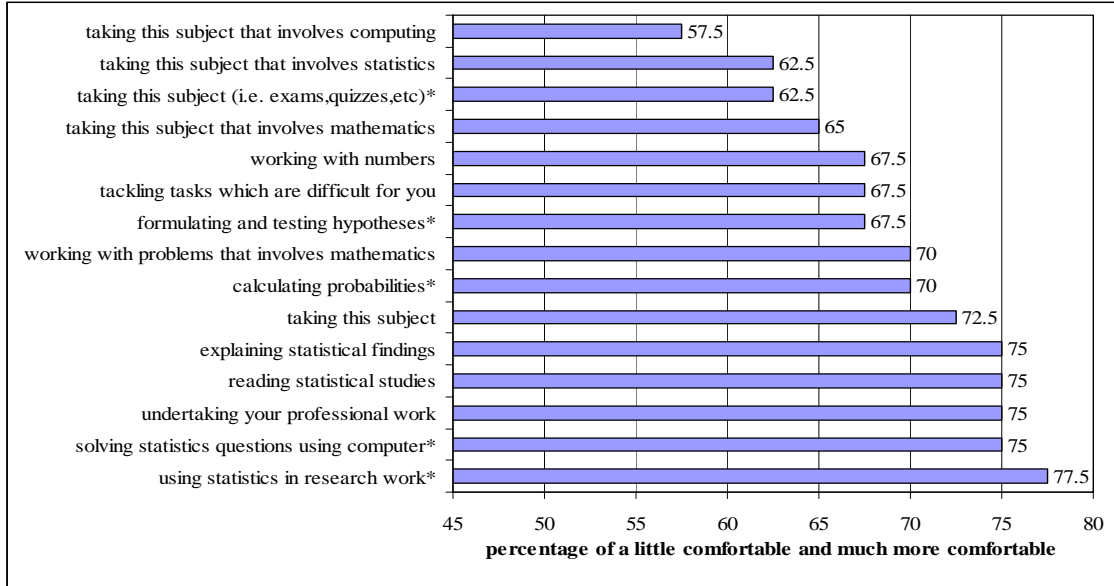
2.5% not answered each category

*5% not answered

Figure 1: Percentage of student perceived competency with topics areas

3.4 Changes in perspective at the end of session

In regards to students' changes in perspective after completing the subject, majority of students were comfortable in most aspects related to the subject. With the use of video resources as teaching and learning tools in the subject, it helped students to reduce their anxieties specifically in using statistics in research work, solving statistics questions using computer, undertaking their professional work, reading statistical studies, and explaining statistical findings (see Figure 2).



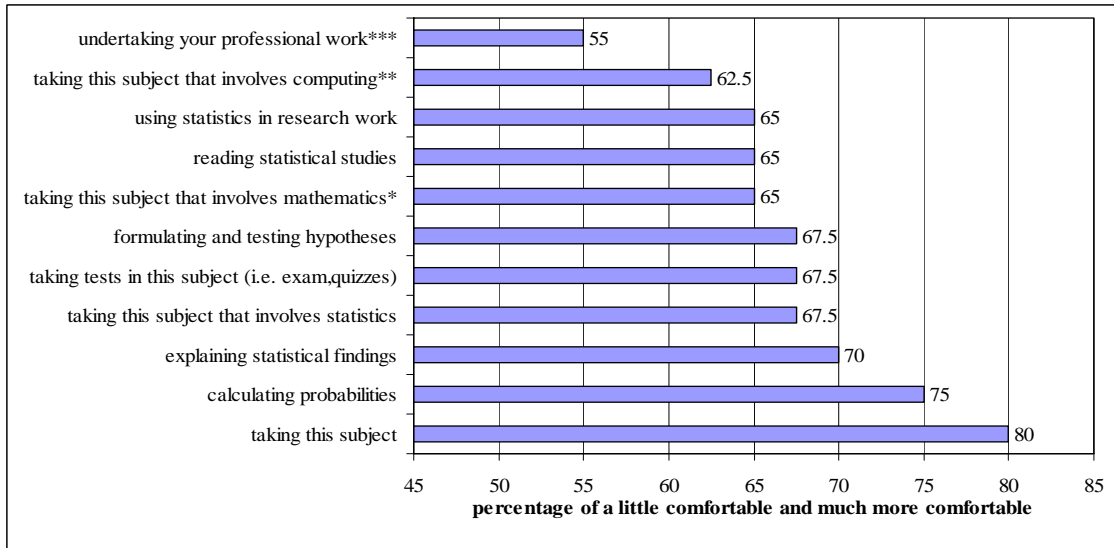
2.5% not answered each category

*5% not answered each category

Figure 2: Percentage of student changed in perspective after completing the subject

3.5 Impact of video resources on student learning

Consistent with the results presented in the previous sections, an analysis of impact of video resources showed that the students were also comfortable in most aspects related to the subject particularly in taking statistics subject, calculating probabilities, and explaining statistical findings (see Figure 3).



2.5% not answered each category

*10% not answered

** 7.5% not answered

***5% not answered

Figure 3: Percentage of impact of video resources on student learning

3.6 Improvement of video resources

The students were asked to comment on how the video resources can be improved to help their understanding of and learning statistics as well as their concerns about learning it. Based on the responses given, several themes were identified particularly on the issues of downloading and accessing the videos and the needs for more videos and topics covered extensively. They also suggested that the duration of videos to be longer, the lectures to be recorded and the videos highlight statistical skills and the use of JMP software. Some of their comments were as follows:

Downloading and accessing the videos

"They are excellent the way they are but we need to be able to download them in an easy way."

"To make it more appropriate so that videos won't get freeze or stuck during the playing time and more information could be made as well."

More topics and more extensively

"Some videos were short. It would be better if it covers the issues more extensively."

"By solving more problems of different kind and including more topics."

More videos

"I can suggest that videos are great in helping us understand more.. so if more videos are available the more better it is.."

"Have videos for each section of the course. They are fantastic!"

Make the videos longer

"They could be made a little longer."

"The videos could be made a little lengthier."

Lectures

"It should cover more topics and should be more informative than what it is now. All the class lectures should also be video-taped so that we can assess them again."

"Hmm well I found it very useful...and I think it can be made available for almost every lectures."

Using JMP

"May be in demonstrating the JMP procedure, like how to produce a relevant output. Sometimes it's fast that I needed to repeat the video to understand what happened. But overall it's really great!"

"JMP notes for each topic."

Statistical skills

"In my opinion, the best way we can do is focus on difficulty of understanding and learning statistics which depend on feedback of student step by step to explain and show the solutions especially emphasize the basic concept and terms of statistics."

"It improved my performance in exams and it improves my understanding of my subject."

Others

"The videos were quite good however they need to be used as an extension of the teaching provided by the classroom interaction. Sometimes no matter what resources are available a student may still struggle (such as I did)."

"For distance students, the video resources take the place of the lab sessions and the availability of a tutor and therefore need to be approached in this manner."

4 Discussion

Research that focuses on the issues of teaching and learning statistics has increased recently in which statistics anxiety has been found to be one of the most common topics discussed in many studies related to statistics subject (Hembree, 1990; Miller & Bichsel, 2004; Onwuegbuzie, 2000; Onwuegbuzie, 2004; Rodarte-Luna & Sherry, 2008; Zeidner, 1991). Furthermore, research that addresses on measurement of and factors affecting statistics anxiety has been done over the past 20 years. However, only a few research studies have been found investigating ways on how to reduce student anxiety in learning statistics (Onwuegbuzie & Wilson, 2003; Song & Slate, 2006). Thus, the specific aim of the present study was to

examine the impact of technological tools used in teaching statistics in particular the impact of the use of video resources on student learning outcomes especially on their understanding of the subject and their level of anxiety.

In responding to the concerns about studying statistics, the students' responses to the prompts given in the e-Learning forum showed that they were anxious in taking the subject in particular the mathematical components included in the subject. Lack of mathematical skills and unpleasant past experiences in learning statistics were two of the main reasons in relation to their anxieties in the subject. Interestingly, the use of video resources was found to be helpful for students to learn and understand statistics which had also reduced their anxieties. Furthermore, more than fifty percent of the students responded that their anxieties were reduced during the semester in varieties of ways. The ways that had helped them reduce their anxieties include the teaching methods and materials shown in the videos such as the lab tests and solutions as well as statistical skills. At the end of the session, more than seventy percent of students were confident in all topics covered in the subject and majority of them were comfortable in using statistics in their research work. In relation to the impact of videos on student learning, majority or eighty-percent of the students found that they were comfortable in taking statistics subject at the end of semester. Several issues were highlighted by students on the improvement of video resources such as easy downloading and access to the videos, the needs for longer video duration and more topics covered extensively as well as more emphasis on statistical skills and the use of JMP software.

The main limitation of this study stems from the fact that number of voluntary participants was limited in sample size which only involved forty students. Although the information was sought from the particular group of students, the purpose of this study was not to make general statement about the level of students' understanding and anxieties in learning statistics for all post-graduate students in Health Informatics. As such, it cannot be assumed that the findings of this study can be generalised to other post-graduate students in different courses of studies. Thus, in future research, it would be desirable to conduct studies on multiple groups of students from various courses of academic programs which would give us more complete picture of students' understanding as well as statistics anxiety and the use of video resources or other learning resources that would help them to learn statistics effectively. Rather, this study tried to provide potentially useful suggestions for instructors and students to use the video resources as a means of improving the understanding and reducing statistics anxiety. Because of anonymity, actual grades for the students in this study could not be associated with the questionnaire data. Therefore, it would also be interesting to extend this study by looking into the relationship between students' performance and their perceived competency, and also their anxieties. Another major follow-up issue is to look into students' learning of other subjects where the teaching and learning resources are available online and also the resources are to be closely aligned with the perceived curriculum needs of the students.

The findings of this study provide the empirical evidence to support that the use of technology such as video resources as teaching and learning tools has the potential in improving students' understanding of the subject effectively and reducing their anxieties in learning it. This study tried to reflect what Song and Slate (2006) suggested that "technology is a tool" and Gunter (2001) postulated that "technology is to close the teaching and learning technology gap between where we are and where we need to be in the 21st century whereby the instructional design and curriculum should be focused on preparing students to participate in using technologies to learn." There are varieties of technological learning resources such as online discussion, online lectures and e-learning forum, other than videos that would benefit students as to support their learning and understanding of statistics specifically. In regards to the results obtained in this study, the technology used in the form of video resources was proven to have positive impact on student learning outcomes.

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