INVESTIGATING STUDENTS’ COMPETENCE LEVEL IN SECONDARY SCHOOL STATISTICS

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Abstract

Statistical literacy is an important skill for today’s citizens. Statistics is widely used in a vast number of disciplines and it is imperative that students in Brunei Darussalam are able to interpret and use data presented to them. This study aimed to determine the level of students’ competence in secondary school statistics and henceforth to investigate their level of statistical literacy. We also examined two factors, confidence and attitudes, and their effects on students’ achievement in statistics. The main study involved 154 Year 11 students from two government secondary schools and used both quantitative (statistics achievement test, confidence level scale and questionnaire) and qualitative (interview) methods of data collection. The low mean percentage test score (35.5%) and the low passing rate (25.3%) from the results of the achievement test showed that some students were not competent enough in their secondary school statistics and thus, indicated a low level of statistical literacy. This is something educators need to be aware of because these students would struggle to interpret data when they leave school for employment and life in the real world. From the results of the confidence level scale included in the achievement test and the questionnaire on students’ attitudes towards statistics, the findings also showed how strongly ‘confidence’ (Pearson r = 0.656) and ‘attitudes’ (Pearson r = 0.613) correlate with students’ achievement. A majority of the students were confident with their responses (64.3%) and had positive attitudes (81.8%) towards mathematics and statistics. However, there were instances where confident students did not pass their test. Similar pattern was also observed for many of the students with positive attitudes. It may be said that having positive attitudes did not necessarily show that the student would pass the test; rather, they just perform a little bit better. The high number of students with positive attitudes may be because students actually like and enjoy learning the topic. They probably see statistics as a topic that is connected to their everyday experiences and was able to see the relevance of statistics. Mathematics teachers are recommended and encouraged to teach statistics in such a way that will arouse their students’ interests, and also assist their students to become more competent in statistics and achieve a much higher level of statistical literacy.

Keywords: Statistics, secondary schools, Brunei Darussalam

1 INTRODUCTION

1.1 Background of Study

Normally, numerical data is presented as evidence or to add credibility to research, advertisements, arguments or claims. The importance of statistics is reflected in school and higher education curriculum where it is included in a wide number of subject disciplines in many countries (Royal Statistical Society, 2005; Garfield & Ben-Zvi, 2007; Sharma, 2013). The school curriculum recommends introducing statistical concepts in primary schools and fostering competencies in statistics in secondary school (Martignon, 2011). We can see statistics being used in a wide number of subjects such as science, geography, history and economics. In higher education, statistics is also used in specialised disciplines such engineering and social science. Students, however, begin learning basic statistical concepts such as data handling, representation and interpretation in mathematics. Thus we feel that statistics is one of the most important topics in mathematics. Students need to be competent in statistics or be statistically literate, as they get ready for
employment and life in the real world. Statistics may not be a traditionally core skill in mathematics such as algebra or geometry but it should still be a key part of the mathematics curriculum (Goldstein, 2006).

In Brunei Darussalam (hereafter, referred to as Brunei), statistics is part of the Mathematics curriculum from Primary Level where they will learn how to collect and organise data, draw simple bar graphs and line graphs. At Lower Secondary Level, they continue to learn statistics in both Year 7 and Year 8. Most students, upon reaching the Upper Secondary, will follow the General Education Programme in which they will sit for the Brunei-Cambridge General Certificate of Education Ordinary Level (or O Level) examination. Students learn newer concepts such as frequency density and cumulative frequency in the Upper Secondary. Probability is not part of statistics because it is considered a separate topic in the O Level syllabus. According to the scheme of work provided by the Ministry of Education (2008) of Brunei, students learn statistics in the final year of their Upper Secondary education.

1.2 Aims and Objectives

This study aimed to determine the level of students’ competence in secondary school statistics. The objectives of this study were to investigate students’ achievement and confidence in statistics and their attitudes towards mathematics and statistics. The research questions and research hypotheses investigated are shown in Table 1.

Table 1. Research Questions and Hypotheses.

<table>
<thead>
<tr>
<th>No.</th>
<th>Research Question</th>
<th>Research Hypothesis</th>
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<tbody>
<tr>
<td>1</td>
<td>What is the existing level of students’ knowledge in statistics?</td>
<td>Students in Brunei are not at a satisfactory level of statistical literacy.</td>
</tr>
<tr>
<td>2</td>
<td>What is the relationship between the students’ scores in statistics achievement test and their confidence level?</td>
<td>Students with high level of confidence will perform better in their statistics achievement test.</td>
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<tr>
<td>3</td>
<td>What is the relationship between the students’ scores in statistics achievement test and their attitudes towards mathematics and statistics?</td>
<td>Students with more positive attitudes towards mathematics and statistics perform better in their statistics achievement test.</td>
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2 LITERATURE REVIEW

2.1 Statistical Literacy

We are now living in the 21st century where by information is easily obtainable and statistical literacy is widely accepted as an essential life skill for a fully functioning citizen (Ridgway et al., 2011). As citizens, we see information presented to us in the form of graphs, tables, percentages or words and we need to be able to interpret them to understand what is going on in the society. The school curriculum and more specifically, the mathematics curriculum of schools is very important in helping students become statistically literate. This resulted in the extension of the mathematics curriculum to include topics in statistics and probability. Watson (2013) stated that not every student who leaves school need to able to do statistical tests but they need to be able to question any statistical claim made without reasonable justification. In order words, students need to be able to interpret statistical information themselves. She believed that statistical literacy begins in mathematics classrooms and listed some areas such as graphical representations, averages and chance as essential for advance studies in statistics. Sharma (2013), in a collaborative study, found Year 9 students in New Zealand being competent in calculations and retrieving information from graphs and tables but many still lack statistical literacy to fully understand statistical information. Sharma (2013) further suggested the use of questioning and class discussion as being important to help develop statistical literacy. The importance of statistical literacy as a life skill is also important for students in Brunei. This research would help provide some information on our students’ ability in interpreting statistical information.

2.2 The Teaching and Learning of Mathematics in Brunei

Based on our experience and from talking to colleagues in the teaching profession, most schools in Brunei still use traditional methods of teaching. Badaruddin (2006) said that teachers in Brunei emphasized on drill and practice with the aim of doing well in tests or examinations and we believe this is still happening in Brunei. This contradicts with the aims of the country’s educational system, which are to promote student-centred lessons and provide students with knowledge, and problem solving skills that will enable them to cope confidently with mathematics in real world (Curriculum Development Department, 2011; Mundia, 2010a, 2010b, 2012). From a teacher’s perspective, examination would always be more important than a student’s understanding of the subject. Teachers were and are still judged by how well their students perform
in a test or examination. They are often under immense pressure from their schools, students’ parents and the Ministry of Education to produce good results in examinations (Sarwadi, 2010; Sarwadi & Shahrill, 2014; Shahrill, 2009; Shahrill et al., 2013). These teachers are always in a hurry to finish the syllabus and then spend the remaining weeks revising for high stakes examinations such as the O Level examination. The drill and practise technique does not benefit most students. This can be seen in the recent O Level results in mathematics where only 30% to 40% obtained credits (from 2010 to 2012). Focusing too much on examinations may indicate that students will be given less time to understand mathematical concepts. We believed it is necessary to find out whether students have a good understanding of statistical concepts like mean or median and interpretation of graphs, even though this may be considered to many, a small contribution of the whole mathematics syllabus. These concepts are important if students are to become competent in statistics or be statistically literate.

2.3 Importance of Students’ Confidence and Attitudes

Parsons et al. (2009), in their research conducted on university students, found that students’ confidence in their ability in mathematics would improve their performance in mathematics. Generally, it is better to have students who are confident in their ability because confidence is an important factor that can affect students’ achievement. Thus this research study also investigated the confidence of the students involved.

There have been many studies that have shown a positive relationship between individuals’ achievements and their attitudes towards mathematics (Guner, 2012). Salleh (1998) in his study on three government secondary schools in Brunei found significant relationship between attitudes toward mathematics and achievement in mathematics. Students who show positive attitudes generally seem to perform better in tests or assessments. They would be more enthusiastic to learn during classes and the quality of their work tends to be better than those with negative attitudes. However, Wilkins and Ma (2003) found that as students progress from primary to secondary school, their attitudes towards mathematics showed a decline. As students proceed from lower secondary level to upper secondary level, the contents taught become more advanced and they will naturally find mathematics more difficult. This could lead to students’ attitudes becoming less positive.

Similarly in statistics, Evans (2007) stated that there were numerous research studies that found there exists a positive relationship between attitudes towards statistics and achievement in statistics. Furthermore, Wang and Wu (2010) also found that students with negative attitudes towards statistics showed lower achievement levels. It is expected that students with more positive attitudes will perform better than students with less positive attitudes. In the United States, Mills (2004) conducted a study on students’ attitudes towards statistics on undergraduate students taking introductory statistics courses. She discovered that students’ overall attitudes were more positive towards statistics than negative. Mills stated that this was due to the reform in statistics education in the past few decades. These include the teaching of statistics concepts in elementary and secondary education. Students are now being taught statistics at an earlier age. This has changed how they perceive statistics. As a result, attitudes towards statistics are more positive than negative. However, it has to be pointed out that these research studies done by Mills (2004), Evans (2007), and Wang and Wu (2010) investigated attitudes of students at the university level. The students involved in their study were students enrolled in undergraduate basic statistics courses. It would be interesting to investigate the attitudes of students toward statistics and mathematics at the secondary school level. This research replicated the studies done by Mills (2004) whereby questionnaires were used to describe student attitudes.

3 METHODOLOGY

3.1 Research Design

The research design was based mostly on the quantitative approach. However, some qualitative approach was also used. Quantitative data were collected using the statistics achievement test, the students’ confidence level scale and the student questionnaire. The qualitative approach involved interviewing students. This combination of quantitative and qualitative approach was able to generate the research data and provide answers to the research questions set forth in the Introduction section.

3.2 Sample Selection

This study was conducted at two government secondary schools in one of the districts in Brunei. Both schools were single-gendered schools, an all-boys school and the other, an all-girls school. There were nine classes altogether with a total of 154 students, 73 from School A and 81 from School B. These Year 11
students were in their third and final year of Upper Secondary education and were scheduled to sit for their O Level examinations at the end of the year. The reason for choosing these two schools was because of convenience. We had very good network connections in both schools and this eased the process of obtaining students’ information or data gathering.

3.3 Instruments of the Study

This research study used four instruments namely the statistics achievement test, the confidence level scale included in the achievement test, the student questionnaire and the student interviews. The test and questionnaire were given to all 154 students. The statistics achievement test consisted of 10 short answer items. The maximum score for the test was 30 and the minimum possible score was zero. This confidence level scale was in the form of a five-level Likert Scale and was designed to measure students’ confidence in answering the test items. The test items were obtained from past O Level examination papers. The achievement test items were designed so that students were only required to do short mathematical computations. Calculators were not required. Based on our observation, not all students would have their calculators with them. Thus, a non-calculator test would not put these students at a disadvantage. The students were only asked to draw simple graphs and most of the items required interpretation of given tables, graphs and charts. This was done so that the test can be completed in a mathematics lesson, which was normally allotted two periods.

The student questionnaire had a total of 27 items. It consisted of revised items from the Students’ Attitudes Toward Statistics (SATS) survey used by Mills (2004). The items were modified to make it more suitable for Brunei’s secondary school students. Items on students’ attitudes towards mathematics were also included in the questionnaire. The questionnaire used the five-level Likert Scale from strongly disagree to strongly agree.

Focus group interviews were used to strengthen any evidence collected from the achievement test. Sometimes, a student would just give the answer to a question without any working. The student’s working may also be insufficient or unclear. We were able to understand how students got their answers from students’ responses during the interviews. There were two focus groups, one from each school. Students were selected based on their scores in the test. Each focus group was made up of two high achievers, two average achievers and two low achievers. Hence a total of 12 students were interviewed.

Data from the research were analysed using Microsoft Excel 2011 for Mac and specialised software called IBM SPSS Statistics (Version 20). Descriptive statistics such as mean, standard deviation, frequency and inferential statistics such as Pearson product-moment correlation coefficient (r) were used.

3.4 Pilot Study: Validity and Reliability of Instruments

A Pilot Study was conducted to a class of 27 Upper Secondary repeaters. These students had studied the topic on statistics and they were not included in the Main Study. The internal consistency reliability analysis on the pilot student questionnaire obtained a Cronbach’s coefficient alpha of 0.715. According to Pallant (2011), this value was within the acceptable level. We removed a number of items from the main study to improve the Cronbach’s coefficient alpha to 0.866, which was a very good level of internal consistency reliability. The mathematics teachers of the two schools involved reviewed the test and questionnaire to improve their face and content validity. The test was piloted to judge its difficulty and to find out whether students had enough time to finish it within the allocated time.

3.5 Data Collection Procedures

The topic on statistics was taught towards the end of the school year. The first author spent one week in each school to conduct the main study. Students were given 45 minutes to sit for the statistics achievement test and a further five minutes to complete the questionnaire. The focus group interviews were conducted in at the respective school libraries. Each focus group interview lasted 15 minutes.

3.6 Ethics

Letters of permission and approval were obtained from the Ministry of Education in Brunei to conduct the research in the two schools. All participants were assured that any data collected from them were for research purposes only and would be kept in the strictest confidence. Parental and participant consent forms were obtained for students who were involved with the interviews. Students were informed that participation was voluntary and that they would be allowed to withdraw from the research study at any time.
4 RESULTS AND DISCUSSIONS

4.1 The Students’ Knowledge Level in Statistics

The test had a Cronbach’s coefficient alpha of 0.827. According to Pallant (2011), this was a very good level of internal consistency reliability. The mean percentage score was 35.53%. The standard deviation of 20.7 indicated that there was quite a big variation in the student percentage scores. If the passing mark was set at 50%, only 25.32% of the students passed the statistics achievement test. None of the students got all the questions correct. Out of 154 students, the highest score obtained was 27 out of 28 marks (96.43%). The lowest score was 1 out of 28 marks (3.57%). The low mean percentage test score (35.53%) and the low passing rate (25.32%) showed that the existing level of students’ knowledge in statistics was not satisfactory.

4.2 The Relationship of the Students’ Statistics Achievement Test Scores and their Confidence Level

The Pearson product-moment correlation coefficient (Pearson r) between the two variables was found to be 0.656. According to Greasley (2008), a coefficient of more than 0.5 would mean a strong positive correlation between the two variables. In general, students who were more confident achieved better in the test. The correlation was significant at 0.01 level (1% level) meaning that the result was statistically significant and highly unlikely due to chance. The findings from this analysis concurred with the research hypothesis that students with high level of confidence will perform better in their statistics achievement test. The scatter plot in Fig. 1 showed the strong positive correlation. The line of best fit drawn had an $R^2$ value of 0.430. Only 43% of the total variation in students’ confidence can be explained by the linear relationship between the two variables.

![Scatter plot of student confidence level and test score.](image)

The confidence level scale for each question was in the form of a five-level Likert Scale. A score of 5 would indicate that the student was very confident his or her answer was correct. On the other hand, a score of 1 would indicate the student was very sure his or her answer was wrong. A score of 3 would indicate the student was not sure. The total confidence score for all the students was calculated. The maximum and minimum possible scores for total confidence were 100 and 20 respectively. A student with a total confidence of 60 was considered to have neutral confidence, neither high nor low confidence. The mean total confidence was 65.92. Furthermore, in Fig. 2, 99 out of 154 students (64.29%) had total confidence of more than 60 (above the 60 line). It can be concluded that a majority of the students were more confident with their answers in the statistics achievement test.
4.3 The Relationship between the Students' Statistics Achievement Test Scores and their Attitudes towards Mathematics and Statistics

The Pearson product-moment correlation coefficient (Pearson r) between the two variables was found to be 0.613. In general, students who were more positive with their attitudes did better in the achievement test. The correlation was significant at 0.01 level (1% level) meaning that the result was statistically significant and highly unlikely due to chance. The findings from this analysis concurred with the research hypothesis that students with more positive attitudes will perform better in their statistics achievement test. The scatter plot in Fig. 3 showed the strong positive correlation. The line of best fit drawn had an R² value of 0.376. Only 37.6% of the total variation in students’ attitudes can be explained by the linear relationship between the two variables.

Similar to the confidence level scale, the attitudes scale was also in the form of a five-level Likert Scale. A score of 5 would indicate that the student had high attitude and a score of 1 would indicate the student had
low attitude. A score of 3 would indicate the attitude was neither high nor low. The total attitude score for all the students were calculated. The maximum and minimum possible scores for total attitude were 135 and 27 respectively. A student with a total attitude score of 81 was considered to have neutral attitude, that is neither positive nor negative attitude. The mean for all students was 90.84. Furthermore, in Fig. 4, 126 out of 154 students (81.81%) had a total attitude score of more than 81 (above the 81 line). It can be concluded that a large number of students had positive attitudes towards mathematics and statistics.

![Scatter plot of students' total attitudes.](image)

5 CONCLUSIONS AND IMPLICATIONS

5.1 Conclusions

Students’ performance in the test was not encouraging because a majority of the students did not perform well in the test. The mean percentage score for the test was 35.53%. Only 39 out of 154 students (25.32%) were able to score more than 50%. The responses in the test and focus group interviews showed that students had a poor understanding of statistical concepts such as data handling, representation and interpretation. Based on the findings, we conclude that the existing level of students’ knowledge in secondary school statistics is unsatisfactory. We believe students are not competent enough in statistics and have a low level of statistical literacy. This may be due to several factors.

Abduliahi and Onasanya (2010), in their study of teacher effectiveness in Kwara State secondary school in Nigeria, found that secondary students’ poor achievement in Mathematics could be improved with having experienced and qualified teachers teaching their students. This may be the case for this study, and the students’ low level of statistical literacy may be due to the ineffectiveness of the teachers. The teachers probably lacked knowledge and understanding in teaching the topic. They were not able to adequately address things such as certain misconceptions students may have. And this may result in the students not understanding what their teachers taught.

Language could also be a reason to students’ poor performance. Brunei’s official language, and the mother tongue is the Malay Language. Hence for most Bruneians, English is not their first language. In some areas in Brunei, for example the research sites of this study, English may even be a third or fourth language. Some students may not have understood the questions that were asked in English Language in the test and this could also explain mistakes such as the confusion in calculating mean from grouped frequency distribution. Jao (2012), in her study involving Canadian students, pointed out that students whose first language is not English performed poorly not due to their poor academic background but because of cultural and linguistic barriers. This could also be the case for the Bruneian students in this study since they are being taught in a language which is not their first language, or even second language (refer also to Pungut & Shahrill, 2014).

Another factor that could also explain students’ poor performance is on the low socio-economic status of
some of the students. Their parents may struggle to provide basic necessities to their children such as notepads, instrument sets and calculators. These parents may also not able to provide transport for their children to attend extra curricular activities or extra classes. Students may not even be given spending money to buy food at school. However, further evidence may be needed to support this suggested factor because Rothman (2003) argued that students with low socio-economic status might achieve academic success at school. Having a low socio-economic status could actually motivate students to improve their academic achievement in order to have a brighter future and achieve a better socio-economic prospect.

It can be suggested from this research study that one of the main reasons for students’ poor performance in the statistics achievement test is probably due to their poor understanding of statistical concepts taught in the lower secondary. Most of the statistical concepts learnt by students in upper secondary were already taught in the lower secondary. Students were also exposed to statistics in their primary school education. Hence we had expected the students to do better in this statistics achievement test. The analysis of the test showed otherwise, in which students did not really understand these statistical concepts they have learnt before entering the upper secondary. Furthermore, students were also weak in the new concepts taught in upper secondary. This was evident from their responses in the test. This concurred with Toh (2010), who revealed that students had weak pre-existing knowledge on Probability and Representation of Data in her A Level (Pre-university level) study (refer also to Ang & Shahrill, 2014). Errors made by students and the misconceptions that existed were what we had already expected and anticipated. It is strongly recommended that teachers need to address these errors and misconceptions extensively so that current and new students do not repeatedly make the same mistakes in the future.

These Year 11 students were approaching the end of their secondary school education and they sat for their O Level examination towards the end of the school year. With a high stakes examination being so close, it was worrying to see students not doing well in the statistics achievement test. Even though statistics was a small contribution to the whole mathematics syllabus, it could help decide between a pass and a fail. Furthermore the many students who might not proceed to A Level studies will be leaving with a poor existing level of statistics. They would struggle to interpret data presented to them during their employment and life.

In addition, there was significant correlation between students’ achievement and their confidence. Generally if a student was confident, he or she will do better in the test. However, test scores were very low. There were many instances where confident students did not pass their test (64.29% of the students were confident, 25.32% of the students passed). Therefore being confident did not indicate that the student would definitely pass the test. On the positive side, it was wonderful to see students being confident because confidence does affect students’ achievement. However, it was alarming to learn that students were not aware their responses in their achievement test were incorrect. Students probably thought that they had understood the topic, but as was observed from their results and the interview data, they had not quite understood what they learnt. Another very likely reason for students being unaware that their responses were incorrect may be due to the misconceptions they have on statistics. They will repeatedly make the same mistakes and have no idea that what they are doing is wrong. We also believe that the high number of students who were confident could be due to them taking statistics for granted. Students thought that statistics was an easy topic and were confident in their ability to do well in this area of mathematics. However, their very low test scores suggested that they had a poor understanding of statistics and that they should be doing more revision on the topic.

A large number of students showed positive attitudes towards mathematics and statistics. Findings from this research study concurred with the findings of previous research done by Mills (2004), Evans (2007), and Wang and Wu (2010). This was reassuring because attitudes can affect students’ achievement. However, many students with positive attitudes did not pass the test (81.81% of students had positive attitudes, 25.32% of the students passed). From the findings of this research study, having positive attitudes did not necessarily show that the student will pass the test, they just perform a little bit better. The high number of students with positive attitudes may be because students actually like and enjoy learning the topic. They probably see statistics as a topic that is connected to their everyday experiences and was able to see how relevant statistics is. It is important teachers continue to teach statistics in a way which will arouse students’ interest in order to prevent students from becoming sceptical about statistics.

5.2 Implications

Even after the implementation of a new educational system, we believe that the traditional drill and practice method of teaching is still prevalent in most schools in Brunei. Teachers are in a hurry to finish the syllabus and spend the remaining few weeks revising for high stakes examination such as the O Level examination.
Focusing too much on drill and practise meant that students were not given enough time to understand statistical concepts. Hence, this may be one of the reasons for the students’ poor performance in the statistics achievement test in this research study.

Furthermore, it could also be suggested that teaching statistics close towards the end of the O Level syllabus diminished the importance of statistics to the students. Topics taught in the beginning of the syllabus such as algebra would get a lot of revision time, as they would appear regularly during subsequent class tests or examinations. Currently, due to statistics being taught so late in syllabus, it may only appear in the qualifying examination, which is the last examination given internally by respective schools before the O Level examination. For the two schools involved, students were taught the topic on statistics after the qualifying examination so that meant that it may have never appeared at all during class tests or examinations. Students would not have been exposed to questions on statistics and may have less time to be familiar with them. It also meant that students would spend less time revising statistics compared to other topics such as algebra, which had been taught much earlier. Teaching statistics near the end of the O Level syllabus also meant that students were not able to apply their statistical skills to their everyday life much earlier. If they were taught in the beginning of the syllabus such as in Year 9, students would have had more time to practise their statistical skills and improve on it before they sat for the O Level examination or leave school in search for employment. Hence teaching statistics very late in the syllabus may also be a reason for students’ poor performance in the statistics achievement test in this research study.

The poor understanding of statistical concepts may not be a surprise to experienced teachers teaching O Level statistics. However, teachers should put more effort into helping low achieving students understand statistical concepts and avoid misconceptions. These students will greatly benefit because a large percentage of them may not be going to A Level studies. They should at least be competent in basic statistical skills, as this would help them when they leave secondary school education.

5.3 Recommendations

Teachers should help students become more competent in statistics and be statistically literate even though statistics make up only a small part of the whole secondary school mathematics syllabus. Teachers are recommended to search and use Internet resources to teach statistics because we are at an age where the Internet is widely used. The Internet resources would provide students with real-life or everyday world examples such as current media articles or anything of interest to the students. These current media articles could be data on poverty or health matters. The teacher could also use statistics on, for example the usage of social media networks or sports and solve problems related to them. This would definitely be appealing to students of this century and it would further arouse their interest in the topic because they will see statistics being used in everyday life. Students will also be able to apply their statistical skills to problems that are currently happening in the outside world. Examples from textbooks may be out dated and may not be of interest to the students of today. This strategy could immensely help improve students’ competence in statistics and help them prepare for life outside of the classroom.

As mentioned earlier, statistics was taught near the end of the syllabus. The topic should be taught earlier in Year 9 instead of Year 10 or Year 11 so that students can learn the basic statistical skills to help them in their life. Once they have been taught the statistical concepts, they can improve their understanding when they encounter situations outside the classroom, which needs them to apply their statistical skills. For example, they may encounter advertisements that require them to interpret tables or charts.

Teachers, especially beginning mathematics teachers, need to be aware of common errors the students make in statistics. They should also try to address the misconceptions students are certain to have and ensure that students understand statistical concepts taught in the lower secondary.

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