# EVALUATION OF EZYSTATS3Q MODEL APP FOR STATISTICAL ANALYSIS LEARNING IN HIGHER EDUCATION

Chan Yuen Fook Suthagar Narasuman Faculty of Education Universiti Teknologi MARA E-mail: yuenfook@salam.uitm.edu.my

#### ABSTRACT

Statistics may be viewed as an intimidating subject for students in universities and a stumbling block for researchers to complete their research projects. Nevertheless, researchers at Harvard University view statisticians as one of the most promising jobs for the next ten years. Henceforth, statistics should be seen as a chance for a better future. According to Calson, Keith and Winquist (2011), "what students do and how they think about what they did determine whether a given active learning approach will be successful" (p. 3). Therefore, a product referred to as the EzyStat3Q Model which is a hands-on guide developed by the writers of this paper to lead university students and researchers to learn the tricks of statistics quickly through a multi modal approach is evaluated. EzyStat3Q Model is a quick and interactive learning model which comprises MOOCs, Mobile App, Interactive Multimedia PowerPoint, e-Book, and Quick Learning Print Module. This creative statistical learning model is expected to lead university students and researchers to learn the tricks of statistics quickly. This model utilizes the concept of multimodality and built-in quick references to trigger active learning through a constructivist approach among students and lecturers in the learning and teaching of statistics. In order to obtain feedback from users, a descriptive research was conducted with two intact groups of 45 masters students at the Faculty of Education of a public university in Malaysia. The data collected via questionnaires were analysed descriptively to identify mean and standard deviation for each item. Besides that, qualitative data from the interviews with five students were used to support the quantitative data collected from questionnaires.

The findings indicated the EzyStats3Q Model App has acquired certain levels of quality in terms of ease of use, user interface, audience appeal, effectiveness, presentation, program content, and documentation. The paper has identified some important implications and recommendations for the improvement of this product at a higher level.

Keywords: EzyStats3QModel App, statistics, active learning

## INTRODUCTION

In an attempt to boost teaching and learning practices, most learning institutions especially higher education institutions have been intensifying the use of Information and Communication Technology (ICT) into the curriculum (Moses, Abu Bakar, Mahmud & Wong, 2011). Instead of traditional teaching whereby an educator becomes the sole controller over the learning process, recent trends in education have identified that students are exposed to the use of ICT such as computers, interactive whiteboard, projectors, and such. Such exposure is deemed to be crucially important in preparing and helping the students to cope with the ever-progressing Information age (MSC, 2005). The creation of a dynamic ICT environment for learning has also triggered rich opportunities for the development of online learning in Malaysia. Online learning process involves the use of a computer and the assistance of the Internet technology with the main aim of enhancing students' learning experiences and performances (Al-Adwan & Smedley, 2012).

In Malaysia, the emergence of online learning has been recognised to penetrate Malaysian educational institutions ever since 1972 when the Ministry of Education set up the Educational Technology Division (Asirvatham, Kaur & Abas, 2005), but it only seems more viable in recent years due to the progressive growth of web-based technologies in Malaysia. According to Khalid, Yusof, Heng and Yunus (2006), more universities in Malaysia have stepped up in offering online-learning environment to students by setting up portals that serve two main functions: 1) as teaching aids that facilitate traditional teaching approach, and 2) as a teaching avenue for off-campus or long-distance programs. In the context of higher education, the emergence of Massive Open Online Courses (MOOCs) and Learning Apps have garnered tremendous attention from educators, administrators and students.

# TRIGGERING ACTIVE LEARNING IN STATISTICS WITH EZYSTATS3Q MODEL APPS

Statistics is an invaluable tool employed by statisticians to make sense of the huge amount of data that can be accessed readily nowadays. Statistics seek to show both the representational and inferential properties of a data set. It has high utility value in empirical studies be it in the Sciences, Economics, Business or Social Sciences. The appropriate usage and optimal utilization of this tool assures an output that can provide accurate and relevant information for making good decisions. The ability to extract quality information from the data depends to some extent, on the statistical background and data-analytic skill of the users. Thus, it is vital that students are equipped with the appropriate statistical skills for them to function intelligently and effectively in the society.

However, all fields have technical terms with specific meanings. In many cases, statistics uses words that are already known, but give them specific meanings. For instance "significance", "hypothesis", "confidence", "error", "normal", "differences", "variance", "relationship", "regression" "parametric" are all common words that statistics uses in specialized ways. Students have to master the statistical meaning of these terms or face the risk of confusion when reading statistics books or talking to statisticians. The problem is not that students do not understand a technical term, but they think they know what the term means, but are actually wrong. Furthermore, statistics is a branch of math so to understand the basis of statistics students need to delve into the mathematical details even though they do not need to know much math to use statistics effectively and to correctly interpret results. Hence, based on an informal study, 90% of the respondents in a blog (Agresti & Meng, 2013) commented about how difficult statistics is or how much they hate the subject.

However, statistics instruction has not always been aligned with the practice of statistics, with research into how students learn statistics or with students' needs and interests. One challenge has been that statistics is often

taught by instructors whose primary training lies elsewhere. For example, statistics courses are often taught by mathematicians whose background may include only theoretical courses, if any, in statistics. There have been numerous recent recommendations for improving the instruction of statistics. For example, recommendations of a joint committee of the American Statistical Association (ASA) and the Mathematical Association of America (MAA) with regard to the teaching of statistics are to:

- 1. teach statistical thinking,
- 2. emphasize data and concepts, not theory and recipes, and
- 3. promote active learning.

Active learning refers to the process of engaging students in various learning activities such as reading, problem solving, writing, etc. and these are the classroom activities that enable students to analyse and evaluate their learning in the class. The whole process of active learning is based on the activities and level of engagement (Prince, 2004). Active learning can also be referred to as query learning. However, it is known as a sub part of machine learning under which people learn by raising various queries and questions which help them to learn from different perspectives and looking at the bigger picture of a problem and learn the ways to solve it (Settles, 2010). Similar foci can also be seen in the recent NCTM Standards that call for teaching data analysis, probability, and statistics throughout the K-12 curriculum and the new Advanced Placement Statistics program in the United States. The Conference Board of Mathematical Sciences has issued Guidelines for Mathematical Preparation of Teachers that recognize the importance of statistics and call for more thorough preparation of instructors. The "Teaching Contemporary Statistics with Active Learning" workshops, sponsored by the ASA since 1998, are designed to enable instructors to improve their teaching of statistics. The focus of the workshops is on demonstrating alternative instructional methods for promoting deeper understanding of fundamental statistical concepts by providing instructors with numerous examples of activities that can be directly implemented in the classroom. Secondary goals include enhancing use of technology and authentic assessment practices in statistics courses, while providing a myriad of print and electronic resources for teaching statistics. Researchers in the United States believe they illuminate some of the distinctions between statistics and mathematics and illustrate how one can teach statistical thinking with real data and active learning.

New technologies allow increased focus on concepts rather than calculations, and numerous resources are now available that enable instructors to focus on (and assess) statistical thinking in an interactive, collaborative, and engaging environment. In fact, researchers at Harvard University view statisticians as one of the most promising job for the next ten years. Professor Meng from Harvard University quoted Hal Varian, Google's Chief Economist "... the sexy job in the next ten years will be statisticians. People think I'm joking, but who would've guessed that computer engineers would've been the sexy job of the 1990s?" (Meng, n.d., para. 1). Many researchers have also pointed out that that in today's workplace, one must not only be able to look at data, understand and process it but also be able to extract value from it, visualize it and communicate it. Such skills will be hugely important skills in the next decades, not only at the professional level but even at the educational level for elementary school kids, high school and college students. Professor Meng added that because now we really do have essentially free and ubiquitous data, statistics should be seen as an important 21<sup>st</sup> century skill (Meng, n.d).

To date, many instructors/researchers in the United States have presented anecdotal evidence suggesting that active learning is effective (e.g., Knypstra, 2009; Bates Prince, 2009) and others have presented evidence that students' exam scores are higher when taught with an active learning approach than when taught with more traditional approaches (e.g., Christopher & Marek, 2009; Steinhorst & Keeler, 1995; Ryan, 2006; Yoder & Hochevar, 2005). Certainly, *what* students do and *how they think* about what they do determine whether a given active learning approach will be successful.

Therefore, this product referred to as the EzyStat3Q Apps is a handson guide developed by the writers of this paper to lead university students and researchers to learn the tricks of statistics quickly and electronically. EztStats3Q was built using Coursesites by Blackboard. The lessons notes uploaded on EzyStats3Q application was developed with a mashup of other programmes and applications such i-spring, flash, MS Powerpoint, MS Word and MS Excel. Coursesites templates and links also provide online access to a host of other active learning applications such as wikis, blogs and discussion boards. As a comprehensive content and learning management system, it also facilitates tools for creating and managing

exams, browser lockdown during test and a link to resources on McGraw-Hill. This mashup of applications increase the versatility of the application and promotes active learning through a hands-on, constructivist approach. Blackboard Inc. (Nasdaq: BBBB) is a global leader in enterprise technology and innovative solutions that improve the experience of millions of students and learners around the world every day. Founded in 1997, Blackboard is headquartered in Washington, D.C., with offices in North America, Europe, Asia and Australia. Blackboard's solutions allow thousands of higher education, K-12, professional, corporate, and government organizations to extend teaching and learning online, facilitate campus commerce and security, and communicate more effectively with their communities. Its many features, which allow one to manage courses, grading and assessments, and social collaboration, are the standard against which other learning management systems are measured. The blackboard has been used to add static material for students to view, such as pages, links, and media. Then, interaction to the Statistics course has been added with discussion boards, blogs, and wikis. Most importantly, the app engages students in the course by communicating with them, assessing them, and putting them into groups through the active learning approach. Furthermore, the EzyStats3Q Model Apps has the advantage of making the learning of statistics easy by introducing 3Q models namely quick notes, quick steps and quick tables in the system. User friendly and interesting lessons which integrate materials from PowerPoint, word and SPSS software make it easy to ramp up on the latest gadgets: i-phone, i-pad, surface and laptop.

Students only need to follow the course step by step to learn quickly how to do statistical analysis and produce great looking tables and statistical analysis reports. Students become active learners with the apps and are able to share knowledge and to collaborate learning with other learners and lecturer in the on line discussion and forum. The apps also allows students to learn on their own pace at anytime and anywhere. Multimodality concept adopted also allows students to learn statistics from printed material, interactive multimedia PowerPoints and versatile social media apps. Finally, this practical, impressive and fast-paced guide has the potential to be commercialised locally and internationally.

### **OVERVIEW OF EZYSTATS3Q MODEL**

#### Accessibility

Accessing the EzyStats3Q Model requires internet connectivity. The app can be accessed through any browser and most gadgets that support the html coding of Coursesites. The current home page of EzyStats3Q Model is https://easystats.coursesites.com/ (Figure 1). At the homepage, students or course participants may login by clicking on the login icon or on Easystats 3Q Model under My Courses. Clicking on the login icon will bring them to the sign in page. They enter their username and password if they already have them. New users may click on "sign up" and follow the instructions to create an account or they may sign in using the social media icons listed.



Figure 1: Easystats 3Q Model Homepage

Clicking on Easystats 3Q Model will take the users to the enrolment page (Figure 2). They may click on the self-enrol icon and at the prompt enter the enrolment password which is "6800". They can click on the login icon if their instructor has already enrolled them as a student.

If their login is successful, they will be directed to the instructor's coursesites homepage. They then click on "Easystats 3Q model" to access the course homepage.

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Figure 2: Easystats 3Q Enrolment Page

This will bring the users to the course homepage (Figure 3).

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Figure 3: Course Homepage

On the left column is the control panel. The users will be able to access the following tools from this column.

#### **Chapter Notes**

The first item on the panel listed the eleven chapters of statistics which make up this course. Each chapter is presented in the form of quick notes, quick steps and quick tables. The chapters are formatted and presented as PPT and Flash files.

#### FAQs

FAQs is a list of frequently asked questions regarding statistics.

### **Course Dialogue**

Forums are made up of individual discussion threads that can be organized around a particular subject and create Forums to organize discussions among instructors and students.

#### Blogs

Blogs are an open communication tool for students to share their thoughts. Blogs can be created by groups or individual students.

#### Assessment

Instructors may post their assignments here. Assignments can be set to be viewed by students according to a timeframe.

#### New and Due

Instructors may use this page to post announcements to students. It also holds the datelines for tasks due and past due.

#### Study Aid

Study Aid contains the modules for the course in e-book and pdf format.

#### **Course Basics**

Course basics contain information on a recommended reading list for the course.

#### Instructor Info

Users may find information regarding the instructors and tutors for the course here.

#### **My Grades**

Students may view their grades at this page.

#### Calendar

Calendar is a useful tool where instructors can make note of due dates for tasks and activities.

#### Our Wiki

Collaborate provides tools for constructing a wiki. In this course, both students and instructors can construct their own collaborative wikis.

A Wiki is a collaborative tool that allows users to contribute and modify one or more pages of related material.

#### E-mail

Instructors can send email to all or selected individual users, students, groups, teaching assistants, instructors or observers.

The tools listed above are available for both instructors and students. Some tools such as creating tests and surveys are only visible to instructors. Test created on coursesites can be taken by students within a folder and the instructor has the option of activating browser lockdown whereby students will not be able to browse the net while taking a test on the same gadget.

#### **RESEARCH METHODOLOGY**

This study employed a mixed methods study so that both quantitative and qualitative descriptions of the relevant features of the EzyStats3Q Model App can be collected. Hence, the study used research instruments such as questionnaires and interview questions to collect data from two intact groups of postgraduate students. A questionnaire using a 5 point Likert-scale was developed by the researchers based on an earlier study by the researchers (Chan et al., 2012) in the evaluation of item analysis software. Both open-ended and closed-ended questions were listed in the questionnaire to gauge the perceptions of postgraduate students on the effectiveness of EzyStats3Q Model in the learning of statistical analysis. In order to gain a better insight into the use of EzyStats3Q Model App in higher education, open-ended questions were also used to interview five postgraduate students in the masters programme on their opinions and suggestions to improve the EzyStats3Q Model App.

A descriptive research design was used to analyse the quantitative data collected from the questionnaires. The study investigated the descriptive features of the research variables of ease of use, user interface, audience appeal, effectiveness, presentation, program content, and documentation. Descriptive statistical analysis such as mean and standard deviation was used to analyse the quantitative data. However, for the qualitative data

collected from the open-ended questions and interviews, theme analysis was used to identify the key issues raised by the respondents.

#### **FINDINGS**

#### **Profiles of Respondents**

The demographic profile included in this analysis entailed gender, ethnicity, and age of the respondents. The results in Table 1 show the frequency and percentage for respondents' gender, ethnicity and age. A total of 87.8% of the respondents are females and 12.2% are males. The composition also indicates that 93.9% of the respondents are Malay and 91.8% of them are more than 25 years old.

Variable	Frequency (n=49)	Percent (%)
Gender		
Female	43	87.8
Male	6	12.2
Ethnic		
Malay	46	93.9
Others	3	6.1
Age		
Less than 25 years old	3	6.1
25 to 30 years old	45	91.8
Missing	1	2.1

#### Table 1: Gender, Ethnicity, and Age

#### EZYSTATS3Q MODEL APP EFFECTIVENESS CRITERIA

As shown in Table 2, the respondents slightly agreed that screen directions were consistent and easy to follow (M = 3.96, SD = .676) and users could exit from any screen (M = 3.84, SD = .657). Besides, the respondents agreed that the program responded to input as indicated by directions (M = 3.84, SD = .590) and they could control the pace and sequence (M = 3.82, SD = .601). They also found that the title sequence was brief and could be

bypassed (M = 3.82, SD = .635) and users navigated through the program without difficulty (M = 3.61, SD = .812). These findings indicate that EzyStats3Q Model App has managed to fulfil the first determining criteria of ease of use.

The respondents viewed the EzyStats3Q Model App's user interface characteristics positively. They found the user interface easy to understand (M= 4.02, SD= .777), the icons used to assist navigation clear and intelligible (M= 3.88, SD= .696) and the interface provided users with an appropriate environment (M= 3.88, SD= .526). The respondents also agreed that users could easily navigate through the program (M= 3.88, SD= .640) and were given feedback when errors were committed (M= 3.67, SD= .834).

Most of the respondents agreed that the program matched interest level of indicated audience (M= 4.24, SD= .662) and expected input was appropriate for indicated audience (M=4.14, SD= .577). Besides that, the respondents also agreed that the required time was compatible with user attention (M= 4.00, SD= .689) and examples and illustrations were suitable for the indicated audience (M= 3.94, SD= .689).

Table 2: EzyStats3Q Model App Effectiveness Criteria

EzyStats3Q Model App Effectiveness Criteria	Mean	Std. Deviation
Ease of Use of EzyStats3Q Model App		
Screen directions are consistent and easy to follow.	3.96	.676
Users can exit from any screen.	3.84	.657
Program responds to input as indicated by directions.	3.84	.590
Users can control pace and sequence.	3.82	.601
Title sequence is brief and can be bypassed.	3.82	.635
Users can navigate through program without difficulty.	3.61	.812

User Interface of EzyStats3Q Model App		
The user interface is easy to understand. The icons used to assist navigation are clear and	4.02	.777
intelligible. Interface provides users with an appropriate	3.88	.696
environment.	3.88	.526
Users can easily navigate through the program.	3.88	.640
Users are given feedback when errors are committed.	3.67	.834
Audience Appeal of EzyStats3Q Model App		
Program matches interest level of indicated audience.	4.24	.662
Expected input is appropriate for indicated audience.	4.14	.577
Required time is compatible with user attention.	4.00	.677
Examples and illustrations are suitable for indicated audience.	3.94	.689
Effectiveness of EzyStats3Q Model App	4 99	715
This is an appropriate use of App for data analysis.	4.22	.710
Students are able to recall and use data analysis.	4.00	.751
information presented	3 98	559
Students develop further interest in topic of data	0.00	.000
analysis from using the program.	3.98	.692
Presentation of EzyStats3Q Model App		
Text is clear and printed in type suitable for target		
audience.	3.90	.714
Examples and illustrations are relevant.	3.90	.549
There is appropriate variety in screen displays. Information is presented in a developmentally	3.90	.586
appropriate and logical way.	3.86	.540
Spelling, punctuation, and grammar are correct.	3.85	.684
Program Content of EzyStats3Q Model App		
Information is current and accurate. Assessment strategies are based on current trend in	4.12	.600
assessment. Program matches stated objectives of statistical	4.02	.692
analysis	4 00	707
Program addresses various data analysis needs	3.98	.692
Program is free of stereotypes.	3.90	.653

Documentation and Supplementary Materials of		
EzyStats3Q Model App		
Learning activities that facilitate integration of software		
into curriculum are provided.	3.96	.576
Objectives are clearly stated.	3.96	.611
Professional knowledge that facilitates integration into		
curriculum is provided.	3.86	.612
Necessary technical documentation is included.	3.58	.739

Scale: 1= Strongly Disagree, 2=Disagree, 3=Slightly Agree, 4=Agree, 5=Strongly Agree

The respondents reported they agreed about the effectiveness of EzyStats3Q Model App in preparing students for real data analysis (M= 4.22, SD = .715) and it was an appropriate use of instructional software for data analysis (M = 4.08, SD = .731). The respondents also agreed that they were able to recall and use data analysis information presented (M = 3.98, SD = .559). Besides, EzyStats3Q Model App could help students to develop further interest in topic of data analysis from using the App (M = 3.98, SD = .692).

The majority of the respondents indicated a high mean score with regards to the text clarity and its print which was suitable for the target audience (M = 3.90, SD = .714). They were also satisfied with the relevant examples and illustrations (M= 3.90, SD = .549). They agreed that there was appropriate variety in screen displays (M = 3.90, SD = .586) and that information was presented in a developmentally appropriate and logical way (M= 3.86, SD = .540). Furthermore, the respondents also agreed about the accuracy of spelling, punctuation, and grammar (M= 3.86, SD = .684).

Generally, the respondents agreed that the information in the program was current and accurate (M=4.12, SD = .600) and the assessment strategies of the particular software were based on current trend in statistical analysis learning (M= 4.02, SD = .692). Hence, the respondents indicated a high mean for the item, "The program matches stated objectives of statistical analysis" (M= 4.00, SD= .707). The respondents also agreed that the App addressed various statistical analysis needs (M= 3.98, SD= .692) and the App was free of stereotypes (M= 3.90, SD= .653).

Besides that, the majority of the respondents agreed that learning activities that facilitated integration of the App into curriculum were provided (M= 3.96, SD= .576) and the EzyStats3Q Model App's objectives were clearly stated (M = 3.96, SD= .611). They also agreed that professional knowledge that facilitated integration of the app into curriculum was provided (M= 3.86, SD= .612) and necessary technical documentation was included (M= 3.58, SD= .739).

Further data for the effectiveness criteria of the EzyStats3Q Model App was obtained from the findings of the semi-structured interviews. The findings revealed that more voice over on learning content should be included in EzyStats3Q Model App. However, some of the respondents highlighted that the design of the App can still be improved further. To illustrate, Respondent 1 stated, "The weaknesses that still exist is relating to the colours used for wordings because they do not have much contrast". As for documentation and supplementary materials, a total of five respondents highlighted that the App should include an online PDF manual for users, and an online suggestion box for users to provide feedback and suggestions for improvement.

Apart from that, EzyStats3Q Model App still needs to overcome the downloading of learning content problem because sometimes, it takes too much time to download a learning module. Several respondents suggested that EzyStats3Q Model App should be made available even when they go offline. In addition, the respondents also suggested that the App should provide multiple choice questions for each of the topics and lets the users test themselves to see their level of statistical knowledge.

As a conclusion, most of the respondents believed that students and researchers would definitely adopt EzyStats3Q Model App because it would save the learners' and researchers' time in learning statistics. One of the respondents stated that, "Students won't have problems even when they learn statistics without an instructor. Researchers can also use the App to learn the tricks to answer their research questions by using the right statistical analysis techniques" (Respondent 3). Another respondent agreed that "It can reduce instructors' workload because instructors can use this App to teach statistics in their class" (Respondent 4).

Furthermore, Respondent 5 agreed that EzyStats3Q Model App can make instructors become an expert in the teaching and learning of statistical analysis. She stated, "Instructors must adopt it because instructors and students can collaborate with others from outside the university in the forum; this collaboration will make the questions more critical and valid. This is important to see students' understanding, and with EzyStats3Q Model App, this is possible".

In addition, the respondents felt that EzyStats3Q Model App can improve the knowledge of statistical analysis of undergraduate and postgraduate students because EzyStats3Q Model App can help students to learn statistics anytime, anywhere and anyhow. Coursesites templates and links provide online access to a host of other interactive learning modes such as wikis, blogs and discussion boards making it easy to ramp it up on the latest gadgets: i-phone, i-pad, surface, laptop and desktop. Furthermore, this ubiquitous model of learning across various platforms allows increased focus on concepts rather than calculations. Apart from that, EzyStats3Q Model App also allows sharing among instructors. Indirectly, it can contribute to the sharing of expertise among the instructors because "instructors can share questions and learning content among themselves. Due to sharing of questions and content, instructors will be able to know the problem of statistical analysis in a more effective way" as indicated by a respondent (Respondent 2). In addition, another respondent highlighted that "EzyStats3O Model App makes the learning process faster and easier. It also gives ideas on how to teach analysis from the examples provided inside the EzyStats3Q Model App" (Respondent 4).

#### IMPLICATIONS AND CONCLUSION

As the pace of changes in educational technology continues unabated, it is essential to reflect on those transferable principles of our practice that will be of benefit to others. The implications of e-learning are that learning and teaching have been moved to desktop, laptop, and mobile devices where teaching and learning can take place in self-paced (asynchronous) formats or in virtual classes through the use of synchronous tools. As e-learning technologies have become more advanced, learning can be customized automatically based on an initial assessment of learner needs. Some

experts also see the evolution of learning content toward shorter learning chunks. Technologies that enable threaded discussion groups, chat rooms, synchronous meeting tools, and other collaborative software are among technologies being adopted in e-learning settings (Stoltenkamp & Mapuva, 2010). Hence, more advanced tools, such as Learning Apps and MOOCs that archive unstructured knowledge resources in ways that can quickly be searched through keyword, form the next step in developing e-learning. By using these social media tools, basic requirements for knowledge-on-demand learning can be presented by anyone at anytime and anywhere delivery of education and training, adapted to the specific requirements and preferences of each individual citizen within different e-learning settings (Wong, 2003).

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