

Development of Computer Assisted Instruction (CAI) in College Statistics

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Abstract The study developed a Computer Assisted Instructional (CAI) learning material in College Statistics using ADDIE Model based on the performance of the students in a local government managed university in Manila. A descriptive developmental method of research designed the CAI learning material in college statistics using the ADDIE model. This model is composed of the five phases; analyzing, designing, developing, implementing and evaluating result provide details of the participants for the validation and evaluation of the CAI. Results reveal that the material is suited to the needs of the students, lessons are adequate to attain the objectives, and the lessons are suited to the students. Furthermore, results show that topics such as introduction to statistics, the measures of central tendency and measures of variations, can be taught using CAI in teaching college statistics as recommended by the graduates who took the board examination.

Keywords: ADDIE Model, Computer Assisted Instruction, development

Introduction

Instructional materials are vital in the process of instruction. They can be used to facilitate effective instruction that

brings out a more meaningful learning. Resources such as textbooks, tasks, and supplementary resources organize and support instruction. CAI as a learning resource are materials intended to enhance a well-designed curriculum and the efforts of a good teacher” (Wieman et al., 2011). They are instructional media to assist learning to make students active as participants in the classroom. It also encourages students to explore more and memorize less. With the advance web technology, information, and printed media; learners with varied learning styles benefit from CAI materials. In addition, many people learn more if information is presented in a variety of format, such as visual, auditory and practice. In fact, Benneth (2012) found that CAI increases student’s interest in learning and in teaching. For teachers in the Arab world, using computer in the classroom, as an instructional aide, as claimed by Bani-Abdelrahman (2010) has a great impact in the field of learning and teaching.

In Michigan, a researcher suggested that CAI may have a positive impact on learning algebra in high school. Additionally, CAI will not diminish the quality of student’s performance in algebra, but rather, it will improve student’s attitude to algebra (Bennett, 2012). Similarly, Tareef (2014) investigated the effects of CAI in the achievements and problem solving skills on educational sciences students. The result showed that with computer-assisted learning methods, students problem-solving skills increase and their achievement is higher than the performance of the control group.

There are many advantages of using computers in education. The learners can proceed at their own pace or, skip ahead or review. Computers are useful in developing students’ positive attitude in learning. Their motivation increase and they improve their self-esteem. Connectedly, computer-assisted instruction gives the students an opportunity to actively participate in the learning process, and

to learn through the use of multimedia, inside and outside the classroom anytime of their preference. (Brown, 2003; Cotton, 1991; Hannafin & Foshay, 2008; Kinney & Robertson, 2003).

Apparently, CAI also found its niche in the teaching of mathematics Mohammed, Awoyemi, Fakomogbon and Omiola (2014) showed that multiple representations have an important role in developing children's understanding of mathematics concepts. The different ways in which multiple representations can be used to convey mathematics concepts, significantly, (Goldin & Shteingold, 2001; Milovanović, Takači, & Milajić, 2011) found technology to provide multiple representations in math. The use of multimedia and computer-based tools can facilitate the learner's thinking that are dynamically linked to the concrete and symbolic representations. In fact, Dimailig (2012) developed an interactive skill book in Mathematics V as a remedial and enhancement material for students in mathematics. According to her, the interactive skill book as an approach to teaching mathematics was effective compared to traditional method. Similarly, in the study of Acuña (2010), she concluded that the developed interactive multimedia device helped a lot to increase the level of performance of second graders in terms of their achievements. In fact, De Leon (2014), used CAI as intervention strategy in different mathematics concepts and topic.

CAI in Statistics

Statistics is a branch of mathematics that deals with numerical facts about things and people. Technological and scientific advancement demand knowledge in statistics. As a scientific body of knowledge, statistics has a vital role in education, economics, psychology, business, government, sociology, engineering, education and in almost all fields of endeavor.

Results of the study of Yung (2003) on the effectiveness of computer-assisted instruction (CAI) in statistics education in the college level in the United States showed that customized CAI significantly improved students' achievement in statistics than the commercially-developed CAI programs. According to him, teacher-made CAI programs were more effective than the commercially-developed CAI programs. Similarly, Basturk (2005) noted that several researchers have studied CAI in teaching statistics (e.g., Meehan, Spinelli, & Warner, 2001). Also, there are some aspects of CAI that were investigated including teaching statistics with laboratories (Prvan et al., 2002) and using EXCEL.

Apparently participants' ability to learn introductory statistics could be enhanced when CAI used as an instructional aid. In addition, Ragasa (2008) stressed that statistics was not interesting because of so many formulas to work on and computations are long and difficult, and that computer-assisted instruction (CAI) would be of great help because of embedded tutorials and drills in which practice are available. He stressed that students can work independently or in group with the teacher as facilitator when CAI is used in the classroom. His study showed that when "computer-assisted instruction and collaborative work" combined, learning and teaching will improve.

From the aforementioned studies, the students using computer-based tools in their statistics courses have better academic performance than their peers who received only face-to-face instruction. This observation applies to the type of computer-based tool, the concepts that are addressed, the measures that are used, and the number of computer-assisted sessions (Sosa, Berger, Saw & Mary, 2011). In addition, Liao and Lin (2016) believed that CAI could also be used as the remedial instruction that offers individual, interesting and,

self-controllable learning environments for students who are having hard time to follow the schedule or having poor learning achievement.

As such, Reston, Krishnan, and Idris (2013) stressed that expansion in statistics education in Malaysia and the Philippines is needed. More contextualized and in-depth qualitative studies should be done, which would include how students learn statistics and how teachers develop their teaching skills in statistics within the Asian cultural perspective. Accordingly, enhanced statistics education literature in Malaysia and the Philippines would increase not only the research skills but also the teaching skills on statistics education.

CAI on ADDIE

As one of the instructional development models, the ADDIE instructional design model is considered more dynamic and a flexible guide for developing learning materials (Melanie, 2008; Ozdileka & Robeckb, 2009). These authors developed a computer assisted learning environment for visually impaired students. The ADDIE instructional development model was applied to the learning environment as learning materials that are used to facilitate students learning and promote their conceptual learning skills.

Similarly, Chookaew, Howimanporn, Sootkaneung, Pradubsri and Yoothai (2014) developed “Computer assisted learning material based on ADDIE instructional development model for visually impaired students.” The finding showed that the developed CAL was one of the greatest factors in improving the students’ conceptual learning progress that leads to positive satisfaction. With the demand for a match between the learning resource and the learning progress in difficult abstract subject like statistic, CAI developed using ADDIE model maybe instrumental for learning improvement of Filipinos, thus the current study.

Purpose of the Research

The primary objective of the study was to develop a computer assisted instructional (CAI) learning material in College Statistics using ADDIE model based on the performance of the engineering students in a local university in Manila, Philippines.

Specifically, the study aimed to:

1. Identify the topics in College Statistics for engineering students for which to develop the CAI.
2. Develop the CAI using the ADDIE model
3. Evaluate the developed CAI in terms of the following:
 - a. Objective
 - b. Content
 - c. Technical quality
 - d. Instructional quality
4. Test the difference between the responses of the students, computer experts and the teachers on the developed CAI.

Methodology

Research Design

A descriptive developmental method of research was employed in this study in an attempt to describe the engineering students' performance in college statistics and develop suited CAI materials in college statistics.

In this research the CAI material was designed using the ADDIE model. This model covers all aspects of instruction that includes: analysis, design, development, implement, and evaluation. A research project based on this design can be sectioned into manageable steps that would be useful in achieving the predetermined goal.

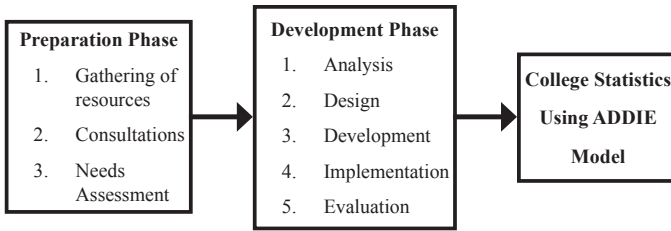


Figure 1. Framework of the Study

Participants of the Study

The study included 110 participants: 50 students from Electronics and Communications Engineering program, 50 from Computer Engineering program, five teachers and five computer experts. Both groups of engineering students were enrolled in statistics during their 2nd year in college, 2nd semester of SY 2013-2014.

Instruments used

The proponent used a survey questionnaire to assess the acceptability of the CAI. The questionnaire contains the following variables which were rated using Likert scale with the following constants: objectives, content, technical quality and instructional quality.

Preparation Phase

Analysis. In designing the CAI, the proponent determined the learning objectives, topics that are included, assessment instruments, content, and platform selection. The researcher identified the lessons that were included in the instructional material by reading the syllabus and further consultation with the faculty members who are teaching statistics.

Interviews with purposely selected five professors who are teaching college statistics and five computer experts teaching computer subjects, identified the following topics: 1) Frequency Distribution, 2) Measures of Central Tendency, and 3) Measures of Variation. Graduates who recently took the board examination confirmed that these topics significantly define the board examination.

After analyzing the result of the preliminary stage, the learning material in statistics was prepared. An initial draft of the module was developed. The researcher ensured that the material is appropriate to the comprehension and ability level of the students and that it was written in English.

Development Phase

In designing the CAI, the researcher made use of the ADDIE model. Starting with the *analysis phase* of the model, the syllabus was examined and topics to be included were determined. Survey was sent to the teachers and students to identify the problems and gaps and the teaching and learning preferences in statistics.

In the *design phase*, the researcher consulted computer experts regarding some important design principles. These principles can be universally applied to any CAI to improve results. In the Technology Integration process, IT platform was designed based on the results of the interview and survey from the IT and computer experts.

The researcher made use of the Microsoft Excel application in designing the chosen CAI material. Microsoft Excel allows users to organize, format and calculate data with formulas using a spreadsheet system. It has the basic features all spreadsheet applications, and has the ability to perform basic calculations in statistics, engineering and financial computation. In addition, it can display data as line graphs, histograms and charts.

In the *implementation phase*, the teachers teaching statistics were asked to facilitate and pilot test the CAI material. For the *evaluation phase*, the student respondents, teacher respondents, and computer experts were asked to rate the designed CAI on the functionality and technical quality.

Data Collection

After the preparation phase, the researcher started collecting the data. The following procedures were adapted by the researcher to gather the data needed in the study. A letter of permission to conduct the study was submitted to the dean of the college. Upon approval, the researcher personally distributed the evaluation checklist to the respondents of the study. The checklists were also retrieved by the researcher to ensure its 100 percent retrieval.

Data are gathered together with their corresponding analysis and interpretation in tabular and graphical forms, organized in a sequential manner following the aforementioned purposes of the research. Validation is not included in the study. Tabulation, analysis, statistical treatment, and interpretation of data were done with the help of statistician.

Data Analysis

The data obtained from the assessment checklist were tallied, tabulated, analyzed and interpreted using the following statistical tools;

The **frequency distribution** was used in the presentation of the responses of the teacher respondents, student respondents and computer expert's respondents to the quality statements in the questionnaire that were administered.

The **arithmetic mean** of each of the thirty (33) questions was computed and was analyzed and interpreted. The rating of the respondents on the objective, content, technical quality and instructional quality of the CAI material were also evaluated. The total mean score of the ratings were obtained based on the following ranges and their corresponding interpretation. Mean Rating of 4.21 – 5.00, Excellent, 3.41-4.20, Very Good, 2.61-3.40, Good, 1.81-2.60, fair and 1.01-1.80, Needs Improvement.

The **analysis of variance (ANOVA)** was used to determine the difference between the responses of the students, the statistics teacher and the computer expert.

Results and Discussion

College Statistics Topics for Engineering Students for CAI Development

From the survey questionnaires and interviews, the topics in Statistics that are included in the study and applicable to engineering, which can be taught using CAI are frequency distribution, measures of central tendency and measures of variation they were also included in the board examination.

Topics	frequency	%
Frequency Distribution	30	0.30
Measures of Central Tendency	35	0.35
Measures of Variation	35	0.35

The Developed CAI using the ADDIE model

The CAI in college statistics was developed using ADDIE model. It is viewed as instructional media to help reinforce the teaching and learning process of students and faculty in statistics. It may also serve as motivational device

to help students upgrade themselves with modern trends. The students are allowed to open and view the CAI for them to study the subject independently at their own pace without much supervision from the teacher.

The developed CAI in college statistics is presented with the following features;

1. Responsive to mobile phones, tablets, laptops, and desktops;
2. The topics are presented with definition and brief discussion with examples and exercises to enrich the analytical skills and knowledge of the students;
3. The lessons are suited to the level of understanding of the students,
4. The program structure allows students to maximize flexibility in navigation freely through the material.
5. The program is appropriate to the users talent and computer capabilities.
6. Every computer unit can be used by students who will perform the same operations, functions and obtained output from a server installed and; the software can be configured in a server to be accessed over the network.

Screenshots of several sections of CAI may be viewed in the appendix section. Figure 2 also shows sample features of the developed CAI customized to its users.

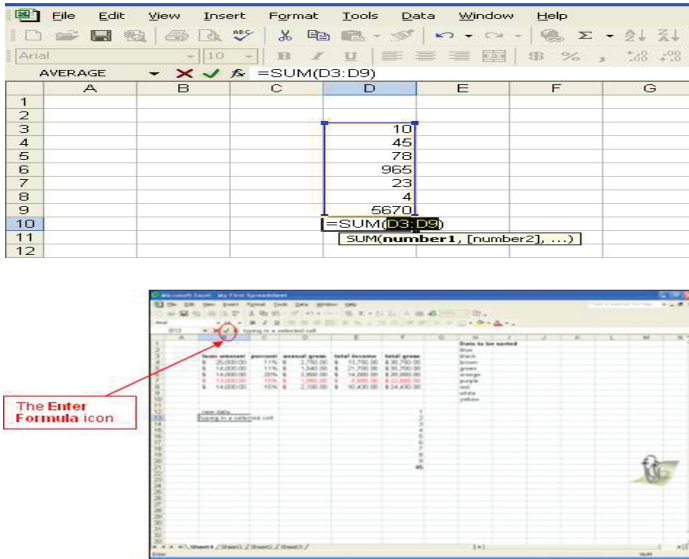


Figure 2. Sample Screenshots of CAI.

Evaluation of the developed CAI in terms of Objective, Content, Technical Quality and Instructional Quality

Table 1. Summary of Responses of the Respondents

Criteria	A	B	C	Mean	VI
1 Objectives	4.36	4.36	4.44	4.39	Excellent
2 Content	4.45	4.53	4.45	4.47	Excellent
3 Technical Quality	4.40	4.41	4.42	4.41	Excellent
4 Instructional Quality	4.42	4.41	4.42	4.42	Excellent
Total Mean	4.42	4.45	4.43	4.42	Excellent

Legend: A- students, B- Statistics Teachers, C- Computer Experts.

Table 1 reveals that the respondents rated content with the highest mean of 4.47 and the lowest was the objectives with a mean of 4.39. The overall rating is 4.42 which is labeled “Excellent.” The content has educational value and lessons are adequate to attain the objectives.

The result was supported by the study of Yung-Chen (2003) that different modes of CAI programs have effects on students' achievement in learning statistics. According to him the teacher-made CAI programs were more effective than the commercially-developed CAI programs.

Sosa et al. (2010) also concluded that students using computer-based learning tools in their statistics courses perform better than their peers who received only face-to-face instruction. Thus, the material may then be applied to a wide range of implementations of computer-based tool.

Difference between the Responses of the Respondents on Developed CAI.

Table 2 show the differences of the respondent's responses on the developed CAI in terms of the objectives, content, technical quality and instructional quality using ANOVA.

Table 2. Comparing Respondent's Responses.

Criteria	F-value		
	$\alpha = 0.05$	P-value	Critical value
Objectives		1.098	4.10
Content		.0018	4.46
Technical Quality		1.04	3.5
Instructional Quality		0.844	3.44

Based on Table 2 the responses of the respondents at level of significance of .05 ($\alpha = 0.05$) and one not significant. This result confirms the initial findings presented in Table 1.

The study conforms to the study of Chookaew et al. (2014) that the developed CAL was a great factor in improving the students' performance in statistics and also promotes positive satisfaction. The result was also supported by the study of Zhang and Hung (2007) that CAI in statistics

transforms traditional teaching and improves teaching skills. According to him it also addresses some skills of developing multimedia courseware in other topics in statistics and application of statistical software of CAI.

Conclusion and Recommendations

The main objective of the study is to develop a computer-assisted instruction in college statistics using ADDIE model. The present study focus only on descriptive statistics.

The topics in Statistics that are included in the study and applicable to engineering which can be taught using CAI are frequency distribution, measures of central tendency and measures of variation they were also included in the board examination.

That the developed CAI has an educational value to students and teachers. It was also a very good learning material to students and to teachers.

The CAI in college statistics was viewed as instructional media to help reinforce the teaching and learning process of students and faculty in statistics. It may also serve as motivational device to help students upgrade themselves with modern trends.

The respondents find that the material is suited to the needs of the students, lessons are adequate to attain the objectives and lessons are suited to the level of appropriateness of the students. It is appropriate for the target users in terms of objective, content, technical quality and instructional quality. However, the topics were too short and not good enough for one semester.

There is no significant difference in the responses of the respondents in terms of objectives, content, instructional quality and technical quality. CAI material was rated by the

respondents as “excellent” in terms of objectives, contents, technical quality and instructional quality. The three groups of respondents rated the material excellent in all categories. CAI if properly organized serve as an effective tool in teaching statistics.

Recommendation

In connection with the results revealed from the present study, the following recommendations are stated:

Teachers should develop instructional materials in statistics which includes other topics in descriptive and inferential statistics that are suited to student needs and appropriate to their level of understanding. The students should be exposed to computer aided instructional material to develop their skills and interest in the subject.

The use of CAI for students with poor learning outcomes or with a diverse student population was suggested. The use of technology is now adapted in most schools, CAI should be used in the most effective and efficient way to increase learning outcomes. Structured instructional design model for teaching statistics and other related topics is a fruitful, relevant experience. Similar study should be conducted in other college and universities.

The administrator should encourage their teachers to develop instructional material in different disciplines. They should initiate seminars and trainings in CAI development and should invest both resources and time for the teachers training.

That this study be replicated on a wider range of national and international scale. The inferential statistics should be included and reliability and validity should be tested.

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References

- Acuña, B.M. (2010). *Interactive multimedia instructional materials: a guidance model in teaching Mathematics for grade II*. (Unpublished Master's Thesis). Eulogio Amang Rodriguez Institute of Science and Technology, Manila.
- Bani-Abdelrahman, A. (2010). The effect of using an instructional computerized package on EFL students' reading achievement in English. *University of Sharjah Journal of Humanities & Social Sciences*, 7(2).
- Basturk, R. (2005). The effectiveness of Computer-Assisted Instruction in teaching introductory Statistics. *Educational Technology & Society*, 8(2), 170-178.
- Bolaños, A. (1997). Probability and statistical concept an introduction (1st Edition), Rex Book Store. Retrieved from <http://www.rexestore.com/social-studies-college-books/427-probability-and-statistical-concepts-an-introduction.html>.
- Brown, K.L. (2003). From teacher-centered to learner-centered curriculum: Improving learning in diverse classrooms. *Education*, 124(1), 49-54.
- Chookaew, S., Howimanporn, S., Sootkaneung, W., Pradubsri, W., & Yoothai, P. (2014). Computer assisted learning material based on ADDIE instructional development model for visually impaired students. Rajamangala University of Technology Phra Nakhon, Thailand.
- Cotton, K. (1991, May). Computer-assisted instruction. Northwest Regional Educational Laboratory, School Improvement Research Series. Retrieved from <http://www.nwrel.org/scpd/sirs/5/cu10.html>.
- De Leon (2015). Development of computer aided instructional CAI material in advanced algebra:

Its acceptability. (Unpublished Master's Thesis). Eulogio Amang Rodriguez Institute of Science and Technology, Manila.

Dimailig (2012). Interactive skill book in Mathematics: Basis for improved Mathematics proficiency. (Unpublished Master's Thesis). Eulogio Amang Rodriguez Institute of Science and Technology, Manila.

Goldin, G. A., & Shteingold, N. (2001). Systems of representations and the development of mathematical concepts. In A. A. Cuoco & F. R. Curcio (Eds.). *The roles of representation in school mathematics* (pp. 1-23). Reston, VA: NCTM.

Hannafin, R., & Foshay, W. (2008). Computer-based instruction's (CBI) rediscovered role in K-12: An evaluation case study of one high school's use of CBI to improve pass rates on CAI Effect on Rural Algebra I Students 33 high-stakes tests. *Educational Technology, Research and Development*, 56(2), 147-160. DOI:10.1007/s11423-006-9007-4.

Kinney, D. P., & Robertson, D. F. (2003). Technology makes possible new models for delivering developmental mathematics instruction. *Mathematics and Computer Education*, 37(3), 315-328.

Liao, Y., & Lin, W.-H. (2016) Effects of matching multiple memory strategies with computer-assisted instruction on students' statistics learning achievement. *Eurasia Journal of Mathematics, Science & Technology Education*, 2016, 12(12), 2921-2931 DOI: 10.12973/eurasia.2016.02313a.

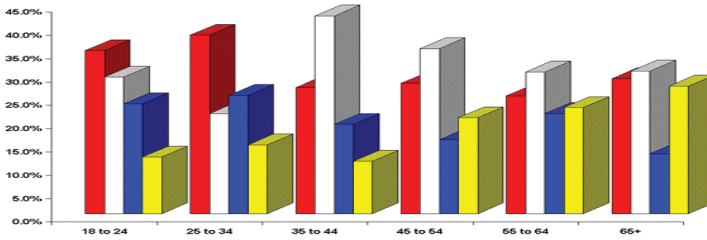
Melanie, M. (2008). Improving the flow of materials in a Cataloging Department: Using ADDIE for a project in the Ohio State University Libraries Library. *Resources and Technical Services*, 52(2), 54-60.

- Milovanović, M., Takači, Đ., & Milajić, A. (2011). Multimedia approach in teaching mathematics— example of lesson about the definite integral application for determining an area. *International Journal of Mathematical Education in Science and Technology*, 42(2), 175-187.
- Mohammed, R.E., Awoyemi, S.O., Fakomogbon, M.A., & Omiola, M.A (2014). *European Scientific Journal*, 10(25), 1857- 7431.
- Ozdileka, Z., & Robeckb, E. (2009). Operational priorities of instructional designers analyzed within the steps of the Addie instructional design model. *Procedia Social and Behavioral Sciences*, 2046–2050.
- Prvan, T., Reid, A., & Petocz, P. (2002). Statistical laboratories using Minitab, SPSS and Excel: A practical comparison. *Teaching Statistics*, 24 (2), 68-75.
- Ragasa, C.Y. (2008). A comparison of computer-assisted instruction and traditional methods of teaching basic statistics. *Journal of Statistics Education*, 16(1), 1–20.
- Reston, E., Krishnan, S. & Idris, N. (2013). Statistics education research in malaysia and the philippines: A comparative analysis. *Science and Mathematics Education Department, University of San Carlos-Talamban Campus*. Retrieved from [https://iase-web.org/documents/SERJ/SERJ13\(2\)_Reston.pdf](https://iase-web.org/documents/SERJ/SERJ13(2)_Reston.pdf).
- Sosa, G.W., Berger, D.E., Saw, A.T. & Mary, J.C. (2011). Effectiveness of Computer-Assisted Instruction in statistics, a meta-analysis. *Claremont Graduate University*. 81(1), 97-128.
- Spinelli, M. A. (2001). The use of technology in teaching business statistics. *Journal of Education for Business*, 77(1), 41-45.

- Tareef, A. B. (2014). The effects of computer-assisted learning on the achievement and problem solving skills of the educational statistics students. *European Scientific Journal*, 10(28), 1857- 7431.
- Meehan, A. M. & Warner, C. B., (2001). Microsoft Excel as a tool for teaching basic statistics. *Teaching of Psychology*, 28(4), 295-298.
- Wieman, C. E., Adams, W.K., Loeblein, P. & Perkins, K.K. (2011). Teaching physics using PhET simulations. University of Colorado, Boulder, CO. Retrieved from <http://www.phet.colorado.edu/en/research>.
- Ymas (2015) Basic and Applied Statistics, (5th Edition), Philippines: Ymas Publishing House.
- Yung-Chen, H. (2003). The effectiveness of computer-assisted instruction in statistics education: A meta-analysis. The University of Arizona ©2003 ACM Digital Library.
- Zhang, X., & Hung, S. (2007). Integration of the high-tech and low-tech in distance teacher training in China: An insight from the case of Jiangsu Radio and Television University. *International Review of Research in Open and Distance Learning* 8(1). Retrieved from <http://www.irrodl.org/index.php/irrodl/article/view/336>.

Appendices

Computer Assisted Instruction in College Statistics



Leticia V Marquez



Overview

The development of *Statistics* started when man began to collect and to record data from anything of interest to them. Today, **Statistics** become an integral part of the academic course. Student studies statistics as well as the art and science of statistics on how to a) gather data and to analyze them precisely and briefly and b) to interpret and give meaning from them.

There are two divisions of Statistics they are the descriptive and inferential statistics. *Descriptive statistics* deals with the gathering or collection, organization and analysis, presentation and computation of data. *Inferential statistics* is concerned with making conclusions about a population or from a small representative of that population called sample.



The CAI consists of four lessons which are as follows:

Lesson 1: Introduction to Statistics

Lesson 2: Data Presentation

Lesson 3: Measures of Central Tendency

Lesson 4: Measures of Variation

General Objectives

After completing this CAI material students are expected to:

1. discuss the background or introduction and the development of statistics
2. identify the measures of central tendency
3. identify, compare and contrast the measures of variations
4. compute the mean, median and mode of grouped and ungrouped data
5. calculate and interpret the various measures of dispersion
6. learn to operate computer
7. learn statistics using Microsoft Excel

Introduction

Statistics is “a branch of science that deals with the studies of collecting, organizing, summarizing and drawing conclusions from the data”. Ymas (2015)

The science of statistics has two divisions the descriptive and inferential statistics. Descriptive statistics deals with the collection, organization, presentation and computation of data. Inferential is concerned with making inferences or conclusions about a particular population based on the information obtained from a small representative of that population called sample.

Words are vital in communication and understanding. In statistics, like other subjects have technical terms, which have different meanings from everyday conversations, that anyone should to make his study of statistics an enjoyable experience Bolaños, (1997).

Basic Terminologies:

Data – are information gathered by a researcher from a population or sample. They have been used to undertake study of particular problems or to provide a basis in decision-making. It can be classified as qualitative and quantitative.

- ▶ **Qualitative Data** – data that can place into categories according to some characteristics that manifest attributes. Example: nationality, gender, SES (Socio Economic Status) and civil status are qualitative data.
- ▶ **Quantitative Data** – data that are numerical in nature. They are used in counting and measuring. Example: age, height, grade, number of students, test scores.

There are two types of quantitative data;

- ▶ **Continuous** – it can assume all values within two specific values or interval. Example: height, weight
- ▶ **Discrete** – assume specific values that can be counted and such values are counting numbers only.

Example: number of students, number of days in a week

Population (N) – a group of people, objects or events under investigation.

Example: $N=5000$

Sample (n) – a small representative of a population.

Example: $n=500$

Parameters – the actual value obtained from a population.

Statistic – the value obtained from a sample. It is an estimate of a true value.

Constant – a property of a group, which makes the members similar to each other.

Variable – a property of a group, which makes the members different to each other. Example: nationality, color, religion

Levels of Measurement

Nominal – the most primitive level of measurement. There is no ranking or order among each category. It is used to distinguish one object from another for identification purposes. Example: nationality, color, religion

Ordinal – data are arranged in specified order or rank. When

objects are measured in this level, we conclude that one is better than the other or comes ahead of another. Example: 1st, 2nd, 3rd, 4th etc.

Interval – In this level, we may specify the precise amount of difference between the values or rank. Example: IQ, score in a test, grade

Ratio – has the same characteristics with the interval level, the only difference is being that the ratio level always starts from an absolute zero point and has always the presence of units of measures. Example: height, weight, age

Data Presentation using Microsoft Excel

In data presentation using Microsoft Excel any one must learn how to operate computer first and should familiarized the basic operations of Microsoft Excel.



Steps how to solve problem in Microsoft excel:

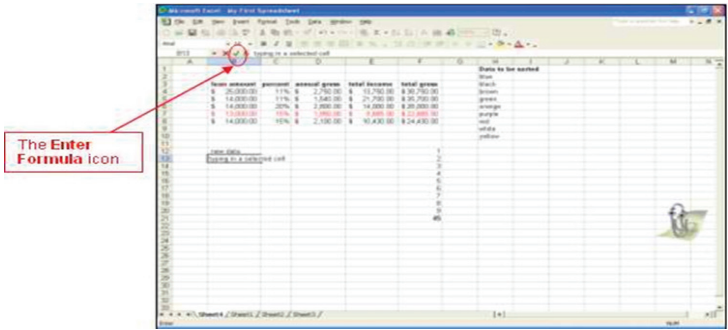
Step 1: Click Start on the bottom left of desktop.

Step 2: Click All Programs and then select Microsoft excel:

To enter data in a worksheet, follow the instructions below.

1. Select the cell that you wanted to enter the data.
2. Then start typing the data.
3. Data appears in the Formula bar as you type.

4. Press the Enter key or click on the Enter Formula icon (the green checkmark) in the Formula bar after you have finished entering the data.



5. The data displayed in the Formula bar will be entered into the selected cell on your worksheet.

Note 1: Press the Enter key or click on the Enter Formula icon to validate entered data. Otherwise, Excel will not recognize the entered data in the cell.

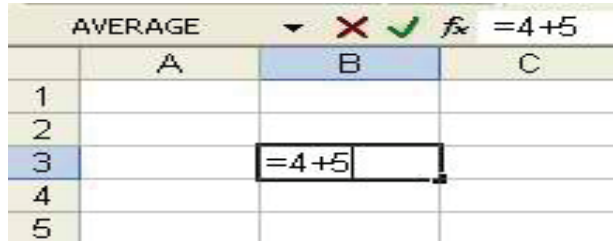
Note 2: Excel automatically increases the width of the cell to fit the data. The width of the column can always be increased by manually by dragging the boundary on the right side of the column heading.

Performing Basic Mathematical Operations

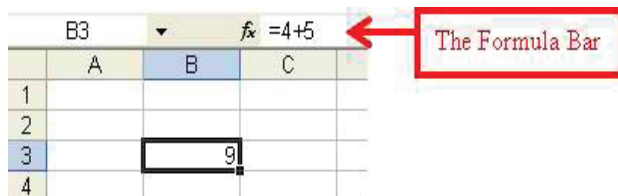
In performing the basic mathematical operations such as addition, subtraction, multiplication or division just click the (equal sign) = sign and one of the arithmetic operators displayed in the table below.

Arithmetic Operator	Meaning	Example
+ (Plus sign)	Addition	3+3
- (Minus sign)	Subtraction	3-1
* (Asterisk)	Multiplication	3*3
/ (Forward slash)	Division	3/3

1. Open your Microsoft Excel workbook.
2. Select the cell you want to see with the mathematical result.
3. Type the = sign.



4. Then type the arithmetic operation you wanted to do
5. Then press the Enter key on the keyboard.
6. The result of the mathematical operation you choose will be displayed in the originally selected cell.



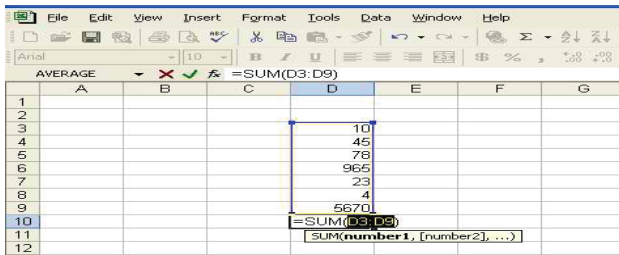
7. The mathematical operation can be viewed and edited from the Formula Bar.

Using the AutoSum Feature

The AutoSum feature help you add number automatically. Excel will suggest the range of cells to be added. If the suggested range is incorrect, select the cells that contain the information you want to add and press

the Enter key. To use this feature, follow the instructions below.

1. Open your Microsoft Excel workbook.
2. Type the data you want to add.
3. Select the cell in which you want the total.
4. Click on the AutoSum icon in the toolbar.
5. Animated lines will surround a suggested summation range.



6. If the range is correct, press the Enter key on your keyboard
7. The total will appear in the selected cell.
8. If the range is not correct, drag your mouse through different cells to select them.
9. Press the Enter key.
10. The auto sum will appear in the originally selected cell.

Activity 1

The following are the scores of the ECE students in Algebra:

32	22	76	48	55	85	38	17	49	50
59	54	42	62	72	29	76	52	42	40
66	76	58	66	76	64	41	86	37	75
92	62	94	88	72	63	65	88	25	88
85	17	38	50	49	48	76	55	22	32

Prepare a frequency distribution for these scores.