

Full length Research Article

CD-Based Instructional Materials in Teaching Statistics At Kalinga-Apayao State College

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Received 21st December 2015; Published 31st January 2016

The use of computer-aided instructional materials in the modern educational trend is very essential to address the gaps between knowledge and technology. This study endeavored to experiment the use of a CD-based instructional material in teaching Statistics in the graduate level of education. It sought to answer the following problems: 1. To determine the academic performances (mean scores) of the two groups respondents on the Pre-test and Post-test under the experimental (with CD material) and control group (non-experimental); 1.1 To determine if there is a significant difference in the academic performance (mean scores) of the students in the Pre-test and Post-test for both the experimental and control group; 1.2 there is no significant difference in the academic performance (mean scores) of the students in the Pre-test and Post-test for both the experimental and control group; 2. To determine the perceived extent of need by the respondents on the use of a CD-based instructional material in Statistics along the areas in Statistics in the graduate level; 3. To determine the preferences of the respondents on the proposed CD-based instructional materials in teaching Statistics in the graduate level; 4. To find out what is the general reactions or attitudes of the respondents on the different parts of the CD-based instructional materials in Statistics. Sixty MAED students were evaluated under the experimental and control group classes in Statistics. The Pre-test and Post-test questionnaire was used to determine the academic performances (mean scores) of both the respondents. While the survey questionnaire was used to assess the need and preferences of students over the CD-based form of instructional materials, and lastly, the reactions of the students towards the CD-based instructional materials was also gathered. The data on the mean scores were categorized according to 5-point grading scale, and data on the extent of needs, preferences and attitudes of students were classified using the 3-point scale and described as "much need/much preferred/much favorable, moderately needed/ moderately preferred/ moderately favorable and less needed/ less preferred/ less favorable. Frequency counts, mean, t-test, correlation and weighted were used to compute and analyze the data gathered in this study. The study found out the mean scores of the respondents in the Pre-test and Post test are described as "outstanding" and "highly outstanding" respectively. The hypothesis of significant difference between the mean scores of the students in the pre and post tests were found to be significant with high positive correlation. It also revealed that the use of CD-based instructional materials in Statistics is "much needed" and "much preferred" respectively. While the reactions of the students toward the different parts of the CD-based instructional materials in Statistics were found to be "much favorable." Therefore the results of the study are generally confirmed that the CD-based instructional material in teaching Statistics is effective.

Key words: Highly Outstanding, Much Preferred, Respectively.

INTRODUCTION

Technology has been a significant tool in almost all human endeavors (Hancer and Tuzemen, 2008). The integration of technology into education is a growing phenomenon hence huge amount of money is being invested into Information and Communication Technologies (ICTs) in education across the globe in order to ensure improved students academic performance (Trautman, 2004). Thus, instructional strategies and lesson plans are parts of these larger models of teaching. In a model of teaching, "alternative instructional strategies are associated with different instructional goals which are all geared toward increasing students' capabilities for future learning" (Morine-Dershimer & Kent, 1999, p.27). Most of the early efforts to improve the teaching and learning process focused on lecture and drill method with the use of textbooks, work books, manuals and other paper-based teaching materials.

In advanced countries and universities around the world, the use of TV, Videos, Computer and Compact Disc have been practiced as teaching devices to enhance and maximize the time for teaching and learning process. In less developed countries like the Philippines where internet connectivity is still a major problem among offices, colleges and universities, the use of computers is only limited for encoding reports, summarizing data, laying out paper presentations and office communication accessory. Thus, the uses of computers and computer laboratory are not well established in the some colleges and universities. But despite of the problems of connectivity, teachers find remedies to introduce the benefits of integrating technology in the classroom instruction through the use of CD-based research works or activities as a source of information and knowledge. This effort can help the students become updated and have the opportunity to make use of the computer facility services. In the graduate level, doing a research work is very difficult without the use of computer. Like in the study of Statistics the use of computer software is more advantage than the use of calculator and

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book manual. Statistical problem solving requires greater time to do the step-by-step procedures from identifying problems until final analysis and interpretation of the summarized data. Its lengthy solutions of statistical problems tend to disappoint students to learn the subject interestingly. With this observed few problems, teachers must also look into the new approaches that can motivate the students enjoy their classes. With great advantages of the technology in the education industries, this study focused on the assessment of the strength and weaknesses of computer-aided statistics as teaching approach and the development of Compact Disc -based programmed materials. Its intention hopes to provide advancement of classroom strategies that can accelerate the teaching and learning processes in advanced statistics.

Conceptual Framework

This study was guided by the concept of a computer -aided instructional material. It was developed through thorough review of the concepts presented below which includes the theory of learning, the related researches on computer-aided / assisted instruction, the roles of technology in education, and instructional material development for computer-assisted program:

On the theory of learning

It is important to think first about how students learn in general. Learning in a course is more complex than merely remembering what students have read or been told, and many of us have found that students do not necessarily learn by having us explain to them how to solve a problem. In fact, it is frustrating to work out a problem elegantly, explaining all the steps clearly, and then find out hardly any of the students understand it.

The theories of learning serve as a basis for theories of instruction that draw conclusions about how students will acquire knowledge and learn. A recent theory of learning which has been widely accepted in education communities stems from earlier work by Jean Piaget, and has been labeled 'constructivism.' Today, this is the guiding theory for much research and reform in mathematics and science education. Constructivists view students as bringing to the classroom their own ideas, material. Rather than 'receiving' material in class as it is given, students restructure the new information to fit into their own cognitive frameworks.

Application of the theory of learning in Statistics

The theories of learning and instruction interact with teachers' particular goals for what students should learn in their courses. What are the skills and ideas teachers would really like their students to take away from their statistics courses? These goals do not necessarily correspond to what students are asked on quizzes or exams. If teachers were asked what they would really like students to know six months or one year after completing an introductory statistics course, most would probably not respond that students should know how to compute a standard deviation by hand, know how to convert normal variables to standard normal variables and look up their probabilities on the z-table, or compute expected values. Many would indicate that they would like students to

understand some basic statistical concepts and ideas, to become statistical thinkers, and to be able to evaluate quantitative information.

In addition to the above concepts, skills, and types of thinking, most statisticians would probably agree that we also have attitude goals for how we would like students to view statistics as a result of our courses. Such attitude or affective goals are:

- It is important to learn some fundamentals of statistics in order to better understand and evaluate information in the world.
- Anyone can learn important ideas of statistics by working hard at it, using good study habits, and working together with others.
- Learning statistics means learning to communicate using the statistical language, solving statistical problems, drawing conclusions, and supporting conclusions by explaining the reasoning behind them.
- There are often different ways to solve a statistical problem.
- People may come to different conclusions based on the same data if they have different assumptions and use different methods of analysis.

Once we have articulated our goals for students in statistics classes, we need to address the issue of how we enable students to learn these ideas and to change their already established beliefs about statistics. Many college statistics classes consist of listening to lectures and doing assignments in textbooks. Do these activities help achieve the goals for our students? Are students being adequately prepared to use statistical thinking and reasoning, to collect and analyze data, to write up and communicate the results of solving real statistical problems?

Additional concepts to strengthen the foundation of this study are the related studies conducted by previous researchers and lecturers. They are outlined as follows:

Development of Computer Assisted Instruction. On the research of Dalwadi, N. (2001) on "Development of Computer Assisted Instruction in Science for the student of standard IX." The study found out that: (i) Computer-Assisted Instruction was found to be effective individualized instructional technique for teaching science to standard IX students. Students opinion towards the use Computer-Assisted Instruction is found to be favorable as far as the statement related to the interest, mode of presentation, content clarity and the question asked in the Computer-Assisted Instruction.

Computer-based Instruction versus lecture based instruction

A comparative study by Cannon, T. R. (2005), on "Computer-base Instruction versus lecture based instruction in developmental Mathematics at a Tennessee Community." Found that: When examining achievement, retention, persistence and success, the only area in this study that showed a significant difference was among the achievement rates.

Effectiveness of Computer Assisted Instruction in Mathematics

A study conducted by Singh R.D. (2005) entitled "Effectiveness of teaching Mathematics through Computer Assisted Instruction and conventional method of instruction on cognitive and non cognitive variables. Computer Assisted Instruction was always found superior, but the gains were more in the case of good students and there was a definite positive change of attitude towards learning Mathematics on the part of both boys and girls due to the use of computers. The study by Jothikani, and Thiagarajan, (2004) on "Effectiveness of Computer Assisted Instruction in Mathematics among B.Sc., Degree students" outlines that: (i) The mean scores of post test of control group are significantly higher than that of the experimental group in all six units with reference to the objectives and their level of achievement in both the years 1999-2000 and 2001-2002.

The study of Phoolwala (2004), An inquiry into the utility and effectiveness of microcomputers in teaching science for standard X found out that : (i) The difference between the mean scores of pre test and post test of experimental group was significant. So it can be said that students can learn effectively through microcomputers. The study of Hsu, Yung-Chen (2003) on "The effectiveness of Computer Assisted Instruction in Statistics education: A meta-analysis." Results of the meta-analysis indicate a small to medium positive effect of applying Computer-Assisted Instruction in teaching college level introductory statistics on students' achievement. The result of the analogous analysis of the variance showed that different modes of Computer-Assisted Instruction program produced significantly different effects on students' achievement in learning statistics.

Level of attainment in teaching information technology. According to the study of (Bai, 2012), the objectives in teaching information technology were moderately attained. This is evidenced that the use of technology should be taught and applied in all levels so that its applicability may become a usual practice in order not to perceive that the use of technology is stranger among students and professionals.

Acceptability of technology used

According to Turner, Kitchenham, Brereton, Charters, and Budgen (2010), technology acceptance model (TAM) was proposed by Fred Davis in 1989 as a means of predicting technology usage. TAM postulates that perceived ease of use and perceived usefulness of technology are predictors of user attitude toward using the technology, subsequent behavioural intentions, and actual usage (Davis, 1993; Masrom, 2007). The TAM employed for this study is shown in Figure 1. Masrom (2007) describes perceived usefulness as the degree to which the user believes that using the technology will improve his or her work performance, while perceived ease of use "refers to how effortless he or she perceives using the technology will be" (p. 3). According to Masrom, both perceived usefulness and perceived ease of use are considered distinct factors influencing the user's attitude toward using the technology, though perceived ease of use is also hypothesized to influence perceived usefulness and attitude toward using the technology.

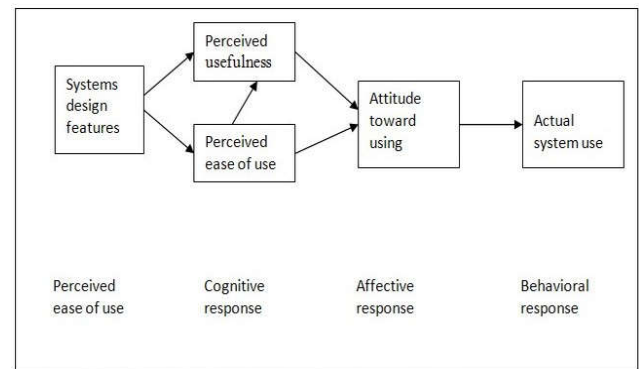


Figure 1. Original Technology Acceptance Model (Davis, 1993, p. 476).

The CBI model

The computer based instructional material model consisted of the following aspects according to Malik, (2012):

- Title of the model
- Rationale for the model
- Aims and objectives
- Inputs consisting of
 - computer use in the classroom
 - computer use in the computer labs
 - computer use by instructor/resource person and students
 - textbooks, website and email
 - CD ROM
 - internet
- Out puts or outcomes of the model
- Evaluation
- VII. Alternative model-(like CD-based IM)

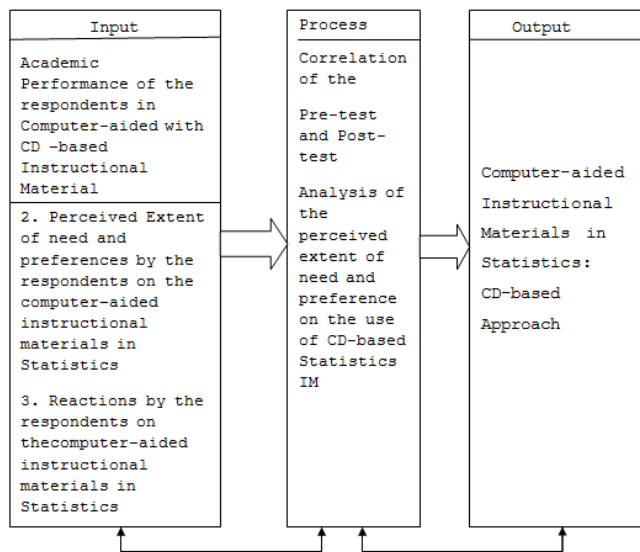
The use of CD-ROM

CD-ROM and floppy disks can be used to store huge amount of information, for example a picture, a simulation, a movie, diagram or a lecture and can be shown in the classrooms. For example a student in a science class asked about the price of part of equipment. A teacher can go online and find the answer instantaneously. In the same way email can be used as a part of computer based instructional material. If a student wants to find the viewpoint of a renowned scientist, one can do so by emailing that scientist and sharing his view with the whole class. Computer games are another way a computer can be used as a part of computer based instructional material.

In the study of Statistics, information about each concept is presented to learners in four ways: (1) as a lay definition of the concept in question; (2) as an example (written in text) illustrating how the concept is used in the context of an experiment (the same example is used throughout the tutorial so that students can build their understanding of statistics in a particular context); (3) as a statistical definition of the concept to learners develop and become familiar with the language of statistics as well as to immerse themselves with in the culture of statistics; and (4) as an example using text, sound, screen recordings (computer recordings of actions performed on the computer), or animations that illustrate how a particular concept is used in a problem (this is different from that presented earlier to facilitate students' understanding of statistics across contexts) and how procedures can be applied using the appropriate software (such as EXCEL for the entry, analysis, and representation of data).

The study of Statistics is getting easier with the use of Statistics software like Micro-stat, Excel Stat, SPSS version and PH Stat. This different software can be stored in CDs which are useful for Data processing and analysis. The use of CD is important as information or knowledge storage for teaching materials because it can accommodate any form of presentation and lesson demonstrations like videos, power-point and others. However to justify the use of this materials, this study was done and targeted to selected students in the graduate level. The study is framed following the input-process-output system. The input contains the academic performances of the respondents, assessment of needs and preferences of the respondents towards the use of CD-based instructional materials in statistics.

The diagram below illustrates the flow of the concepts of the study.



Paradigm of the Study

Statement of the Objectives and Hypothesis

This study generally aimed to assess the use of CD-based instructional material in teaching statistics among the two groups of MAED students at Kalinga-Apayao State College. Specifically, it aimed to seek answers to the following specific objectives:

- To determine the mean scores of the two groups of respondents (control and experimental groups) in the Pre-test and Post-test in Statistics;
- To determine if there is significant difference in the Mean Scores of the two groups of respondents in the Pre-test and Post-test in Statistics;
- Hypothesis: There is no significant difference in the Mean Scores of the students in the Pre-test and Post-test of the two groups of respondents;
- To determine the perceived extent of need on the use of a CD-based instructional material by the two groups of respondents in Statistics;
- To determine the preferences of the two groups of respondents on the use of CD-based instructional materials in teaching Statistics;

- To find out the reactions of the two groups of respondents on the different parts of the CD-based instructional materials in Statistics;
- Hypothesis: There is no significant difference on the reactions of the two groups of respondents on the use of the CD – based instructional materials in Statistics.

Research Design

Experimental study was done to groups of MAED students enrolled in Statistics on the use of the CD-based instructional materials in teaching Statistics among the MAED students during the second term of 2013. The pre-test and post-test method was used to gather the mean scores of the two groups of students. While two sets of survey instruments were used to assess the level of need and preferences by the same groups of students.

Respondents

The respondents of this study consisted of two groups of students taking Statistics where-in each group composed of 30 students.

Procedures

The Pre-test was given to both the experimental and control groups of students in Statistics Class. After the Pre-test, the experimental class was taught using the CD-based material in learning Statistics while the control group was taught both in traditional and computerized computation. The experimental group was instructed that in every topic the students were asked to answer first the Pre-test sheet then after which they were allowed to proceed to the lessons and activities. After every lesson, the students were given the Post-test sheet. If they got very satisfactory score in the Post-test then they can proceed to the next lesson but if they got below very satisfactory rating then they have to repeat the lesson and the post-test.

Validity and Reliability of Instrument

This study made use of the pre-test and post-test from statistics books. While the survey instrument for the extent of needs and preferences, the set questionnaire was lifted from the study of Masroom (2007) on Technology –based Learning Approach.

Statistical Treatment

To summarize and classify the academic performance of the student-respondents, the performance scale made use of the five-point numerical grading scale.

Grades	Limits of Description	Interpretation
1.00	1.00 – 1.24	Excellent
1.25	1.25 – 1.49	High Outstanding
1.50	1.50 – 1.74	Outstanding
1.75	1.75 - 1.99	Very Good
2.00	2.00 – 2.24	Good

In describing the coefficient of correlation, the following limits of description are used:

- +, - 0.90 – 1.00 Very high to perfect correlation/very dependable relationship
 (+, -) 0.70 – 0.89 High correlation; marked relationship
 (+, -) 0.40 – 0.69 Moderate Correlation; substantial relationship
 (+, -) 0.20 – 0.39 Low Correlation, definite but small relationship

The responses of the respondents on the extent of need and preferences used the three-point scale with the descriptive equivalents as follows:

Extent of Need and Preferences

Numerical	Actual	Description	Limits	Limits
3		2.24 – 3.00	Much Needed/Much Preferred	
2		1.67 – 2.23	Moderately Needed/Preferred	
1		1.00 – 1.66	Less Needed/Less Preferred	

Statistical Tools

The data were analyzed through the use of the following Statistical formula:

- The mean formula was applied to determine the
- academic performance of the students in the pre- test and post –test to get the mean scores. However, the MS Excel Stat was used to compute the Mean Value.
- The t-test and correlation were used to test the significant difference between the pre-test and post-test conducted to the MAED students who were exposed to the CD-based instructional materials.
- The weighted Mean Formula was used to determine the extent of needs and preferences towards the use of Computer-aided instructional material by the respondents using the MS Excel Stat computation

RESULTS AND DISCUSSIONS

This study presents the following statistical tables with the corresponding statistical results and interpretations.

Table presents the Mean Scores of the Students in the Pre-test and Post test in the Experimental (CD method) and Control Groups(combined method)

Exact Limits	Scores	Mean Scores Pre-test	Mean Scores Post test	Description
1.00-1.24	81-100	0	8	E
1.25-1.49	61- 80	12	11	HO
1.50-1.74	41- 60	6	8	O
1.75-1.99	21- 40	4	3	VG
2.00-2.24	01- 20	8	0	G
Mean per group		44	66	O

Table 2. Presents the Correlation and t-test of the Pre-test and Post test of the Two Groups of Students for both the Experimental and Control Group

Statistics	Computed	Description	Interpretation
Correlation	0.89	High positive Correlation	
t-test	3.38	Greater than t-crit value at .05=2.35	Significant

The table shows that the mean ratings of the respondents in the Pre-test and Post are 44 and 66 which are described as “outstanding” and “highly outstanding” respectively. It further shows that the mean score of the post test is greater than the mean score on the pre-test. This is an indication that there was a great positive change in the performance of the students when they were taught under the two methods of teaching.

Table 2 presents the Correlation and t-test of the Pre-test and Post test of the Two Groups of Students for both the Experimental and Control Group. The result of the computation in the table shows that the correlation between the pre-test and post of both the two groups of students in Statistics class have a high positive correlation which is supported by the re- computed value of 0.89. While the t-test computation shows that t-computed value of 3.38 is greater than the t-value of 2.35 at 0.05 level of significance. This led to decision that the hypothesis which states that there is no significant difference of the mean scores in the pre-test and post test of both the two groups of students is rejected. Therefore, it is implied that there is a significant difference of the mean scores in the pre-test and post test of the groups of respondents.

The findings of the study corroborate with the study of Phoolwala (2004) in his study on the effectiveness of microcomputer in teaching Science which stated that there is a higher degree of performance of the experiment with the Pre-test and Post test method of evaluation. Pre testing is one way of knowing the initial knowledge of the student's. It is a tool which the teacher will know the learning level of knowledge. In this study, it was also observed the students have enough background in statistics, but they lack skills in computation and analysis of data. In this regard, the result of this study is considered a benchmark to adopt better methods of instructional delivery. Table 3 presents the Extent of Preferences by the students on the Use of CD-based IM in Statistics. As seen in the table, it displays that the overall mean of the preferences by the respondents on the development of instructional materials in Statistics is 2.70 which indicated as “much preferred.” All the items were assessed as “much preferred”, however, the topic on F-test or ANOVA got the highest weighted of 2.80, followed by the computation of Scheffe's test, correlation-test and mean, median, mode and weighted mean, t-test, correlation and Regression analysis.

The other topics are also rated as “much preferred “ but the students wanted to have all the necessary instructional materials as it was strongly accepted in the previous studies that the use of instructional materials are helpful in enhancing and accessing the learning process. The findings of this study revealed that there is much needs in the development of more computer-aided instructional materials, like the CD-based IM, in the different areas of statistics.

Table 3. Presents the Extent of Preferences by the students on the Use of CD-based IM in Statistics

Topics in Statistics	(3)	(2)	(1)	Weighted Means
Statistical Tables And graphs	20	10	0	2.67
Mean, Median ,Mode & Weighted Mean	22	8	0	2.73
Quartile, Decile, &Percentile	20	10	0	2.67
Variability	18	12	0	2.60
Probability	19	11	0	2.63
Normal Curve& Z-scores	22	8	0	2.73
Z-test & T-test	20	10	0	2.71
Correlation Tests	21	9	0	2.75
Correlation and Regression	21	9	0	2.70
Chi-square test	20	10	0	2.67
F-test/ANOVA	22	8	0	2.80
Scheffe's Test	23	7	0	2.77
Over all Mean				2.70

Table 5. Presents the reactions of the Students on the different parts of the CD-based instructional material in Statistics

Parts of CD-based IM for Statistics	3	2	1	Weighted mean
Motivation	22	8	0	2.73
Pre-test	21	9	0	2.70
Power-point Lecture series	25	4	1	2.80
Student Activities	19	11	0	2.63
Post-test	23	7	0	2.77
Additional exercises for mastery	27	3	0	2.90
Overall mean				2.76

In the table, it reveals that the responses on the attitudes of the respondents towards the parts of the CD-based instructional materials in Statistics is noted “much favourable” as evidenced by the overall weighted mean of 2.76. The additional exercises for mastery are ranked first and its mean is 2.90 with a description of “much favorable. Ranked 2 is the Power-point presentation which has a mean of 2.80 with a description “much favorable”. Followed by Post-test with a mean of 2.77 and is said “much favorable” as indicated in the table. Fourth is the motivation that includes video clips with a mean of 2.73 and noted as “much favorable.”The less means are the Pre-test and student activities with computed means of 2.70 and 2.63 and are both described as “much favorable.”

According to Dillon’s(2001) in his study brought great positive effects to the respondents because when they were asked to use this material they were all eager to have it as the system to be adopted. As they said, with this approach they can work along with it with fewer efforts to go through the lessons as long as they really mean to learn through this said CD –based instructional materials in Statistics. The package of the instructional learning material is flexible and adaptable to anytime or schedule of study and even at any place where you can do your own learning. This enables learning to navigate and apply these packages are often a source of challenge and difficulty to undergraduate and graduate studies.

Findings and Conclusions

The study found out the mean score of the respondents in the Pre-test and Post test are described as “outstanding” and “highly outstanding” respectively. Thus, it is implied that there is a significant difference between mean scores of the students under the experimental and control groups. It also revealed that the use of CD-based instructional materials in Statistics are “much needed” and “much preferred” respectively. And lastly, it was found out that the students’ reaction towards the different parts of the CD-based instructional materials in Statistics is “much favorable.”

Therefore, it can be generalized that the use the CD-based instructional material in teaching Statistics is effective, much preferred, and much favorable.

Recommendations

The use of a CD –based instructional learning material for Statistics should be introduced as an imperative method to enhance the students’ academic learning level and interest.

- The non-experimental class should also learn to adopt the CD-based learning materials in Statistics to improved their academic performance and mastery.
- The pre-test and post test method should be adopted as a way to evaluate the progress of the academic achievements of the students since it has substantial relationship to the each other.

The conduct of Practice tests should be regularly given to students in Statistics with computer-aided instruction to bring the results to a significant mark. It is recommended that the use of the said IM should be highly accepted and recommended by school authorities as an approach in teaching and learning atmosphere in College and in the graduate level.

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