

Fortuitous: A Proposed Activity-Based Book In Mathematics Of Chance

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Abstract: This study evaluated a developed book in Probability. The contents of the book were based on the syllabus on Math 110ED which is in accordance with the standard set by the Commission on Higher Education of the Philippines for Education students taking up Probability. The book was checked and evaluated by eight (8) mathematics experts and assessed by 45 Bachelor of Education Students. The researcher made the book very simple yet activity-based using the learning objectives of the syllabus utilized in the College of Education. The researcher also made a program of work in the development of the book which catered to the needs of the learners in learning concepts and mathematics skills. The book was comprised of counting techniques, fundamental counting principles, permutations, combinations, and probabilities. All were presented in words and narrative form and represented by formulas followed by simplified examples and learning activities and exercises at the end of each chapter. The researcher gave importance to these learning activities and exercises because these are proven to be effective in enhancing the interests, critical thinking and problem-solving skills of the learners. The book was designed to be used in a lecture situation. Since education students will utilize the book, the principles and application of the activities are applied in relation to their field and to help them pass their board exam. The researcher also introduced his invented shortcut techniques in solving some probability problems to make the presentation of the book interesting to the learners. The study revealed that the book was prepared and developed systematically and passed through the necessary stages before its finalization. It was rated "very satisfactory" by mathematics experts and students regarding its: relevance of contents; adequacy of scope; and appropriateness of teaching procedures and therefore, it is acceptable for classroom use. However, the evaluators suggested that learning activities, images and pictures presented in the book should be enhanced and be improved to increase its suitability to the learners. Comments of the experts were incorporated into the manuscript and its final copy was checked by the book writers leading to a quality activity-based book in Probability. The developed book was named "FORTUITOUS".

Index Terms: Book, combination, critical thinking, mathematics experts, permutation, probability, problem-solving skill

1 INTRODUCTION

Chingos and Whitehurst [1] mentioned that students learn principally through interactions with people (teachers and peers) and instructional materials (textbooks, workbooks, instructional software, web-based content, etc.) According to them, instructional materials greatly affect students learning. The use of instructional materials helps the students in remembering important information and when properly used, helps gain and hold the attention of students and served as a vehicle for improving the quality of learning for every student [2]. In the Philippines, one of the aggravating problems of education is an insufficiency of textbooks, modules and relevant instructional materials. According to the author in [3], "the educational system of the country could not cope with a simple roadmap in terms of solving its backlogs including instructional materials". Textbooks, modules and other instructional materials play a very vital role in educating the students. It is, therefore, the major concern of the teachers as well as the administrators to prescribe relevant and latest learning materials like those in coping with the rigors of academe to help attain the Philippines' vision of developing students with higher-order thinking skills [4]. Instructional learning materials are needed by the students nowadays because numerous studies showed that these materials help students learn better and improve their mathematics performance. Acero, et.al. [5] stated that "instructional materials have concretized pretty well the principle of individual differences allowing each student to proceed at his own pace

while [6] verified that her Math Module I helped her students improve their competence and enhance their mathematical skills; and [7] proved that module in Elementary Algebra was effective in her teaching-learning process because it served two purposes. One, it could be used to supplement students' knowledge and two, the module and the teacher worked wonders for the performance of the students because one visualizes and the latter clarifies, monitors and evaluates. Likewise, [8] showed that his K-12 aligned activity book in Grade 7 Mathematics engaged the students in learning activity thus improving their mathematics performance. One of the mathematics subjects that is needed by the students nowadays to enhance their higher-order and critical thinking skills is a probability. Probability as defined by the authors in [9] "is a field of mathematics that deals with chance or mathematics that involves certainty". "Probability was used by gambler to increase the likeliness of winning in gambling but it is now embraced as a subject for serious academic study and was taught for high school and college students in such areas of study as mathematics, statistics, finance, science (in particular physics), artificial intelligence/machine learning, computer science, and philosophy" [10]. Although Probability is now considered as one of the important fields in mathematics, there is a dearth of textbooks and instructional materials that were written solely for the subject. It is always included as only a part of Statistics and there is a limit in its resources that's why the researcher wanted to develop a simplified instructional material about this particular topic alone. He knows that it can be helpful to the education students to master the subject especially those who will take the Licensure Examination for Teachers (LET). The book will also help the teachers since this will become their guide in teaching the discipline. These circumstances prompted the researcher to conduct the study. Specifically, the research sought to discern the preparation, organization, and development of the book. It also investigated how the mathematics experts and students assessed the book as to the relevance of contents, adequacy of the scope, and appropriateness of teaching procedures and

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if there exists a significant difference in the respondents' evaluation of the Probability Book (PB).

2 METHODOLOGY

A developmental research design was used in this study. The most common types of developmental research involve situations in which the product-development process is analyzed and described, and the final product is evaluated [11] as cited in [12]. This design was used to develop the Probability Book (PB) named **FORTUITOUS**. The evaluation was done by mathematics experts and students. The contents of the book were based on the syllabus on Math 110ED-Probability. The areas that were used in the study were all topics of the said subject. It was checked and evaluated by mathematics experts and assessed also by students. The mathematics experts were five (5) doctorate degree holders and three (3) master's degree holders from different institutions in Nueva Ecija and the students were 10 mathematics majors and 35 Bachelor of Science in Elementary Education students. The response of the mathematics experts and the students in the assessment sheet as to the relevance of contents, adequacy of scope and appropriateness of teaching procedures of the **FORTUITOUS**, were tallied and tabulated using weighted mean while the difference in the evaluation of the two groups of respondents was tested using the t-test.

3 RESULTS AND DISCUSSION

1. Development of the Book

The steps that were undergone by the researcher in developing the book were the following:

1.1 Preparation.

The researcher refers to the course outline in Math 110ED-Probability used by the Wesleyan University-Philippines, College of Education. The researcher gathered information through instructional books, questions from the Licensure Examination for Teachers (LET), magazines, internet, and social networking site. The contents of the book were information and learning activities and exercises about the different topics in Probability. The researcher also introduced some of his invented shortcut techniques in solving problems to make the presentation of the book interesting to the learners.

1.2 Organization and Design of the Book

The researcher made the book very simple yet activity-based using the learning objectives of the syllabus utilized in the College of Education. The researcher also made a program of work in the development of the book which catered to the needs of the learners in learning concepts and mathematics skills as assessed by mathematics experts and students. The book was comprised of counting techniques, fundamental counting principles, permutations, combinations, and probability. All are presented in word and narrative form and represented by formulas followed by simplified examples and learning activities and exercises at the end of each chapter. The researcher gave importance to these learning activities and exercises because these are proven to be effective in enhancing the interests, critical thinking, and problem-solving skills of the learners. The book was designed to be used in a lecture situation. Since education students will utilize the book,

the principles and application of the activities are applied in relation to their field and to help them pass their board exam. The mathematics experts checked and evaluated the book while the students only assessed the book. Comments of the experts were incorporated into the final manuscript. The developed book was called "FORTUITOUS.". The final copy was checked by the book writers leading to quality activity-based book in Probability.

2. Evaluation of the Book

Before accepting the book as one of the supplementary materials in Probability, it must pass some evaluation and validation process to prove its effectiveness in the teaching-learning process. Table 1 shows the evaluation and assessment of the mathematics experts and students of the book as to the relevance of content, adequacy of scope and appropriateness of teaching procedures.

2.1. Relevance of Contents

It can be observed on the table that the mathematics experts described the relevance of the contents of the book as "very satisfactory" as represented by its weighted mean of 4.18. The result further shows that "logical presentation of the lesson" has the highest weighted mean of 4.22 and is verbally described as "excellent" while "learning enhancement of the activity" has the lowest weighted mean of 4.14 and is verbally described as "very satisfactory". This implies that the mathematics experts find the logical presentation of the lesson of the book to be excellent but they find that the learning enhancement of the activity needs improvement for it to be excellent and perfectly acceptable.

Table 1. Evaluation of Mathematics Experts (ME) and Students (S) of the Probability Book

Relevance of Contents	ME	Description	S	Description
Timeliness of contents	4.18	VS	4.23	E
Learning enhancement of the activity	4.14	VS	4.15	VS
Clearness of Learning Activity	4.17	VS	4.16	VS
Logical Presentation of the Lesson	4.22	E	4.2	E
Overall Mean	4.18	VS	4.19	VS
Adequacy of Scope	ME	Description	S	Description
Clarity of Direction	4.09	VS	4.1	VS
Comprehensiveness of Material	4.2	E	4.19	VS
Arrangement of Learning Elements	4.14	VS	4.22	E
Suitability of the Activities	4	VS	4.2	E
Overall Mean	4.11	VS	4.18	VS
Appropriateness of Teaching Procedures	ME	Description	S	Description

The simplicity of Language Used	4.25	E	4.24	E
Reliability of Images/ Pictures	4.02	VS	4.12	VS
Completeness of the Provided Details	4.1	VS	4.21	E
The usefulness of the Contents	4.22	E	4.22	E
Overall Mean	4.15	VS	4.2	E
Composite Mean	4.2	VS	4.2	VS

1.00 to 1.79 Needs Improvement (NI) /Totally Unacceptable (TU), 1.80 to 2.59 Fair (F)/ Unacceptable (U), 2.60 to 3.39 Satisfactory (S) / Slightly Acceptable (SA), 3.40 to 4.19 Very Satisfactory (VS) / Acceptable (A), 4.20 to 5.00 Excellent (E)/ Perfectly Acceptable (PA)

For the students, they find that the relevance of the contents of the book to be "very satisfactory" as represented by its weighted mean of 4.19. The table also shows that "Timeliness of contents" has the highest weighted mean of 4.23 and is verbally described as "excellent" while "learning enhancement of the activity" with the lowest weighted mean of 4.15 and is verbally described as "very satisfactory". This means that the students found the timeliness of contents of the book to be excellent but the learning enhancements of the activity to be lacking excellence to be considered as perfectly accepted.

2.2. Adequacy of Scope

The table also showed the evaluation of the mathematics experts and students on the adequacy of the scope of the book. The result revealed that the mathematics experts and students described the adequacy of the scope of the book as "very satisfactory". The table further displays that the "comprehensiveness of material (WM=4.20)" of the book is excellent for the experts while for the students, their excellent part of the adequacy of scope is "arrangement of learning element (WM=4.22)". The least in terms of the weighted mean for experts is "suitability of activities" while for the students it's the "clarity of direction". This means that the mathematics experts approved the comprehensiveness of material with regards to the adequacy of the scope, but they feel the need for more suitable activities for the book to be perfectly acceptable. In addition, the student finds the arrangement of learning elements of the book to be excellent but wants more clear directions for the book to be perfectly acceptable.

2.3. Appropriateness of Teaching Procedures

It can also be noticed in Table 1 the evaluation of the mathematics experts and students about the appropriateness of teaching procedures of the book. It can be further observed that experts agreed that "simplicity of language used" has the highest weighted mean of 4.25 and is verbally described as "excellent" while their lowest is "reliability of images/ pictures" with the lowest weighted mean of 4.02 and is verbally described as "very satisfactory". This means that the mathematics experts think that the simplicity of language used in the book is excellent but they want more reliable images/pictures for the book to be perfectly acceptable. As to the students, they described the teaching procedures of the book as "excellent" as represented by the overall weighted mean of 4.20. It can be seen that "Simplicity of Language Used" had the highest weighted mean of 4.24 and is verbally described as "excellent" while their lowest is also the same as the experts. The "reliability of images/ pictures" with the lowest

weighted mean of 4.12 and is verbally described as "very satisfactory". This implies that the students think the book excels in the language used but they think that the images/pictures used need improvement for it to be more reliable and perfectly accepted.

3. Comparison of Respondents' Evaluation of the Probability Book.

The table below shows the difference in the evaluation of the mathematics experts and students on the probability book as a whole.

Table 2. The difference in the Evaluation of the Two Groups of Respondents

Evaluation of the Book	Mathematics Experts	Students
Mean	4.15	4.19
Variance	0.006263	0.001988
t Stat	-1.6208 ns	

Table 2 illustrates the respondents' evaluation of the book. The data revealed that t Stat = -1.6208. It means that there is no significant difference in the assessment of the mathematics experts and the students in terms of the relevance of contents, adequacy of scope and appropriateness of teaching procedures of the book. This implies that the mathematics experts and the students are in the same way and similar level of acceptance of the book.

4 CONCLUSIONS AND RECOMMENDATIONS

Teachers want instructional materials that will help them prepare students for real-world of work. This is because instructional materials affect teaching indirectly by influencing the greater community. In addition, instructional materials influence the continuing professional development of the teachers as well as their college students. In relation to this, teachers should develop learning activities and materials in different areas in the field of education that are easy to use, engaging and enjoyable [13]. These are the reasons why the author created a Simplified Activity-Based Probability Book called FORTUITOUS. It was prepared and developed systematically and passed through the necessary stages before its finalization. It was acceptable based on the relevance of the contents, adequacy of the scope, and appropriateness of teaching procedures and could be used as supplementary learning material. However, the study is limited only to the development of instructional material and does not cover how the teacher used the book in his teaching to verify further if the material is suited to the learning styles of the learners [14] as cited in [15]. Therefore, teachers teaching probability are encouraged to try the developed book in their class to strengthen the finding of the recent study.

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