Predictive factors of user acceptance on the primary educational mathematics aids product

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Predictive factors of user acceptance on the primary educational mathematics aids product

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Abstract. Mathematics learning in primary schools requires instructional media. According to Piaget's theory, students are still in the concrete operational stage. For this reason, the development of the primary level mathematics aids is needed to support the development of successful mathematics learning. The stages of this research are the stages of commercialization with preparatory, marketing, and measurement analysis procedures. Promotion as part of marketing is done by doing a demonstration to the teacher. Measurements were performed to explore the predictive factors of user feasibility in adopting the product. Measurements were conducted using the concept of Technology Acceptance Model (TAM). Measurement variables include external variables, perceived usefulness, perceived ease of use, attitude, intention to use, and actual use. The result of this research shows that the contribution of predictive factors of mathematics teachers on the teaching aids product as follows: the external variable and perceived ease of use at 74%, perceived usefulness at 72%, intention to use (behavioral) at 58%, attitude at 52%, and the consequence factor (actual use) at 42%.

1. Introduction

The importance of teaching aids in learning Mathematics for primary education (elementary school and junior high school), referred to as mathematical aids or manipulative mathematical aids are based on several components. These components are the abstract essence of Mathematics, the character of primary school age students who are still at the stage of concrete operational of mental development, learning theories such as Piaget, Brunner, Ausubel, and applicable Curriculum demands. Also, many studies have demonstrated the effectiveness of the use of visual aids in mathematics learning at primary education level [1-6].

However, mathematical aids suited to the needs and demands of the Curriculum are not yet available in the market. The general objective of this research is to develop and market the mathematics aids for school in the synergy between Unnes and Children Toys. Therefore, Unnes's mathematics learning and teaching aids product can be optimally utilized by the consumers through the proper provision production and marketing. Kelly said in her article that the research of mathematical aids from year to year provides benefits not only for teachers and parents but also for the entrepreneur who works for this kind of business [7]. After analyzing the business for aids product in the first year and empirical validation of the first year's excellent product, and the second and third year trial to measure the effectiveness of the product, this research has been promoted as part of marketing. Marketing is an

organizational function and a set of processes for creating, communicating, and delivering value to customers and for managing customer relationships in ways that benefit organizations and stakeholders [8]. Marketing is a socioeconomic process based on meeting the needs of individuals and groups by creating exchanges to provide maximum individual or group satisfaction [9].

Promotion is a part of marketing that is essential after the product is ready to be distributed into the market. Promotion is one means for companies to introduce products of the enterprise to the public as the target market of the product. Without any promotion, the product will be unfamiliar to the consumers, and they will not be interested in buying the product. Therefore, advertisement as a medium of advertising is necessary [9]. In this study, in addition to using media leaflets/brochures, booklets, catalogs, or posters, the promotion is done through direct demonstration activities to the teachers. Navratilova [10] states that "... this diffusion has advantages because the teachers meet the agent of change face to face and they can see the demonstration of the findings. Besides, the promotion is also promising ". Development activities for the teacher are conducted through a professional teacher coaching association known as KKG/MGMP [3]. The diffusion of mathematical aids as a product of mathematical learning innovation has been formulated by a diffusion model [11-12]. Furthermore, to know the user's response to mathematics aids product, it was done by the measurement to determine the predictive factors of user feasibility of the product to adopt or use theaids product.

2. Methods

This study is the 3rd year of Research and Development research design [13] for three years. Research subjects for the measurements were taken randomly from 6 districts/cities representing 6 region areas in Central Java, namely Karanganyar, Wonosobo, Semarang, Tegal, Banyumas, and Kudus. The subjects of the research were the mathematics teachers of the elementary and junior high schoolswho were taken randomly representing the 6 areas. The total number of teacher respondents was 195. The measurement of product acceptance was performed using the concept of Technology Acceptance Model (TAM). This analysis was conducted as an evaluation of product development. Research variables include external variables, perceived usefulness, perceived ease of use, attitude, intention to use, and actual use. External variables include self-efficacy, prior user experience, factors suggested by others or theory, subjective norms, expectations, risks, beliefs, and aids' characteristics [14-16].

The analytical method used is Structural Equation Model (SEM). The analysis steps are illustrated in Figure 1.

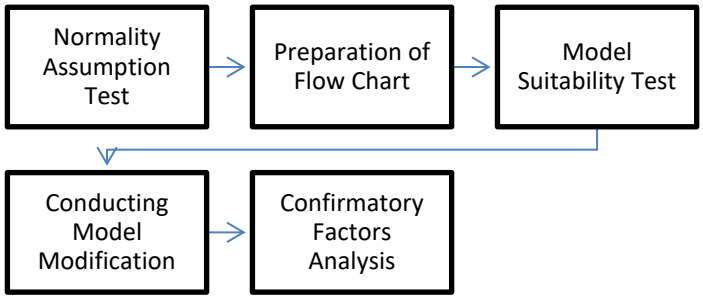

Figure 1. The steps of analysis using SEM

After obtaining the suitable model, further confirmatory factor analysis was performed. Confirmatory factor analysis is used to test the theoretical concept indicators (manifest) that make up the latent variable whether it is a valid and reliable indicator as a latent construct. The testing criterion can be seen on load factor value > 0.5, and t factor value (t-values) is greater than critical value 1.96. The value of R2 is used to find out how much contribution value of an indicator in forming latent variable. From the results of SEM analysis, then it is interpreted to describe predictive factors of product feasibility by respondents to the action of adopting or using aids product.

3. Result and Discussion

3.1. External Variable Analysis

Based on the model fit test for the external variable of product feasibility of mathematics aids by the teacher, it obtained the suitable model as shown in Figure 2 and 3.

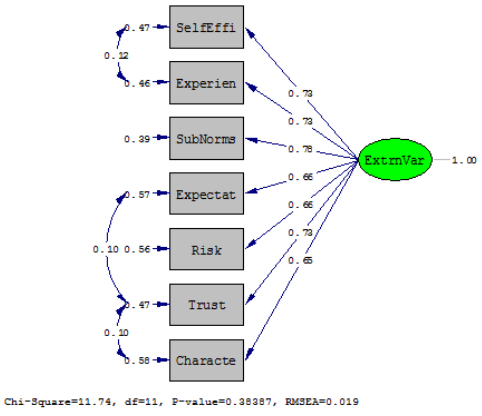

Figure 2. Output Standardized Solution Model of External Variables

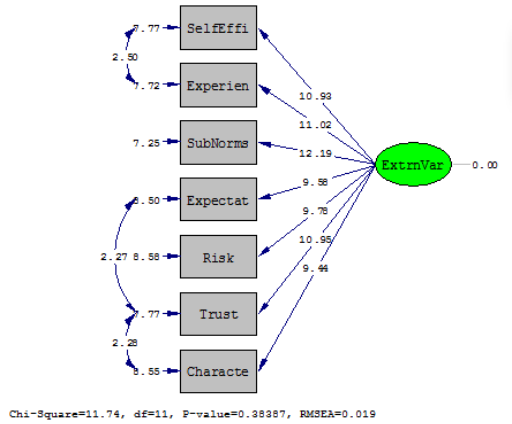

Figure 3. Output T-Values Model of External Variables

From the output of T-Values Model, it can be seen that the value of Chi-Square shows the decrease of value from the second model which is 11.74, p-value equal to 0.38387 more than 0.05, and RMSEA value is 0.019 less than 0.08. It means that this research model already has a good level of compatibility. The results of the model suitability analysis are more clearly presented in Table 1.

Table 1. Summary of Analysis Results on the Suitability of External Variables Models on Feasibility of Mathematics Teaching Aids

Suitability Model Index	Level of Model Suitability	Model Index	Criteria
Chi-Square	Small value	11.74	Good
P-Value	≥ 0.05	0.38387	Good
RMSEA	≤ 0.08	0.019	Good
GFI	≥ 0.90	0.98	Good
CFI	≥ 0.94	1.00	Good

The results of external variable confirmatory factors analysis are presented in Table 2.

Table 2. Results of External Variable Confirmatory Factors

Factors	Loading Factor	t-values	R2
Self Efficacy	0.73	10.93	0.53
Previous experiences	0.73	11.02	0.54
Subjective norms	0.78	12.19	0.61
Expectation	0.66	9.58	0.43
Risk	0.66	9.78	0.44
Trust	0.73	10.95	0.53
Characteristics of APM	0.65	9.44	0.42

Based on the analysis results, it can be seen that the results of each sub factor have met the requirements of the loading factor above 0.50. Meaning that it can be accepted, the value of each loading factor, i.e., self-efficacy at 0.73, experience of the previous usage at 0.73, subjective norms at 0.78,

expectation at 0.66, risk at 0.66, trust at 0.73, and characteristics of APM at 0.65. The value of t-values also shows a value greater than 1.96 for all sub factors; therefore, it can be concluded that 7 sub factors measure the external variables. Sub factor that gives the biggest contribution that measures external variable is subjective norm equal to 0.61 or 61%, followed by experience sub factor using previous aids, self-efficacy to succeed using aids, and trust to product aids quality. This result suggests that the opinions or influences of others around users to use aids are important for teacher decision making to adopt and use mathematical aids products. Giving experience to teachers in using mathematical aids is also important for teachers to receive the aids product.

3.2. Analysis of All Variables of Feasibility Criteria on Mathematics Teaching Aids Product

After the normal assumption test of research data arranged flow diagram where on each variable is a factor that will give the prediction acceptance product aids user (teacher). The result of the model matching test has got the suitable model as shown in Figure 4 and Figure 5.

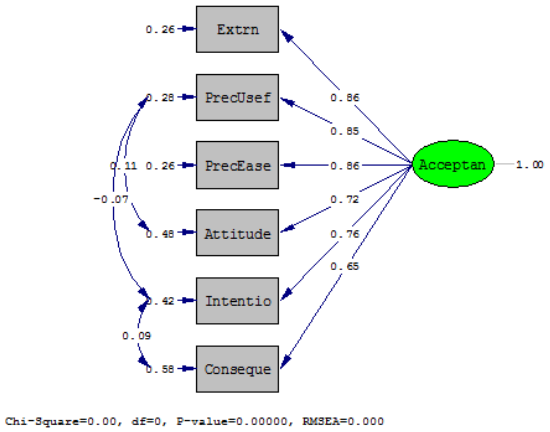

Figure 4. Output Standardized Solution Model of All Variables

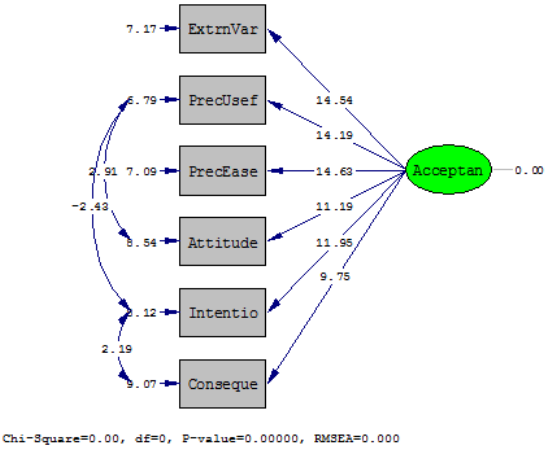

Figure 5. Output T-Values Model of All Variables

Based on the output, Chi-Square value shows a quite small value at 7.35, p-value at 0.28963 more than 0.05 and RMSEA value at 0.034 close to 0.08. Therefore, this model of research has a good level of suitability.

Subsequently, the results of confirmatory factors obtained from the output are shown in Table 3.

Table 3. Results of Confirmatory Factors Analysis

Factors	Loading Factor	t-values	R2
External Variables	0.86	14.54	0.74
Perceived Usefulness	0.85	14.19	0.72
Perceived Ease of Use	0.86	14.63	0.74
Attitude	0.72	11.19	0.52
Intention to use (Behavioral)	0.76	11.95	0.58
Consequence Factor (Actual Use)	0.65	9.75	0.42

Based on the tables, it can be seen that the results of each factor have fulfilled the requirements of the loading factor more than 0.50. Therefore, it is feasiblewhere the value of loading factor of each is external variables at 0.86, perceived usefulness at 0.85, perceived ease of use at 0.86, attitude at 0.72, intention to use (behavioral) at 0.76, and factor consequence (actual use) at 0.65. The value of t-values also shows a value greater than 1.96 for all sub factors. it can be concluded that the external variables and 7 sub factors, perceived usefulness, perceived ease of use, attitude, intention to use (behavioral), and the factor of consequence (actual use) are the factors that measure the feasibility of mathematics aids product for the teacher. Factors that contribute the most to measure the feasibility of mathematics aids products for teachers are external variables and perceived ease of use at 0.74 or 74%, and perceived usefulness at 0.72 or 72%.

4. Conclusion

Based on the results and discussion, it can be concluded that the predictive factors of mathematical aids product user feasibility to adopt or to use mathematic aids product are external variables, perceived usefulness, perceived ease of use, attitude, intention to use (behavioral), and the consequence factor (actual use); whereas the 7 sub factors of external variables namely self-efficacy, past usage experience, subjective norms, expectations, risks, beliefs, and characteristics of mathematical teaching aids. the amount of contribution of predictive factors of mathematics teaching aids feasibilityby the teachers from the largest sequence are external variables and perceived ease of use at 74%, perceived usefulness at 72%, intention to use (behavioral) at 58%, attitude at 52%, and the consequence factor (actual use) at 42%.

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