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DEVELOPMENT OF ALKIN MODEL INSTRUMENTS AS EVALUATION TOOLS OF BLENDED LEARNING IMPLEMENTATION IN DISCRETE MATHEMATICS COURSE ON STIKOM BALI

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ABSTRACT

This study was conducted with the main purpose of obtaining in-depth information about the validity and reliability of *Alkin* model instruments used to evaluate the effectiveness of blended learning in Discrete Mathematics courses on STIKOM Bali. The approach of this study was instrument development research, with five steps: 1) definition of variables, 2) translation variables into indicators, 3) arrangement of instrument's item, 4) test of instrument, and 5) validity and reliability analysis of instruments. Subjects involved in this study, such as: an expert in informatics engineering education and experts in evaluation education involved in testing the validity of instrument contents, and as many as 50 students who were involved to be respondents to fill out the test result instrument of content validation by experts, so it can be obtained the instrument validity and reliability instruments. The tools used in data collection are questionnaires that have not been tested and photos documentation. The technique used to analyze the validity of the instruments contents using Gregory formula, while the technique used to analyze the validity of instrument items using correlation formula Pearson-product moment, Techniques used to analyze the instrument's reliability using the formula of Cronbach Alpha coefficient. The results of this study indicate the content validity and the instrument's reliability belonging to excellence criteria. Also, from the validation of instrument items obtained 52 instrument items that remain used because it's valid and three instrument items are discarded because it's not valid.

Keywords: *Instruments, Alkin Model, Evaluation, Blended Learning, Discrete Mathematics*

1. INTRODUCTION

Generally, the outcome of the evaluation activity is a recommendation as a basis for decision-makers or policy-makers in making the right decisions. That statement accordance with the thoughts and opinions of some of the following researchers, such as: Koedel, *et al* [1]; Erford, *et al* [2]; Aspinwall, Pedler, and Radcliff in 2018 [3]; Ardana, Ariawan, and Divayana [4]; Mapitsa and Khumalo [5]; Han, Borgonovi, and Guerriero [6]; O'Keeffe [7]; Samperiz and Herrero [8]; Huang [9]; Panezai, and Channa [10]; Edmonstone [11]; Ariawan, Sanjaya, and Divayana [12]; Ainsa [13]; Cincera and Simonova [14]; Yuan and Kim [15]; Bichi, Hafiz, and Bello [16]; Jampel, *et al* [17]; Madigan, *et al* [18]; Mahayukti, *et al* [19]; Jager, *et al* [20]; Cornelius, Wood, and Lai [21]; Divayana [22]; Saunders [23]; Cutts, *et al* [24]; Opposs [25]; Divayana, Adiarta, and Abadi [26]; Southall and Wason [27]; Hammonds, *et al* [28]; Comings, Strucker, and Bell [29]; Culkin [30]; Zumbach and Funke [31]; Prinsloo and Harvey [32]; Abrams, Varier, and Jackson[33]; Suandi, Putrayasa, and Divayana [34]; Bolyard [35]; Derrington and Kirk [36]; Reinking [37]; Divayana, Adiarta, and Abadi [38]; Hepplestone, *et al* [39]; Wotela [40]; See, Gorard, and Siddiqui [41]; Arnyana, *et al* [42]; Saucier, *et al* [43]; Donaldson and Papay [44]; Sanjaya and Divayana [45]; Klerk, Veldkamp, and Eggen [46]; Norman and Parker [47]; Jin, *et al* [48]; Divayana [49]; Delahunty, Seery, and Lynch [50]; Finucane, Martinez, and Cody [51]; Sumual and Ali

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[52]; Liu, Xu, and Stronge [53]; Bruce, Luckner, and Ferrell [54]; Põldoja, Duval, and Leinonen [55]; Divayana and Sanjaya [56]; Stewart, Hong, and Strudler [57]; Climie and Henley [58]; Divayana, *et al* [59]; Thurmond, *et al* [60]; Divayana [61]; Sherry, Fulford, and Zhang [62]; Arnold and Reed [63]; Divayana [64]; Roberts, *et al* [65]; Beckmann and Mahanty [66]; Mengoni, Bardsley and Oates [67]; Divayana, *et al* [68]; Hempenstall [69]; Lowenthal, Bauer, and Chen [70]; Schwab [71]; Divayana, Adiarta, and Abadi [72]; Harris-Packer and Ségol [73]; Lawrence and Cahill [74]; Campanotta, Simpson and Newton [75]; Firth, Frydenberg, and Bond [76]; Toyoda [77]; Divayana, *et al* [78]; Chow and Hollo [79]; Divayana, Adiarta, and Abadi [80]; Miller, *et al* [81]; Divayana [82]; Cho, *et al* [83]; Brink and Bartz [84]; Sudiana, *et al* [85].

Evaluation begins with the assessment process of the object being evaluated. In the assessment process required measuring tools in the form of instrument that clear and good quality. To obtain a clear and qualified instrument, it is necessary to the validity test and reliability test of the instruments. These are related with the opinions of some of the following researchers, such as: Santosa, Marchira, and Sumarni [86]; Ghazali [87]; M.M. Mohamad, *et al* [88]; Raz, *et al* [89]; Vera, *et al* [90]; Bolarinwa [91]; Erci and Erışık [92]; in principle has a common perception that the instruments of high validity and high reliability is very good for use in conducting assessments or tests.

Valid and reliable instruments are essential and indispensable in conducting evaluations in the field of education (whether evaluating educational policies, education systems, or educational facilities). The need for valid and reliable instruments is also needed to evaluate one of the learning models, i.e., blended learning that is implemented on STIKOM Bali, especially in Discrete Mathematics course. In evaluating the implementation of blended learning of Discrete Mathematics subject, a valid and reliable measuring instrument is needed based on the appropriate evaluation model to measure accurately and optimally the effectiveness level of blended learning in Discrete Mathematics course on STIKOM Bali. But the fact that happens is not as easy as what is imagined, because to obtain valid and reliable instruments as a tool to evaluate the implementation of blended learning in Discrete Mathematics course is not easy. These are related to Sugiharni's statement [93], which states that in making instruments very difficult, and even still often found instruments that have not yet valid but still used for measurement. Based on the difficulty in determining valid and reliable instrument to be used as an evaluation tool for the implementation of blended learning in Discrete Mathematics course, it is necessary to develop items of instrument based on *Alkin* evaluation model so that later can be used to measure the effectiveness of blended learning implementation in Discrete Mathematics course on STIKOM Bali is thoroughly reviewed from *component of assessment system*, *component of program planning*, *component of program implementation*, *component of program improvement*, and *component of program certification*.

Based on those facts, the main problem to be solved in this research is how to develop valid and reliable *Alkin* model instrument to measure effectiveness level of blended learning in Discrete Mathematics course on STIKOM Bali? Referring to the problems statement, the purpose of this research is to develop a valid and reliable *Alkin* model instrument that can be used as a tool for evaluation of the implementation of blended learning in Discrete Mathematics course on STIKOM Bali.

Some of the studies that background this study are research conducted by Ardana, Ariawan, & Divayana [94] on "development of decision support system of blended learning platform selection for mathematics and ICT learning at SMK TI Udayana." The results of research conducted by Ardana, Ariawan, and Divayana shows that the election of Edmodo platform as a blended learning platform to facilitate the process of learning Mathematics and ICT in SMK TI Udayana through the selection mechanism using the concept of Weighted Product calculation. The weakness found in the research is not yet showing the validation and reliability of the instruments used to determine and measure the effectiveness of the blended learning implementation using the chosen platform. Research conducted by Divayana [95] on "evaluation of blended learning implementation in SMK TI Udayana using *CSE-UCLA* model". The research results conducted by Divayana can show the effectiveness level of blended learning implementation on SMK TI Udayana regarding five evaluation components of *CSE-UCLA* model, including system assessment, program planning, program implementation, program improvement, and program certification. The weakness found in that research was'nt yet showing the validation and reliability of the instrument in every evaluation aspect used to measure the effectiveness of blended

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learning implementation in SMK TI Udayana. Another research conducted by Divayana & Sugiharni [96] on "evaluation of computer certification program at Universitas Teknologi Indonesia using *CSE-UCLA* model". The research results are conducted by Divayana & Sugiharni can show the effectiveness level of computer certification program implementation at Universitas Teknologi Indonesia which is also reviewed from the five components of *CSE-UCLA* model evaluation, while the weakness found in those research wasn't yet able to show the validation and instrument's reliability in every evaluation aspect used to measure the effectiveness of computer certification program implementation at Universitas Teknologi Indonesia.

Based on the problems, previous researches, and some related researches, the researcher is interested to conduct research about the development of *Alkin* model instruments as measurement tools to evaluate the implementation of blended learning Discrete Mathematics course on STIKOM Bali. In this research, there are some focus of research problem which needs to find solution, such as 1) *Alkin* model evaluation component used to measure effectiveness level of blended learning in Discrete Mathematics course on STIKOM Bali; 2) Aspects of *Alkin* model evaluation used to measure effectiveness level of blended learning in Discrete Mathematics course at STIKOM Bali.

2. RESEARCH METHODOLOGY

The approach used in this study is instrument development. The steps taken in the development of *Alkin* model instrument to evaluate the implementation of blended learning in Discrete Mathematics course on STIKOM Bali can be shown in the following Figure 1.

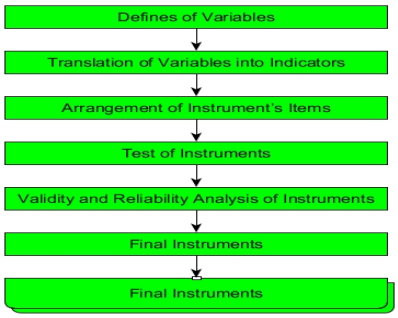

Figure 1: Stages of Alkin Model Instrument Development

(a) Defines a variable

In the development of *Alkin* model instruments, the stage of a variable definition is to determine the evaluation components used to measure the effectiveness of blended learning implementation of Discrete Mathematics courses.

(b) Translation of Variables into Indicators

The stage of variables translation into the more detailed indicators is intended to determine evaluation aspects based on the evaluation components that have been obtained in the previous stage used to measure the effectiveness of blended learning implementation in Discrete Mathematics courses.

(c) Arrangement of Instrument's Item

The stage of instrument's item arrangement is to make the instrument items used to measure the effectiveness of blended learning implementation of Discrete Mathematics courses based on evaluation aspects that have been obtained in the previous stage.

(d) Test of Instruments

The implementation of instruments test is intended to test contents validation of instruments that have been formed by involving experts, as well as the items validity and reliability of instruments test that has been formed by involving all students taking in Discrete Mathematics courses.

(e) Validity and Reliability Analysis of Instruments

The implementation of content validity analysis of instrument is intended to analyze the content validation test results from each instrument that has been done by two experts so that the analysis results can be obtaining instrument items that are valid to be used and invalid instruments will be discarded. In addition to the content validity of instruments, also analyzed the validity of instruments items by involving all students who take Discrete Mathematics courses. Similarly, analysis of content validity and items validity, the implementation of instrument's reliability analysis is intended to analyze the reliability test results data of each instrument item that has been done by all students who take Discrete Mathematics course so that analysis results can be obtained the instrument that is correct reliable for use and unreliable instruments will be discarded.

Research subjects involved in conducting contents validity test of the instrument are two experts (one expert in the field of informatics engineering education and one expert in the field of educational evaluation). Research subjects involved in performing instrument reliability tests are all students who take Discrete Mathematics courses in the Information Systems Department of 2017/2018 academic year on STIKOM Bali. The object of this study was instruments of *Alkin* model used as measurement tools to evaluate the effectiveness level of blended learning in Discrete Mathematics

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course. The location of this research was conducted at STIKOM Bali.

Instruments used to obtain some data that was expected to be used as a data collecting instrument that was in the form of questionnaires containing items about the instruments of *Alkin* model that will be tested and photo documentation as authentic evidence of the research. Testing of instruments validity in this study was to analyze the content validity of instruments. Content validity is the validity determined by the degree of items representativity. The content validity analysis technique from *Alkin* model instrument was done through the expert test with Gregory formula. The Gregory formula [97] is follow:

$$\text{Content Validity} = \frac{D}{(A + B + C + D)} \quad (1)$$

Notes:
A = cells that indicate disagreement between the two evaluators
B and C = cells that show different views between the two evaluators
D = cells that indicate a valid agreement between the two evaluators

To determine the category of content validation results of the instruments which have been assessed by the expert refers to the classification of validity set forth by Guilford. The category of instruments validity which refers to validity classification put forward by Guilford [98], can be seen as follows:
$0{,}80 < r_{xy} \leq 1{,}00$: Excellent validity
$0{,}60 < r_{xy} \leq 0{,}80$: Good validity
$0{,}40 < r_{xy} \leq 0{,}60$: Moderate validity
$0{,}20 < r_{xy} \leq 0{,}40$: Less validity
$0{,}00 < r_{xy} \leq 0{,}20$: Poor validity
$r_{xy} \leq 0{,}00$: Invalid

Testing of instrument item validity using Pearson-Product Moment Correlation formula, which can be seen by following formula [99].

$$r_{xy} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{\{N\sum X^2 - (\sum X)^2\}\{N\sum Y^2 - (\sum Y)^2\}}} \quad (2)$$

Notes:
r_{xy} : Coefficient of Pearson Correlation
$\sum XY$: Number of multiplication between X and Y scores
$\sum X$: Number of X scores
$\sum Y$: Number of Y scores
$\sum X^2$: Sum of X squares scores
$\sum Y^2$: Sum of X squares scores
N : Number of participants

The correlation significance test is done by comparing the correlation count (r_{xy}) with r in the table (r_{table}). On the positive correlation, if (r_{xy}) > (r_{table}) it can be concluded that xy has a significant positive correlation. Instruments reliability testing of *Alkin* model in this study is by using Cronbach Alpha coefficient. This test determines the consistency of respondents' answers to a research instrument. The calculation steps of instruments reliability with Cronbach Alpha coefficient are as follows:

(a) Calculating the variance score of each item by following formula [100].

$$S_i = \frac{\sum X_i^2 - \frac{(\sum X_i)^2}{N}}{N} \quad (3)$$

Where :
S_i = Variance score of each item
$\sum X_i^2$ = Sum of X_i squares scores
$(\sum X_i)^2$ = Number of X_i items squared
N = Number of respondent

(b) Sum the variance of all items by the following formula [99].
$\sum S_i = S_1 + S_2 + S_3 + ...S_n$

(c) Calculating of total variance by the following formula [100].

$$S_t = \frac{\sum X_t^2 - \frac{(\sum X_t)^2}{N}}{N} \quad (4)$$

Where:
S_t = Total variance
$\sum X_t^2$ = Sum of total X squares scores
$(\sum X_t)^2$ = Number of total X items squared
N = Number of respondent

(d) Calculating of Alpha value by the following formula [100].

$$r_{11} = \frac{k}{k-1} * \left\{1 - \frac{\sum S_i}{S_t}\right\} \quad (5)$$

Where:
r_{11} = Reliability value
$\sum S_i$ = Number of variance score each items
S_t = Total Variance
k = Number of items

e) Finding the value of r_{table} Pearson's Product Moment with significance for $\alpha = 0.05$.

f) Comparing r_{count} with r_{table}. If r_{count} is greater than r_{table} ($r_{count} > r_{table}$) then the instrument is reliable, but if r_{count} is smaller than r_{table} ($r_{count} < r_{table}$) then the instrument is not reliable [101].

3. RESULTS AND DISCUSSION

Based on the problems statement and stages of instrument development in this study, there are

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several results obtained in this study need to be shown and explained in detail, including:

(a) Defining Variables

On this stage, the determination of *Alkin* evaluation model components that can be used as a measurement variable of the effectiveness of the blended learning implementation in Discrete Mathematics course on STIKOM Bali. The components of *Alkin* evaluation model are intended, including system assessment components, program planning components, program implementation components, program improvement components, and program certification components.

(b) The translation of variables into indicators

On this stage, the translation of the variables into the more detailed indicators. As for the indicator here are aspects of *Alkin* evaluation model used to measure the effectiveness of blended learning implementation in Discrete Mathematics course on STIKOM Bali. The aspects of the *Alkin* evaluation model obtained based on more detailed description from the evaluation component can be seen in Table 1 below.

Table 1: Evaluation Aspects of Alkin Model to Measure the Effectiveness of Blended Learning Implementation in Discrete Mathematics Courses on STIKOM Bali

No.	Evaluation Components	Evaluation Aspects
1.	System Assessment	1. The vision of blended learning 2. The mission of blended learning 3. The purpose of blended learning 4. Legality of blended learning implementation 5. Academic community support to the implementation of blended learning
2.	Program Planning	1. Readiness of Lecturer's ability 2. Readiness of student's ability 3. Readiness of development team ability in supporting facilities of blended learning 4. The organizational structure of development team 5. Readiness of supporting facilities and infrastructure for the blended learning realization 6. Readiness of fund for the blended learning implementation
3.	Program Implementation	1. Socialization of blended learning features for users 2. Introduction of hardware required in blended learning 3. Introduction of software required in blended learning
4.	Program Improvement	1. Operation of blended learning for Discrete Mathematics course 2. Installation and hardware settings used in realizing blended learning 3. Installation and setting software used in realizing blended learning 4. Budget management used to realize blended learning
5.	Program Certification	1. The physical display of blended learning applications 2. The level of reliability and accuracy 3. Speed of response 4. Ease of giving feedback 5. Secrecy guarantee

(c) Arrangement of Instrument's Items

The items of *Alkin* model instrument used to measure the effectiveness of blended learning implementation in Discrete Mathematics course on STIKOM Bali, can be shown in Table 2 below.

Table 2: Item of Alkin Model Instrument

Evaluation Components	Evaluation Aspects	Instrument's Items
System Assessment	1. The vision of blended learning	1. Vision clarity of the blended learning implementation in Discrete Mathematics course 2. The vision of blended learning implementation in Discrete Mathematics course on STIKOM Bali has been known and understood by lecturers coordinator of Discrete Mathematics course 3. The vision of organizing blended learning in Discrete Mathematics course on STIKOM Bali has been known and understood by all students who are follow the course
	2. The mission of blended learning	4. Mission clarity of the blended learning implementation in Discrete Mathematics course 5. The mission of blended learning organizing in Discrete Mathematics course on STIKOM Bali has been known and understood by lecturers coordinator of Discrete Mathematics 6. The mission of blended learning organizing in Discrete Mathematics course on STIKOM Bali has been known and understood by all students who are follow the course
System Assessment	3. The purpose of blended	7. Purpose clarity of the blended learning implementation in Discrete

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Evaluation Components	Evaluation Aspects	Instrument's Items
	learning	Mathematics course 8. The purpose of blended learning organizing in Discrete Mathematics course on STIKOM Bali has been known and understood by lecturers coordinator of Discrete Mathematics 9. The purpose of blended learning organizing in Discrete Mathematics course on STIKOM Bali has been known and understood by all students who are follow the course
	4. Legality of blended learning implementation	10. There is a clear legal basis in the form of Chairman Decree who granted the permission to hold blended learning in Discrete Mathematics course on STIKOM Bali 11. There is a clear legal basis in the form of Head of Department Decree which permits to hold blended learning in Discrete Mathematics course on STIKOM Bali
	5. Academic community support to the implementation of blended learning	12. Student enthusiasm in following lecture program of Discrete Mathematics based on blended learning 13. Support from Chairman, head of the department, and lecturer coordinator of Discrete Mathematics courses in the implementation of Discrete Mathematics learning process based on blended learning
Program Planning	1. Readiness of Lecturer's ability	14. Lecturer's ability to operate computers and smart phones 15. Lecturer's ability to use the internet 16. Lecturer's ability to pack the Discrete Mathematics material by appealing to digital format, but still following the provisions or standards contained in the syllabus and semester lesson plan 17. Lecturer's ability to operate a blended learning support facility in the form of e-learning available in STIKOM Bali for uploading material, giving an assignment, quiz, and even exam to the students
	2. Readiness of student's ability	18. Students' ability to operate computers and smart phones 19. Students' ability in using the internet 20. Students' ability to use the blended learning support facilities in the form of e-learning available in STIKOM Bali for download the material, upload the answers of the task, quiz, exam, and even for discussion
	3. Readiness of development team ability in supporting facilities of blended learning	21. The ability of the development team to create blended learning support facilities 22. The ability of the development team to maintain the stability of blended learning support facilities
	4. The organizational structure of development team	23. Clarity of organizational structure form of the team involved as a developer of blended learning support facilities 24. Clarity of main task and function of the development team
	5. Readiness of supporting facilities and infrastructure for the blended learning realization	25. Completeness of facilities used in realizing the blended learning implementation, such as computer or laptop, smart phone, internet access, and e-learning 26. Completeness of blended learning support infrastructures, such as classroom or laboratory, desk, chair, air conditioner, and electricity
	6. Readiness of fund for the blended learning implementation	27. The availability of funds sourced from institution to realize the blended learning support facilities 28. The availability of funds sourced from donations of campus members. 29. The availability of funds obtained through donors from government or private agencies
Program Implementation	1. Socialization of blended learning features for users	30. The implementation of workshop activities to introduce blended learning features for lecturers 31. The implementation of workshop activities to introduce blended learning features for students
	2. Introduction of hardware required in blended learning	32. The implementation of workshops to introduce the hardware used in realization of blended learning for lecturers 33. The implementation of workshop activities to introduce the hardware used in creating blended learning for students
	3. Introduction of software required in blended learning	34. The implementation of workshop activities to introduce the software used in creating blended learning for lecturers 35. The implementation of workshop activities to introduce the software used in creating blended learning for students

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Evaluation Components	Evaluation Aspects	Instrument's Items
Program Improvement	1. Operation of blended learning for Discrete Mathematics course	36. Lecturers have been able to create member accounts and activated it their self 37. Students have been able to make member accounts and activated it their self 38. Lecturers have been able to create interactive digital documents 39. Lecturers can upload and share materials, tasks, quiz, middle test, and final test through blended learning 40. Students can find and download material that has been shared by the lecturer through blended learning 41. Students can hold discussions with their lecturers and friends in one class about Discrete Mathematics material through the discuss facility available in blended learning
	2. Installation and hardware settings used in realizing blended learning	42. Development team already have the competence in installing and setting up the hardware used in blended learning implementation for Discrete Mathematics courses on STIKOM Bali 43. Lecturers already have skills in installing and setting up the hardware used in making the material of Discrete Mathematics course in digital format
	3. Installation and setting software used in realizing blended learning	44. Development team already have the competence in installing and setting up the software used in blended learning implementation for Discrete Mathematics courses on STIKOM Bali 45. Lecturers already have skills in installing and setting up the software used in making the material of Discrete Mathematics course in digital format
	4. Budget management used to realize blended learning	46. There are transparency of the development teams in budget management used to realize blended learning in Discrete Mathematics course on STIKOM Bali 47. There are good involvement and coordination among chairman and development teams in making financial accountability report which is used in realizing blended learning in Discrete Mathematics course on STIKOM Bali
Program Certification	1. The physical display of blended learning applications	48. The physical display of blended learning supporting facilities for Discrete Mathematics course on STIKOM Bali in general is adequate and still feasible to use 49. The physical display of blended learning supporting facilities for Discrete Mathematics course on STIKOM Bali has been good and enabled students to make use of them easily
	2. The level of reliability and accuracy	50. In general, the blended learning supporting facilities in Discrete Mathematics courses on STIKOM Bali have a high level of reliability and proficiency in the search process of digital resources about Discrete Mathematics.
	3. Speed of response	51. In general, the blended learning supporting facilities in Discrete Mathematics courses on STIKOM Bali have a high response speed in the process of finding digital teaching materials about Discrete Mathematics.
	4. Ease of giving feedback	52. Supporting facilities for blended learning in Discrete Mathematics courses on STIKOM Bali provide convenience for lecturers to provide feedback on questions posed by students 53. Supporting facilities for blended learning in Discrete Mathematics courses on STIKOM Bali provide convenience for students to give criticism and advice to lecturers about discrete mathematics learning process
	5. Secrecy guarantee	54. The supporting facilities of blended learning in Discrete Mathematics course on STIKOM Bali provide a high guarantee on the confidentiality of data storage on digital resources/materials about Discrete Mathematics. 55. Supporting facilities for blended learning in Discrete Mathematics courses on STIKOM Bali provide a high guarantee on the confidentiality of data storage about member accounts owned by each blended learning user.

In the development of *Alkin* model instruments, the stage of Arrangement of Instrument's Items intends to make the instrument's items used for measure the effectiveness of blended learning implementation in Discrete Mathematics courses based on the evaluation aspects that have been obtained in the previous stage.

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(d) Test of Instruments

Trials conducted on *Alkin* model instruments include validation test of instrument contents, validation test of each instrument's item and reliability test of established instruments. The test result of content validation of *Alkin* model instruments can be shown in Table 3 below.

Table 3: Trial Results on the Contents of Alkin Model Instruments

Expert-1		Expert-2	
Less Relevance (Score: 1 - 2)	**Very Relevance (Score: 3 - 4)**	**Less Relevance (Score: 1 - 2)**	**Very Relevance (Score: 3 - 4)**
11, 53, 54	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 55	11, 53, 54	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 55

The trial results from were two experts, then incorporated into the cross-tabulation that shown in Table 4 below.

Table 4: Cross-tabulation of Trial Results from Both Experts

		Expert-1	
		Less Relevance (Score: 1-2)	**Very Relevance (Score: 3-4)**
Expert-2	**Less Relevance (Score: 1-2)**	**A** 11,53,54 **(3)**	**B** - **(0)**
	Very Relevance (Score: 3-4)	**C** - **(0)**	**D** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 55 **(52)**

The next step is to calculate the content validity using Gregory formula based on cross-tabulation data from judge test conducting by two experts on the instrument's items of *Alkin* model which will be used to evaluate the blended learning in Discrete Mathematics course on STIKOM Bali. The complete calculation can be explained as follows.

$$\text{Content Validity} = \frac{D}{A + B + C + D}$$

$$\text{Content Validity} = \frac{52}{3 + 0 + 0 + 52} = \frac{52}{55} = 0.945$$

The trial results of instrument's item validity of *Alkin* model can be shown in Table 5 below.

Table 5: Validity Test Result of Alkin Model Instrument's Item

Items-	r_{xy}	r_{-table} (n=50, α = 0.05)	Decision
1	0.416	0.279	Valid
2	0.356	0.279	Valid
3	0.376	0.279	Valid
4	0.288	0.279	Valid
5	0.628	0.279	Valid
6	0.512	0.279	Valid
7	0.297	0.279	Valid
8	0.376	0.279	Valid
9	0.405	0.279	Valid
10	0.440	0.279	Valid
11	0.087	0.279	Invalid
12	0.355	0.279	Valid
13	0.322	0.279	Valid
14	0.340	0.279	Valid
15	0.322	0.279	Valid
16	0.586	0.279	Valid
17	0.595	0.279	Valid
18	0.326	0.279	Valid
19	0.380	0.279	Valid
20	0.308	0.279	Valid
21	0.383	0.279	Valid
22	0.412	0.279	Valid
23	0.340	0.279	Valid
24	0.359	0.279	Valid
25	0.288	0.279	Valid
26	0.665	0.279	Valid
27	0.644	0.279	Valid
28	0.348	0.279	Valid
29	0.448	0.279	Valid
30	0.405	0.279	Valid
31	0.383	0.279	Valid
32	0.312	0.279	Valid
33	0.314	0.279	Valid
34	0.303	0.279	Valid
35	0.388	0.279	Valid
36	0.476	0.279	Valid
37	0.644	0.279	Valid
38	0.348	0.279	Valid
39	0.488	0.279	Valid
40	0.316	0.279	Valid
41	0.327	0.279	Valid
42	0.376	0.279	Valid

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Items-	r_{xy}	r_{-table} (n=50, α = 0.05)	Decision
43	0.320	0.279	Valid
44	0.359	0.279	Valid
45	0.368	0.279	Valid
46	0.545	0.279	Valid
47	0.595	0.279	Valid
48	0.351	0.279	Valid
49	0.548	0.279	Valid
50	0.354	0.279	Valid
51	0.296	0.279	Valid
52	0.529	0.279	Valid
53	0.190	0.279	Invalid
54	0.085	0.279	Invalid
55	0.332	0.279	Valid

The trial results of instrument's item reliability of *Alkin* model can be shown in Table 6 below.

Table 6: Trial Result of the reliability of Alkin Model Instrument's Item

Items-	σ_i^2
1	0.250
2	0.250
3	0.250
4	0.248
5	0.250
6	0.246
7	0.244
8	0.250
9	0.250
10	0.248
11	0.224
12	0.240
13	0.236
14	0.246
15	0.218
16	0.250
17	0.248
18	0.160
19	0.248
20	0.250
21	0.246
22	0.250
23	0.250
24	0.250
25	0.246
26	0.250
27	0.248
28	0.218
29	0.250
30	0.246
31	0.250
32	0.250
33	0.236
34	0.250
35	0.246
36	0.250
37	0.248
38	0.202
39	0.250
40	0.250
41	0.246
42	0.250
43	0.250
44	0.250
45	0.248
46	0.250
47	0.246
48	0.218
49	0.248
50	0.250
51	0.182
52	0.250
53	0.246
54	0.240
55	0.236
$\sum \sigma_i^2$	13.302

Through the calculation using Excel obtained some data as follows:

k = 50, $\sum S_i$ = 13.302, S_t= 83.950, so the reliability coefficient becomes:

$$r_{11} = \frac{k}{k-1} * \left\{1 - \frac{\sum s_i}{s_t}\right\}$$
$$r_{11} = \frac{50}{50-1} * \left\{1 - \frac{13.302}{83.950}\right\}$$
$$r_{11} = \frac{50}{49} * \left\{1 - \frac{13.302}{83.950}\right\}$$
$$r_{11} = 1.02 * 0.842$$
$$r_{11} = 0.859$$

(e) Analysis of validity and reliability

The content validity results of *Alkin* model instruments above are matched with instruments validity categorization which refers to the classification of validity by Guilford, so the content validity (r_{xy} = 0.945) is included in the excellent category (excellent validity) since it's in the range 0.80 <r_{xy} <1.00. A valid item in the validity test of each item is obtained by comparing the calculated correlation value (r_{xy}) with the r-value in the table (r_{-table}). If the value r_{xy}> r_{-table} then the item can be said to be valid. Valid items are still used, while invalid items are not used anymore. The discarded item is point 11, 53, and 54.

The reliability value shown above belongs to the category of reliability is very high because the value of reliability coefficient = 0.859 is in the categorization range of reliability coefficient from Guilford that is 0.80 <r_{11}<1.00 so that instrument's item can be said ready and continuous for use in evaluation of blended learning in Discrete Mathematics course on STIKOM Bali.

(f) Final Instruments

Based on the results indicated earlier in Table 5 and the results of content validity analysis and the validity of instrument's items, so there are 52 instrument items used as a measurement tool for the effectiveness of blended learning implementation in

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Discrete Mathematics course on STIKOM Bali. Those items are item-1, item-2, item-3, item-4, item-5, item-6, item-7, item-8, item-9, item-10, item-12, item-13, item-14, item-15, item-16, item-17, item-18, item-19, item-20, item-21, item-22, item-23, item-24, item-25, item-26, item-27, item-28, item-29, item-30, item-31, item-32, item-33, item-34, item-35, item-36, item-37, item-38, item-39, item-40, item-41, item-42, item-43, item-44, item-45, item-46, item-47, item-48, item-49, item-50, item-51, item-52, and item-55.

The results of this study have been able to answer the obstacles found in research that has been done by Ardana, Ariawan, and Divayana about determining the valid and reliable instrument's item so that it can be used in measuring the effectiveness of blended learning optimally. The results of this study are also able to solve the problems found in the research of Divayana, which has been able to show the existence of valid and reliable instruments for every evaluation aspects used to measure the effectiveness of blended learning implementation in SMK TI Udayana. Also, the results of this study are also able to solve the problem of research have conducted by Divayana and Sugiharni because it has been able to display a valid instrument and reliable on every aspect of the implementation effectiveness in computer certification program.

The results of this study generally have similarities with research that conducted conducted by Divayana, Ardana, and Ariawan in 2017 about "measuring the effectiveness level of a lecturer in transferring knowledge of linear algebra through multimedia facilities using the formative-summative model based on certainty factor" [102], i.e. in the term of that research objectives to determine the effectiveness of particular program implementation. The difference lies in measuring tool used to determine the effectiveness level the implementation of a program, where Divayana, Ardana, & Ariawan using instruments of formative-summative evaluation model based on certainty factor, whereas the researcher in this study using Alkin evaluation model instruments.

The results of this study also have similarities with research that was conducted by Divayana, Sanjaya, Marhaeni and Sudirtha in 2017 about "mobile-based CIPP evaluation model in evaluating the use of blended learning platforms at vocational schools in Bali" [103], i.e. in the term of that research objectives to determine the effectiveness level of blended learning implementation. The difference lies in the measuring instrument used to determine the effectiveness level of blended learning implementation, where Divayana, Sanjaya, Marhaeni, and Sudirtha use the instruments of CIPP evaluation model based on the mobile phone in determining the effectiveness level of blended learning implementation while the researchers in this study using the instrument using Alkin evaluation model in determining the effectiveness level of blended learning implementation.

The novelty shown in this research is the finding of valid and reliable evaluation instrument items based on Alkin model that can be used as an accurate measuring tool to measure the effectiveness of blended learning implementation of Discrete Mathematics course from the perspective of system assessment component, program planning component, program implementation component, program improvement component, and program certification component.

The obstacles still found in this research are the inability to determine instrument's items that have the most dominant influence on each evaluation components as the most important measure of blended learning effectiveness in Discrete Mathematics course.

4. CONCLUSIONS

Alkin model instrument's items used to measure the effectiveness level of blended learning in Discrete Mathematics course on STIKOM Bali have shown the high level of validity and reliability so that items are ready to be used as the evaluation tool. Solutions that can be done to overcome the obstacles found in this study is to modify the calculation of instrument's item validity by using a combination of Pearson-Product Moment Correlation formula with the weighted product method which is one part of artificial intelligence method.

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