Measurement of Reliability of Test Instruments Through Management of Education and Psychology

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Abstract

At this time in the world of work or in job management workers are required to be able to solve problems that mean that in education and psychology management must be able to build or develop instruments in all fields of management. The development of measurement instruments in the field of psychology and education many assume the use of unidimensional measurements, which conceptually formulated that there is one type of ability factor, personality, character, and attitude measured by one measurement instrument. This study aims to allow readers to understand the notions of reliability, reliability of learning outcomes tests, general models of reliability, simple methods of estimating reliability, retesting methods, parallel methods, halves, moment product equations, Flanagan equations, Rulon equations, reliability coefficients , and standard measurement errors. In order for this management research to take place smoothly, the researcher uses the literature study method as his research method.

Keywords: *Educational management, Measurement Instruments, Reliability*

1. Introduction

Creating and developing critical thinking instruments is something that needs to be done. This aims to train critical thinking skills in solving a problem [1]. The development of measurement instruments in the field of psychology and education many assume the use of unidimensional measurements, which conceptually formulated that there is one type of ability factor, personality, character, and attitude measured by one measurement instrument. hence this is where a good and synergic management is needed between the various components of education involved which are formal, non-formal, and informal, both in the family, school, environment, and wider community [2].

The high tendency of multidimensional measurement instruments is caused by several things, including the following (Widhiarso, 2009: 39): 1) constructional characteristics of psychology and education; 2) the involvement of aspects in the preparation of measuring instruments; 3) number of items in the instrument; 4) the technique of writing instrument items; and 5) different measurement units. It can be concluded that the measurement of education, both measuring ability and non-ability constructs is very vulnerable to the diversity of measured attributes [3].

A measurement can be trusted if several times the measurement of a subject gets the same result. A good measurement will certainly be able to distinguish the ability of students. However, in fact there are currently no perfect measurements.

Reliability is the achievement of beauty in every measurement [4]. or reliability derived from the word reliability which means the extent to which the results of a measurement can be

trusted. as discussed earlier that measurements will be trusted if they have relatively the same results. As an education and psychology management instrument, before conducting an analysis to estimate the reliability of measurements made, researchers are expected to carry out factor analysis to identify how many dimensions are produced.

From the explanation above, it is intended to provide an understanding of education and psychology management instruments in order to develop and make thinking instruments a person is able to solve existing problems. For this reason, the researcher takes the research title “Measurement of Reliability of Test Instruments Through Management of Education and Psychology”.

2. Research Methods

Basically this research method is a way to collect data or information needed which will then be analyzed [5]. At the time this management research took place researchers used the Library Study method to be a method used to collect relevant information in accordance with the topics and problems that became the object of research [6], which can be used to discuss existing problems [7] and with the existence of research methods researchers can collect information or data and conduct an investigation of the information that has been obtained [8]. The following are some literature studies related to this management research:

1. This research was conducted by Ahmadi, A., & Dewi, CA (2018) entitled "The Effect of Media-Based SAVI Learning Interactive Simulation on the Understanding of Student Concepts in Electrochemical Materials" explained that the results of instrument testing showed that the essay test instruments were valid and had sufficient reliability . Data on understanding the concepts obtained were analyzed by statistical tests t. The results of the study are there are differences in the understanding of the concept of students taught using the SAVI approach based on interactive media simulation rather than conventional methods [9]
2. This research was conducted by Martín-Albo, J., Núñez, JL, Navarro, JG, & Grijalvo, F. (2007) with the title "The Rosenberg Self-Esteem Scale: translation and validation in university students", this study explains that the factor in the measurement comparing the model of self-esteem dimensions and finding that the four-dimensional model is more apt to describe self-esteem than one dimension "[10]
3. This research was conducted by Bahri, S., Abrar, A. I. P., & Angriani, A. D. (2017). with the title "COMPARISON OF DEDUCTIVE AND INDUCTIVE METHODS ON MATHEMATICAL LEARNING OUTCOMES REVIEWED FROM STUDENT LEARNING MOTIVATION" This study aims to find out the description of learning outcomes, the instruments used in this study are learning outcomes tests and questionnaires and reliability tests produce a reliable measurement. [11]
4. This research was conducted by Pidarta, M. (2016) entitled "Educational Management in the Era of Globalization." This study explains that education management in this era of globalization so that educational institutions can succeed more than in this era of globalization. Education management has such great benefits that it provides opportunities for education personnel to take part in making decisions within the limits of ability. [12]
5. This research was conducted by Junike, J., Yusrizal, Y., & Halim, A. (2016) entitled "Development and Implementation of Test Instruments to Measure Procedural Knowledge Using the Approach of Inquiry in Banda Aceh 10 SMA" this study aims to develop valid and reliable instruments carried out 2 stages, namely: (1) analyzing the material, indicators, learning objectives; and (2) compiling learning tools, expert revisions, trials and data analysis [13]
6. This research was conducted by Nugroho, RE, & Samiâ, W. (2017) entitled "The Effect of Discipline Development and Learning Motivation on Midshipman Learning Achievement of the Tangerang Science Education and Training Center (BP2IP)" this study explains that learning achievement in the field of education is the results of measurements of students which include cognitive, effective and psychomotor factors

after following the learning process which is measured using test instruments or relevant instruments [14].

From 6 (six) literature studies it can be concluded that reliability is a matter that can be trusted and valid instruments are carried out in 2 stages, namely analyzing the indicators, learning objectives; and (2) compiling learning tools, expert revisions, trials and data analysis. This reliability has so many benefits for learning achievement and also an important thing for measuring education and psychology management.

3. Results and Analysis

The progress of education and psychology management is currently demanded so that workers are able to solve a problem for that as discussed earlier, namely the development of measurement instruments for education and psychology in order to develop and develop one's skills and ways of thinking. For this reason, in order to solve the existing problems [15-16] multiple psychological and educational measurements are needed, for example by comparing the model accuracy index between the one-factor self-efficacy model and three factors.

One of the conditions for measuring a management test can be trusted is that the test must have adequate reliability, where reliability can be divided into 2 types, namely reliability, consistency of response and reliability, consistency of combined items. To check reliability there are 3 mechanisms of respondent's responses to the test or instrument including the retest test technique. The retest test is testing twice using a similar test at different times. For example test A is given to group K students in the time W1 and W2. Then student scores on W1 are correlated with student scores on W2. What needs to be considered here is that the test results on W2 are not affected by the test on W1, and do not let W2 occur when the measuring object has changed from W1. These two things are the difficulties in implementing the retest test; (b) splitting technique.

In this split-second technique, measurements are made with two groups of equivalent items at the same time. Because each group of items constitutes half of all tests, usually the first group of items is taken from odd numbered test items, while the second group item is taken from even numbered test items. Please note that reliability with this technique is very relative, because reliability will depend on the method of numbering and grouping of items taken; and (c) equivalent form. Here the measurement is done by using two tests that are made equivalent then given to the respondent or the object of measuring the test at the same time. Scores from both groups of test items were correlated to obtain test reliability.

The measurement of good education management will certainly distinguish the ability of students. For example, Cemara is smarter than Melati, the score obtained by Cemara should be higher than Melati. In reality, our measurements are never perfect. Reliability theory was developed to determine the uncertainty. Every management measurement, both in science and in class assessment always contains measurement errors. Measuring the meter with a mm scale for example has a measurement error of 0.01 mm. Measuring on a cm scale has a measurement error of 0.1 cm. The basic concept of reliability also uses these measurement errors.

In general the basic concepts are expressed in mathematical equations as follows:

Earnings score = Score + Actual measurement error.

Errors in measuring education management represent the difference between the observation score (acquisition) and the actual score. On the basis of this concept the reliability of the test is developed. Various results have been derived from this theory which ultimately contain several implications for measurement (specifically class based assessment). Table 1 as we have discussed shows the sources of score acquisition errors that might contribute to the score's absence. Reliability theory is determined based on the variance between the acquisition score which is the sum of the actual score variants with variants of measurement errors, namely:

$$\sigma_X^2 = \sigma_T^2 + \sigma_E^2$$

then the measurement becomes steady. The reliability coefficient rxx presents the relative index of the effect of the actual score and the measurement error score on the score obtained. The general reliability equation is derived from the comparison between the actual score variants and the acquisition score variants:

$$r_{XX} = \frac{\sigma_T^2}{\sigma_X^2} \quad atau \quad r_{XX} = \frac{S_T^2}{S_X^2}$$
$$r_{XX} = \frac{\sigma_T^2}{\sigma_T^2+\sigma_e^2} \quad atau \quad r_{XX} = \frac{S_T^2}{S_T^2-S_e^2}$$

The main purpose of estimating the reliability of management is to determine how much variability occurs due to measurement errors and how much variability the actual test score Reliability has two features. Keajegan the first is internal consistency, namely the degree to which the item is homogeneous both in terms of the level of difficulty and the form of the problem. Keajegan the second is external stability, namely the extent to which the score produced remains the same as long as the measured person's ability has not changed. Differences in scores from one measurement to another can occur.

Therefore the reliability coefficient must really be calculated in advance the standard measurement error. For this reason, the main sources that cause the measurement error need to be identified in the measurement.

The difference in understanding reliability depends on how the reliability index is calculated. There are at least four concepts of reliability, namely: (a) parallel or equivalent; (b) test-retest or stability; (c) split-half or split in half; and (d) consistency interval. Some people argue that the method of internal consistency (internal consistency) so that the division of methods into three parts, namely: (a) equivalent; (b) stability; and (c) internal consistency. Both of these techniques are in the same principle. If the results of the first test score are the same as the results of the second test score, then the test is said to have high reliability or there is a high correlation between the results of the first test and the results of the second test.

The retesting method or test-retest method often called the stability method is the oldest approach used to estimate reliability. The stability approach is often called a single-test-double-trial method. A set of tests is administered to a group of subjects, then after a certain time lag a set of tests is re-administered to the same group of subjects. This is a data retrieval technique to measure reliability based on the retest method. When a test is given twice, surely the difference between the first test score and the second test score occurs only because of a measurement error. As an illustration, if we measure the length of a table, then a week later the length of the table is measured again, the difference in length that occurs is actually due to measurement errors.

Factors that influence the difference between the first score and the second score of management, namely: (a) the measured characteristics have changed from the first test to the second test. For example for example the third grade elementary school reading, writing and numeracy test is held in August. The second test, the same test, was given to the same students in October. We expect education and psychology management to have a change in the ability to read, write and count in the two-month period. We expect the low reliability index as a result of these changes; (b) the experience of students in taking the same test will affect the actual score. This is called reactivity. The success of a management process can be seen from managing education and psychology well [17-18].

The moment product equation can be used to determine halve reliability. Of the ten questions presented, the distribution can be done by dividing the two parts, namely the beginning and the end.

Table 1.1. Calculation of Initial and Final Reliability

No	Nomor soal awal						Nomor soal akhir						X^2	Y^2	XY
	1	2	3	4	5	X	6	7	8	9	10	Y			
1	1	1	1	1	1	5	1	1	1	0	0	3	25	9	15
2	1	1	1	1	1	5	1	1	1	0	0	3	25	9	15
3	1	1	1	1	1	5	1	1	1	0	0	3	25	9	15
4	1	1	1	1	0	4	1	1	1	0	0	3	16	9	12
5	1	1	1	1	0	4	1	1	1	0	0	3	16	9	12
6	1	1	1	1	0	4	1	1	1	0	0	3	16	9	12
7	1	1	1	1	0	4	1	1	1	0	0	3	16	9	12
8	1	1	1	1	0	4	1	1	1	0	0	3	16	9	12
9	1	1	1	1	0	4	1	1	0	0	0	2	16	4	8
10	1	1	1	1	0	4	1	1	0	0	0	2	16	4	8
11	1	1	1	1	0	4	1	1	0	0	0	2	16	4	8
12	1	1	1	1	0	4	1	1	0	0	0	2	16	4	8
13	1	1	1	1	0	4	1	1	0	0	0	2	16	4	8
14	1	1	1	1	0	4	1	1	0	0	0	2	16	4	8
15	1	1	1	1	0	4	1	0	0	0	0	1	16	1	4
16	1	1	1	1	0	4	1	0	0	0	0	1	16	1	4
17	1	1	1	1	0	4	1	0	0	0	0	1	16	1	4
18	1	1	1	1	0	4	1	0	0	0	0	1	16	1	4
19	1	0	1	0	1	3	0	0	1	1	0	2	9	4	6
20	1	0	1	0	1	3	0	0	1	1	0	2	9	4	6
21	1	1	0	1	1	4	0	0	0	1	0	1	16	1	4
22	1	0	1	0	1	3	0	0	1	1	0	2	9	4	6
23	1	0	1	0	1	3	0	0	1	1	0	2	9	4	6
24	1	0	0	0	1	2	0	0	1	1	0	2	4	4	4
25	1	0	0	0	1	2	0	0	1	1	0	2	4	4	4
26	1	0	0	0	1	2	0	0	1	1	0	2	4	4	4
27	1	0	0	1	1	3	0	0	0	1	0	1	9	1	3
28	1	0	1	0	1	3	0	0	0	1	0	1	9	1	3
29	1	0	0	0	0	1	0	1	1	1	0	3	1	9	3
30	1	0	0	0	1	2	0	0	0	1	0	1	4	1	2
31	1	0	0	0	1	2	0	0	0	1	0	1	4	1	2
32	1	0	0	0	1	2	0	0	0	1	0	1	4	1	2
33	1	0	0	0	1	2	0	0	0	1	0	1	4	1	2
34	1	0	0	0	0	1	0	0	0	1	0	1	1	1	1
35	1	0	0	0	0	1	0	0	0	1	0	1	1	1	1
36	1	0	0	0	0	1	0	0	0	1	0	1	1	1	1

The initial part referred to in table 1.1 is the five first hemisphere questions (1,2,3, 4 and 5) and the final part is the five second hemisphere questions (6, 7, 8, 9 and 10). To estimate reliability, it is done by following the following steps.

1. Determine the total score of the initial questions (1, 2, 3, 4, and 5)
   ∑Xt = Amount of total initial score
   ∑Xt = 109
2. Determine the total score of the final questions (2, 4, 6, 8, and 10).
   ∑Yt = Total final total score
   ∑Yt = 73
3. Determine the square of the total score of the initial questions (1, 2, 3, 4, and 5).
   ∑Xt2 = Square of the total initial score
   ∑Xt2 = 345
4. Determine the square of the total score of the final questions (6, 7, 8, 9 and 10).
   ∑ Yt2 = Square of the total final score
   ∑ Yt2 = 231

5. Determine the number of multiplications of the initial part (X) with the final score Y.
   ∑XY = 223
6. Calculate reliability values
   r = N xy-x (y) Nx2-x2N y2-y2
   r = 36223-1097336345-109236231-732 = 0.449

Reliability in the new sixth step is the reliability of the half of the test. To determine the reliability of the test the equation is actually used:

r11 = 2r1 + r = 20.4491 + 0.449 = 0.6206

Another equation that can be used to determine the reliability of halves is the Flanagan equation, namely:

r11 = 21-S12 + S22St2

r11 = reliability test S12 = first hemisphere variant
S22 = Second division variant ST2 = Total variant

Variants can be determined by the equation:

s2 = X2-∑X2NN

Table 2.2. Calculation of Initial and Final Reliability of the Flanagan Equation

No	Nomor soal										Total		Awal	Akhir	Selisih	
	1	2	3	4	5	6	7	8	9	10	X_t	X_t^2	X_1	X_2	d	d^2
1	1	1	1	1	1	1	1	1	0	0	8	64	5	3	2	4
2	1	1	1	1	1	1	1	1	0	0	8	64	5	3	2	4
3	1	1	1	1	1	1	1	1	0	0	8	64	5	3	2	4
4	1	1	1	1	0	1	1	1	0	0	7	49	4	3	1	1
5	1	1	1	1	0	1	1	1	0	0	7	49	4	3	1	1
6	1	1	1	1	0	1	1	1	0	0	7	49	4	3	1	1
7	1	1	1	1	0	1	1	1	0	0	7	49	4	3	1	1
8	1	1	1	1	0	1	1	1	0	0	7	49	4	3	1	1
9	1	1	1	1	0	1	1	0	0	0	6	36	4	2	2	4
10	1	1	1	1	0	1	1	0	0	0	6	36	4	2	2	4
11	1	1	1	1	0	1	1	0	0	0	6	36	4	2	2	4
12	1	1	1	1	0	1	1	0	0	0	6	36	4	2	2	4
13	1	1	1	1	0	1	1	0	0	0	6	36	4	2	2	4
14	1	1	1	1	0	1	1	0	0	0	6	36	4	1	2	4
15	1	1	1	1	0	1	0	0	0	0	5	25	4	1	3	9
16	1	1	1	1	0	1	0	0	0	0	5	25	4	1	3	9
17	1	1	1	1	0	1	0	0	0	0	5	25	4	1	3	9
18	1	1	1	1	0	1	0	0	0	0	5	25	4	1	3	9
19	1	0	1	0	1	0	0	1	1	0	5	25	3	2	1	1
20	1	0	1	0	1	0	0	1	1	0	5	25	3	2	1	1

21	1	1	0	1	1	0	0	0	1	0	5	25	4	1	3	9
22	1	0	1	0	1	0	0	1	1	0	5	25	3	2	1	1
23	1	0	1	0	1	0	0	1	1	0	5	25	3	2	1	1
24	1	0	0	0	1	0	0	1	1	0	4	16	2	2	0	0
25	1	0	0	0	1	0	0	1	1	0	4	16	2	2	0	0
26	1	0	0	0	1	0	0	1	1	0	4	16	2	2	0	0
27	1	0	0	1	1	0	0	0	1	0	4	16	3	1	2	4
28	1	0	1	0	1	0	0	0	1	0	4	16	3	1	2	4
29	1	0	0	0	0	0	1	1	1	0	4	16	1	3	2	4
30	1	0	0	0	1	0	0	0	1	0	3	9	2	1	1	1
31	1	0	0	0	1	0	0	0	1	0	3	9	2	1	1	1
32	1	0	0	0	1	0	0	0	1	0	3	9	2	1	1	1
33	1	0	0	0	1	0	0	0	1	0	3	9	2	1	1	1
34	1	0	0	0	0	0	0	0	1	0	2	4	1	1	0	0
35	1	0	0	0	0	0	0	0	1	0	2	4	1	1	0	0
36	1	0	0	0	0	0	0	0	1	0	2	4	1	1	0	0
										∑	182	1022	115	67	48	106

Steps to determine reliability with the Flanagan equation, namely:

1. Choose ten questions into two parts. The first part is questions number 1, 2, 3, 4 and 5. The second part is numbers 6, 7, 8, 9, and 10.
2. Determine the number of scores and squares of each hemisphere's score: ∑ Xt = 182 ∑ Xt2 = 1022 ∑X1 = 115 ∑X2 = 67 ∑X22 = 147
3. Determine the total number of variants: St2 = Xt2 -∑Xt2NN = 1042-18223636 = 1022-920.11136 = 2,830
4. Determine the number of variants of the first hemisphere (questions 1, 2, 3, 4, and 5). S12 = X12 -∑ X12NN = 417-11523636 = 417-367.361136 = 1.3789
5. Determine the number of variants of the second hemisphere (questions 6, 7, 8, 9, 10): S22 = X22 -∑ X22NN = 147-6723636 = 147-124.694436 = 0.6196
6. Determine reliability by entering the numbers obtained in step three to fifth. r11 = 21-S12 + S22St2 = 21-1.3789 + 0.61962.830 = 0.5877

Many found that researchers unilaterally use alpha coefficients in estimating the reliability of management measurement results done, whereas alpha coefficients require the existence of several assumptions, for example, between one item with another item in one instrument is expected to have the same measurement unit and accuracy in explaining pure scores. Many researchers do not understand that alpha coefficients have certain criteria so that the estimation results have accurate accuracy, for example the fulfillment of pure score equality assumptions revealed and unidimensionality of data. If the alpha coefficient is applied to multidimensional measurements, the results of the underestimate will be obtained.

In the process of delivering information quickly, efficiently [19], the existence of accurate information is indeed very necessary especially for everyday life, because accurate information can be an assessment and will affect the recipient of that information [20] needed in various aspects, for example the form of presentation information, so that information can be effective and easy to understand [21]. The reliability index provides information that is very useful for evaluating tests. To find out the indication of the influence of the actual score in the error score, the reliability index can be used by estimating how much the score fluctuates as a measurement error. A test that has an index of 0.90 is certainly more reliable than a test that has a reliability index of 0.8. However, the reliability index does not present precisely the measurement results. For example, the measurement results of intelligence tests show a score of 110. Even though the reliability coefficient obtained is very high, for example 0.93, we may think that the score is better than the score of 100, or we might assume that the excess score is 10 due to measurement errors. The reliability index must also take into account the amount of variability that occurs. To know the real score, the standard error of measurement must be taken into

account. Standard measurement error is a function of test reliability and score variability with equations:

$$SEM = S_X\sqrt{1 - r_{XX}}$$

Standard error of measurement presents a measure of variability in the score as a basis for measurement errors. For example, for example, Hafidz tested for IQ is 105. If the test is not reliable enough, when tested several times, the IQ score will not be 100. It may be that the score he obtained is less than 105 at other times the score is higher than 105. If done many times, the results will be like a normal distribution. Standard measurement errors indicate how much variability occurs. Standard measurement errors can be used to determine the interval, how much the score obtained is accurate.

Tests that consist of many questions will be more reliable than the test consisting of a few questions. As an example we take in a physics test for a class increase for example, consisting of 40 questions will have different reliability with a test consisting of 60 questions. How to determine the reliability of the number of different questions can be used the Spearman and Brown equations as follows:

rn= nr1+n-1r
rn= indeks reliabilitas setelah ditambahkan soal
n = perkalian penambahan soal
r = indeks reliabilitas awal

For example on a test consisting of 40 physics questions and a reliability index of 0.6 plus 20 other physics questions so that it becomes 60 questions. What is the reliability index now? Addition of 20 questions on 40 questions, then the length of the test is now 60 questions. The length of the test now is 1.5 initial tests.
By using the equation above then

$$r_n = \frac{1.5\times 0.60}{1+(1.5-1)0.60}$$
$$r_n = 0.692$$

Addition of 20 items in the initial test which had a reliability index of 0.60 resulted in an increase in the reliability index of 0.692. The results achieved by psychometricians agree that it is not always an increase in the length of the test which will result in the addition of a reliability index [22].

4. Conclusion

Reliability derived from the word reliability means the extent to which the results of a measurement can be trusted. A measurement result can only be trusted if in several times the measurement of the same subject group, the measurement results are relatively the same, as long as the aspects measured in the subject have not changed. Reliability is divided into two types, namely: (a) reliability of consistency of responses; and (b) reliability of the consistency of combined items. There are three mechanisms for checking the reliability of respondents' responses to tests or instruments, namely: (a) retest test technique; (b) split technique; and (c) equivalent forms or parallel test methods. The second split technique is calculated by: (a) moment product equation; (b) Flanagan equation; and (c) the Rulon equation.

Several types of reliability coefficients that can be applied to multidimensional measurement models, namely: 1) Stratified Alpha Coefficient of Reliability. 2. Mosier Composite Reliability Coefficient. 3. Wang Composite Reliability Coefficient. 4. Raykov's Composite Reliability Coefficient. 5. McDonald's Composite Reliability Coefficient. There are two important aspects in reliability, namely middle price reliability (means) and individual size reliability. This is related to the standard middle price error and standard measurement error. In research studies, errors in middle price standards and related statistics, such as standard errors in the difference

between middle prices and standard errors, a correlation coefficient is more important than the standard error of measurement.

References

[1] Arifin, Z. (2017). Mengembangkan Instrumen Pengukur Critical Thinking Skills Siswa pada Pembelajaran Matematika Abad 21. *Theorems*, *1*(2).

[2] Sumaryati, S. (2017). Manajemen Pendidikan Karakter. *Tarbawiyah Jurnal Ilmiah Pendidikan*, *13*(02), 205-220.

[3] Widhiarso, Wahyu. 2009. "Koefisien Reliabilitas pada Pengukuran Kepribadian yang Bersifat Multidimensi." Jurnal Psikobuana, Vol. 1, No. 1, pp. 39-48.

[4] Hartanto, H. (2017). VALIDITAS DAN RELIABILITAS WARWICK-EDINBURG MENTAL WELL BEING SCALE. Counsellia: Jurnal Bimbingan dan Konseling, 6(2), 1-16.

[5] Febriyanto, E., & Yulianto, F. H. N. L. (2018). Penerapan Viewboard Rooster Berbasis Bootstrap Sebagai Penunjang Pelayanan iDuhelp! Pada Perguruan Tinggi. Jurnal Ilmiah Teknologi Informasi Asia, 12(2).

[6] Handayani, I., Febriyanto, E., & Bachri, E. W. (2018). Aplikasi Stat Counter Sebagai Alat Monitoring Aktivitas Website PESSTA+ Pada Perguruan Tinggi. SISFOTENIKA, 8(2), 188-197.

[7] Aini, Q., Rahardja, U., & Allamiah, F. (2018). Perancangan Sistem Absensi Kinerja Pengabdian Tri Dharma secara Online pada Website Berbasis YII Framework. *Sisfotenika*, *8*(1), 13-22.

[8] Rahardja, U., Harahap, E. P., & Pratiwi, S. (2018). Pemanfaatan Mailchimp Sebagai Trend Penyebaran Informasi Pembayaran Bagi Mahasiswa Di Perguruan Tinggi. Technomedia Journal, 2(2), 38-51.

[9] Ahmadi, A., & Dewi, C. A. (2018). Pengaruh Pembelajaran SAVI Berbasis Media Simulasi Interaktif Terhadap Pemahaman Konsep Mahasiswa Pada Materi Elektrokimia. Jurnal Kependidikan Kimia Hydrogen, 2(1), 144-148.

[10] Martín-Albo, J., Núñez, J. L., Navarro, J. G., & Grijalvo, F. (2007). The Rosenberg Self-Esteem Scale: translation and validation in university students. The Spanish journal of psychology, 10(2), 458-467.

[11] Bahri, S., Abrar, A. I. P., & Angriani, A. D. (2017). PERBANDINGAN METODE DEDUKTIF DENGAN INDUKTIF TERHADAP HASIL BELAJAR MATEMATIKA DITINJAU DARI MOTIVASI BELAJAR SISWA. MaPan: Jurnal Matematika dan Pembelajaran, 5(2), 201-215.

[12] Pidarta, M. (2016). Manajemen Pendidikan dalam Era Globalisasi. Jurnal Ilmu Pendidikan, 5(2).

[13] Junike, J., Yusrizal, Y., & Halim, A. (2016). Pengembangan dan Implementasi Instrumen Tes untuk Mengukur Pengetahuan Prosedural dengan Menggunakan Pendekatan Inkuiri di SMA Negeri 10 Banda Aceh. Jurnal Pendidikan Sains Indonesia, 4(1).

[14] Nugroho, R. E., & Samiâ, W. (2017). Pengaruh Pembinaan Disiplin dan Motivasi Belajar terhadap Prestasi Belajar Taruna Balai Pendidikan dan Pelatihan Ilmu Pelayaran (BP2IP) Tangerang. *Sains Manajemen*, *2*(2).

[15] Rahardja, U., Aini, Q., & Putri, D. M. (2018). Pemanfaatan Automated Email System (AEMS) Sebagai Media Notifikasi Penilaian Hasil Belajar. SENSITEK, 1(1), 49-54.

[16] Rahardja, U., Lutfiani, N., & Rahmawati, R. (2018). Persepsi Mahasiswa Terhadap Berita Pada Website APTISI. *SISFOTENIKA*, *8*(2), 117-127.

[17] Azizah, N., Supriyanti, D., & Astriyani, E. (2017). The Role of Web Based Accounting Online System 2.0 as the Company's Income and Expense Management. Aptisi Transactions of Management (ATM), 1(1), 48-53.

[18] Rahardja, U., Lutfiani, N., & Alpansuri, M. S. (2018). Pemanfaatan Google Formulir Sebagai Sistem Pendaftaran Anggota Pada Website Aptisi. or. id. *SISFOTENIKA*, *8*(2), 128-139.

[19] Rahardja, U., Aini, Q., & Faradilla, F. (2018). Implementasi Viewboard Berbasis Interaktif Javascript Charts Pada Sistem Penilaian Perkuliahan. Jurnal Ilmiah Teknologi Informasi Asia, 12(2), 91-102.
[20] Rahardja, U., Aini, Q., & Khoirunisa, A. (2017). Implementasi Business Intelligence Menggunakan Highchart pada Sistem Penilaian Absensi berbasis YII Framework. CSRID (Computer Science Research and Its Development Journal), 9(2), 115-124.
[21] Rahardja, U., Aini, Q., & Santoso, N. P. L. (2018). Pengintegrasian YII Framework Berbasis API pada Sistem Penilaian Absensi. SISFOTENIKA, 8(2), 140-152.
[22] Martono, A., & Maesaroh, S. (2017). Utilizing Customer List Menu To Monitoring Customer Data On Web Based Accounting Online System 2.0. Aptisi Transactions of Management (ATM), 1(2), 101-109.