DEVELOPMENT INSTRUMENT OF STUDENT CHARACTER IN MATHEMATICS INSTRUCTIONAL

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***ABSTRACT*:** *Education have an important role in character building of students. The characters that can be developed in learning mathematics are honest, disciplined, diligent, responsibility, and self- confidence. The characters can be done through a process of habituation, integrated in subject and the teacher as a model for students. Achievement of the character in learning Mathematics is often difficult to detect because the teacher does not have an instrument that can measure the character achieved by student. Therefore an instruments to measure the characters building in mathematics instructional will be useful for teachers to see an indication of the character of student achievement.The purpose of this study was to develop an instrument to measure the character building of students in mathematics instructional. This study was carried out from the development of the conceptual definition, operational definitions, determination constructs, dimensions, and indicators, preparation of the blue-print and item, expert validation, field testing, and data analysis. Data trial results were analyzed using factor analysis and structural equation modeling analysis. The results showed that there are five main factors constructed the instrument character with good validity and reliability.*

Keywords: Student Character, Mathematics Instructional, Structural Equation Modeling,

1. INTRODUCTION

Education has a very important role in the life of a nation. The better the quality of education in a country, the more qualified human resources as well. In general [1] state that education have the power to promote the growth of manners (inner strength, character), mind (intellect), and body of student. In another word, it can be stated that education is not only aimed at producing intelligent and skilled person, but also private character. Education is character building efforts so that students can have a good character, which is necessary for their survival as a human. Education is not just a transfer of knowledge, but to be able to change, improve and built the character of man in particular, intelligent, independent and good moral.

In the education system in Indonesia [2], education declared a conscious and deliberate effort to create an atmosphere of learning and the learning process so that learners are actively developing the potential for him to have the spiritual power of religion, self-control, personality, intelligence, noble character and skills needed himself, society, nation, and state. The similar thing was stated by [3] that education is a conscious effort devoted to the development of human beings as a whole, through a variety of its dimensions (religious, moral, personal, social, cultural, temporal, institutional, relational, etc., for the sake of the process of perfecting itself continuously over the meanings of life and history of the world in solidarity with others

As a conscious and deliberate effort, the quality of education including the character building of students can also be planned, of course with due regard to the various aspects of the implementation process. One of the most important aspects that determine the quality of education is a learning process, wherein the evaluation of student achievement is one very important element.

During this time, learning outcome assessment conducted by teacher based on test scores only. Assessment of student achievement that is only based on the value of the test lead teachers lack proper understanding of the character of the students were held and required students in learning mathematics. On the other hand, establishment of the good character of students is one of the objectives in studying mathematics. Therefore, it needs a valid and reliable instrument that is able to measure the character of students in mathematics instructional.

Character is a latent variable that can not be measured directly as the physical variables. In order to measure the characteristics of latent variables, the manifest variables can be used to be measured the latent variables. Measurement of the manifest variables requires a standardized instrument. The problem now is how the teacher can have a standardized instrument and be qualified to measure the students' Character.

On the other hand, the limited knowledge and time the high school math teachers have in developing a valid and reliable instrument to measure the students' Character becomes a constraint for the lack of attention in achieving the fundamental objectives in Mathematics instruction. Therefore, it is necessary to develop a Character instrument in mathematics instruction in high school.

2. METHOD

Operationally, this study aimed to: (1) generate the indicators of Student Character, (2) determine the construct validity and reliability of the Character instrument in the mathematics instruction. Development procedure of the non-test character instrument was done in some steps [4], so in this research the procedure consisted of: theoretical review for building conceptual definition, building operational definition, defining construct, dimension, and indicators, constructing blueprint and items, analyzing readability and social desirability, field testing, and data analysis. This field testing was conducted in two senior high school and two junior high school in Manokwari, that were followed by 250 students studied mathematics.

The data analysis was performed in two steps using exploratory factor analysis and confirmatory factor analysis (Structural Equation Modeling - SEM). The results of the

confirmatory factor analysis using IBM SPSS Statistics program package 22 was the establishment of several factors as a model which is a linear combination of the items. The model obtained is then analyzed by using the SEM analysis lisrel 8.8 program package. By using the lisrel program, the testing of Confirmatory Factor Analysis (CFA) was conducted.

There are several requirements in exploratory factor analysis, namely: (1) the correlation between the variables. The first stage in the analysis of factors is to calculate the correlation between variables. If the observed variables are not significant, it is not possible formation of one or more factors, (2) the adequacy of the sample size by using Kaiser-Meyer-Olkin (KMO) formula, and (3) test whether the observed data is a sample from a multivariate normal population distribution by using the Bartlett test of spherity ($\chi 2$). Analysis factor can not be used if the value of $\chi 2$ has a probability (sig) is greater than 0.05, and (4) examine the Anti-image correlation (AIC) with the criterion measure of sampling adequacy (MSA) ≥ 0.50. According to, the MSA item smaller than 0.50 released one by one from the models ranging from the smallest, to the next item remaining factors analyzed again until all remaining items meet the existing requirements [5, 6].

There are three tests was performed, in order to conduct CFA, namely: (1) the suitability of the data with the model, (2) the validity and reliability of the model, and (3) the significance of the coefficients of the structural model. According to Hair *et al*. [6], the evaluation of the degree of fit of the data to match the model through the entire model (overall model fit), the measurement model fit (measurement model fit), and the suitability of the structural model (structural model fit). The suitability of the whole models was tested by using several measures, as proposed by[7,8] among others: (1) Normed Fit Index (NFI), (2) Non-Normed Fit Index (NNFI), (3) Parsimony Normed Fit Index (PNFI), (4) Comparative Fit Index (CFI), (5) Incremental Fit Index (IFI), (6) Relative Fit Index (RFI), (7) Goodness of Fit Index (GFI), (8) Adjusted Goodness of Fit Index (AGFI), (9) Parsimony Goodness of Fit Index (PGFI), (10) Root Mean Square Residual (RMR), and (11) Root Mean Square Error of Approximation (RMSEA). After match of the model and the data are met, further analysis according to [9,10] is to test the measurement model fit, with an evaluation of each constructor separate measurement models through evaluation of the validity and reliability. Reliability measurements performed using Constructed Reliability (CR) and Variance Extracted (VE). A construct have a good reliability and validity when every indicator has a value of CR ≥ 0.70, and the value of VE ≥ 0.50.

3. RESULT AND DISCUSSION

Constructing the indicators

According to the Oxford Advanced leaner's Dictionary, character is (a) mental or moral qualities that make a person, group, nation or etc different from the others [11], while the character in the Webster's New World Dictionary [12] stated as follows: "The distinctive trait, distinctive quality, moral strength, the pattern of behavior found in an individual or group". The word character comes from the Greek word meaning "to mark" and focuses on how to apply the value of kindness in the form of action or behavior. The term character is closely related to personality a person, which a person can be called a person have the character if the behavior in accordance with the moral norms. Thus it can be stated that the character is a personality, the pattern of behavior, or quality trait found in an individual or group, or nation.

The Character Education according to Informational Handbook and Guide as mentions by [13], there are about the eight traits of character education for inclusion in character education instruction, they are: (1) **Courage.** Having the determination to do the right thing even when others don't; having the strength to follow your conscience rather than the crowd; attempting difficult things that are worthwhile, (2) **Good Judgment**. Choosing worthy goals and setting proper priorities; thinking through the consequences of your actions; and basing decisions on practical wisdom and good sense, (3) **Integrity**. Having the inner strength to be truthful, trustworthy, and honest in all things; acting justly and honorably, (4) **Kindness** Being considerate, courteous, helpful, and understanding of others; showing care, compassion, friendship, and generosity; and treating others as you would like to be treated, (5) **Perseverance**. Being persistent in the pursuit of worthy objectives in spite of difficulty, opposition, or discouragement; and exhibiting patience and having the fortitude to try again when confronted with delays, mistakes, or failures, (6) **Respect.** Showing high regard for authority, for other people, for self, for property, and for country; and understanding that all people have value as human beings, (7) **Responsibility.** Being dependable in carrying out obligations and duties; showing reliability and consistency in words and conduct; being accountable for your own actions; and being committed to active involvement in your community, and (8) **Self-Discipline.** Demonstrating hard work and commitment to purpose; regulating yourself for improvement and restraining from inappropriate behaviors; being in proper control of your words, actions, impulses, and desires; choosing abstinence from premarital sex, drugs, alcohol, and other harmful substances and behaviors; and doing your best in all situations.

According [14], there are three major components in the character, those are moral knowledge, moral feeling, and moral action. Moral knowledge include: moral awareness, knowledge of moral values, perspective knowledge, moral reasoning, decision making, and personal knowledge. Moral feelings include: conscience, self-esteem, empathy, look for the good, self-control, humility, whereas moral action include: competence, desires, and habits. Specifically, the values of good character in Indonesia comes from religion, Pancasila, culture, and national education goals. The values of these characters consists of 18 character value that is: (1) religious, (2) honest, (3) tolerance, (4) discipline, (5) hard work, (6) creative, (7) independent, (8) democratic, (9)

curiosity, (10) the national spirit, (11) love of the homeland, (12) the achievements, (13) a friendly communicative, (14) love peace, (15) likes to read, (16) enviroment care, (17) social care, and (18) responsibility [15].

Further [16] states that the character can be formed in mathematics instructional, among others, the ability of students in logical, analytical, systematic, critical, and creative thinking. Critical thinking is the ability to think, which is focused on making the decision on what is believed to be or to be done, while creative thinking is to think consistently and continuously produced something creative/original and useful in solving the problem.

Based on some of the above description, it can be stated that there are some indicators of characters that can be achieved by students in the learning of mathematics, namely: (1) logical thinking, (2) systematic thinking, (3) analytic thinking, (4) critical thinking, (5) creative, (6) communicative, (7) kindness, concerned, (8) diligently, (9) nationalist, (10) responsibility, (11) self-discipline, (12) honest, (13) self-esteem, dignity (14) humility, low profile (15) intelligent, (16) independent, (17) hard work, (18) religious, (19) likes to read, book lover (20) eager to learn, diligent (21) Integrity, (22) self-confidence, (23) empathy, and (24) control themselves.

The research continued with construct the items of instrument. There are 3 items for each indicator, so that there are 72 items that justified by expert. Criticisms and suggestions from experts used to select items of instrument, in order to obtain items for field testing. There are 48 items, 2 for each indicator conducted field testing.

Statistical Analysis and Discussion

Data from field testing were analyzed using factor analysis. The statistics based on the analysis, both exploratory and confirmatory factor analysis given in Table 1 and Table 2.

Table l: Statistics of Exploratory Factor Analysis

No.	Variable	Statistics
1	Correlation beetwen variables	0.85
2	Kaiser-Meyer-Olkin	0.920
3	Chi-Square of Bartlett Test	24645.759
4	Measure of sampling adequacy	0.732 – 0.827
5	Number of factors (matrix component analysis)	6
6	Number of factors (matrix rotation analysis)	5
7	Total Variance Explained	84.841%

Table 2: Statistics of Confirmatory Factor Analysis

No.	Variable	Statistics
1	Normed Fit Index	0.91
2	Non-Normed Fit Index	0.92
3	Parsimony Normed Fit Index	0.90
4	Comparative Fit Index	0.76
5	Incremental Fit Index	0.76
6	Relative Fit Index	0.90
7	Goodness of Fit Index	0.91
8	Adjusted Goodness of Fit Index	0.82
9	Parsimony Goodness of Fit Index	0.71
10	Root Mean Square Residual	1.12
11	Root Mean Square Error of Approximation	0.101
12	Standardized Loading Factor	0.71 – 1.93
13	Constructed Reliability	0.80 – 0.87
14	Variance Extracted	0.57 – 0.73

Table 1 shows that the statistics produced in accordance with the criteria required in exploratori factor analysis, see [5, 7, 8, 17]. There are more than 50 percent of variables that have a significant relationship, so factor analysis could be continued. If there are no significant correlations between these items, then this means that they are unrelated and that we would not expect them to form one or more factors. In other words, it would not be worthwhile to go on to conduct a factor analysis [5].

Three other statistical values in Table 1, namely: KMO, Chi-Square Test of Bartlett, and MSA, also indicates that further analysis of the factors for the formation of a factor do. KMO has been produced showing the fulfillment of the adequacy of the required samples. Result of Chi-square value of Bartlet and the value of the MSA is also in accordance with the terms required in exploratory factor analysis. KMO value obtained is 0.920. KMO values greater than 0.90 are included in the eligibility criteria very

well for the sample size needed in factor analysis [6]. On the ither word, if the value of KMO is greater than 0.5 and significance smaller than 0.05, then the sample can be further analyzed using factor analysis.

Further analysis is performed using image Anti Correlation (AIC). AIC method aims to examine the feasibility of an item to be used in the grouping variables. The value of good AIC for the criterion measure of sampling adequacy (MSA) is greater than 0.50. If there is an item with MSA value smaller than 0.50, then the item is issued each one of the models from the value with the smallest value of MSA. Furthermore, the remaining items were analyzed factor again until all the remaining items have value MSA $\geq$ 0.50 [6].

Further analysis using Matrix Component analysis shows that the factors that formed from 24 variables (48 items) that is constructed resultin in 6 factors. However, the group that is formed can not be interpreted properly. Rotation of factors needs to be done if the method of extraction of factors has not produced a clear component of the main factors. The purpose of the rotation of these factors in order to obtain a simpler factor structure to be easily interpreted [7, 8]. After the matrix rotation, there are five factors resulted. The five factors can be interpreted more easily.

Based on the result of matrix rotation, the 24 indicators can be grouped into 5 factors. The five factors are: (1) hard work, diligent, creative, independent, fond of reading, and eager to learn, (2) self-esteem, honesty, discipline, responsibility, and confidence, (3) logical, systematic, analytical, critical, and intelligent, (4) care, self-control, empathy, and communicative, (5) religious, integrity, nationalism, low profile (humble). Further, the model obtained be analyzed use confirmatory factor analysis.Tabel 2: show that the structural model is fit. The suitability of the whole models was evaluated by using several statistics, among others: NFI, NNFI, PNFI, CFI, IFI, RFI, GFI, AGFI, PGFI, RMR, dan RMSEA [9, 10, 13]. The next statistics, i.e: CR and VE show that model tested have good validity and reliabilitity. The model have good validity and reliabilitity when every indicator has a value of CR $\geq$ 0.70, and the value of VE $\geq$ 0.50 [9, 10, 18].

Based on Table 2, it appears that of the 11 criteria used, there are five criteria that match the criteria for suitability of the model and the others not match the criteria, see [6, 7, 8, 9, 10]. According to [7, 8], it is very difficult to get all the criteria that match the degree of suitability or goodness of fit (GOF) between the data and the model. As a rule of thumb, if one of the criteria has been match, then the model considered appropriate. So, the character instrument consist of five factors, where the first group is referred to smart student, group two is confindence student, the third group is thinking student, the fourth group is care student, while the student care fifth group called integrity student.

4. CONCLUSION

Based on the results of research and discussion, it can be concluded that, there are five factors that construct the instrument of student character in mathematics instructional, namely: (1) smart student, (2) confidence student, (3) thinking student, (4) care student, and (5) integrity student.

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