

Multiple intelligences instrument development: Identification system of multiple intelligences tutor

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Abstract

Research instruments are an important factor in a study in which the truth of researched results lies that determines the conclusion. Instruments are used to collect data and measure a research variable's object. This study aimed to retest a valid, consistent, and reliable instrument related to multiple intelligences previously developed by McClellan & Conti. In this study, Multiple intelligences adapted from American psychologist, Howard Gardner, consisted of nine constructs, namely: (1) physical/kinesthetic, (2) existential/spiritual, (3) interpersonal, (4) intrapersonal, (5) logical thinking, (6) musical/rhythmic, (7) naturalistic, (8) verbal, and (9) visual. Designed as a survey study, it involved 140 respondents from primary education tutors of Universitas Terbuka at Pekanbaru selected using simple random sampling techniques. The data was analyzed using SPSS version 23.00 for Windows. The results showed that all questionnaire items were valid and reliable with a high average Cronbach Alpha reliability value ($0.763 > 0.6$), and every statement item has a high value ($0.786 - 0.887$) with a total construct value of 0.859. This study provides an alternative assessment related to multiple intelligence. Knowing each tutor's multiple intelligences will make the tutor focus more on the superiority of his intelligence. This will have good consequences for the development of the student learning process.

Keywords: *multiple intelligences, instrument development, tutor, mapping*

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Introduction

In the 21st century, competition and challenges in all life aspects have become fiercer than ever. This century demands the mastery of various knowledge and skills, thus, urging educational institutions to improve in order to prepare individuals to face the real world. Basically, humans are equipped with

various types of intelligence which go hand in hand with their potentials. However, in Indonesia, intelligences are still regarded as a single intelligence, that is, one is considered intelligent when they excel in academics (Vebrianto et al., 2020). Many students are disappointed or discontent with how their teachers teach at schools (Gardner, 1983). Teachers tend to be monotonous in their way of teaching. Rather



than adjusting to their student's diverse and distinct intelligences, they adjust to their own intelligence (Fikriyah & Aziz, 2018). Implementation of intelligence is still not taken seriously and still tends to ignore the fundamentals of multiple intelligences themselves.

Study results show that one of common problems faced by students are discrepancy between students' learning style and educators' teaching style (Patimah et al., 2019). Teachers are having difficulties in choosing an appropriate strategy (Sadiqin et al., 2017). Prospective teachers are also having the same problem when it comes to lecture, especially freshmen adjusting to new environment, from high school to college. Some students find it challenging to follow the materials delivered by the teachers. In this case, Universitas Terbuka has not yet carried out a mapping or strived for an improvement to teaching methods for tutors.

Reflecting on those conditions, tutors are expected to facilitate a learning process that embraces all kinds of students' intelligence and to implement integrated learning to make it more meaningful and easier to understand. This is because the tutor will prepare the best learning process according to the multiple intelligences he has. The essence of multiple intelligences, according to Gardner, is recognizing the uniqueness of each individual and their way of learning, developing models to assess them, and infinite ways to realize themselves in this world (Nadejda & Nina, 2020). During learning process, a tutor should be conscientious and take into account many things including learning approaches being used. Tutors must identify and understand different intelligences. Activities designed by teacher must foster the development of multiple intelligences, integrating individual differences in the process (Adilla et al., 2019). In addition, some students may display all intelligences in themselves and some only display one kind of intelligence (Yavich & Rotnitsky, 2020). According to Chatib, in its implementation, multiple intelligences (MI)-based learning strategies should contain the following supporting elements: (1) learning strategies should be related to syllabus, especially indicators of learning outcomes; (2)

learning strategies should adopt student-based approach; (3) method selection should be adjusted in accordance with students' learning style; and (4) learning strategies should be accompanied with authentic assessment rubrics (Sunayah et al., 2018). Other research also shows that the implementation of multiple intelligences learning can be considered successful if the types of learning instruments (syllabus, lesson plans, learning materials, and also learning evaluations) are available and there is a desire from the teacher to learn the theory and the way of delivering the material using MI theory (Asad et al., 2020). This is supported by a study showing that assessment instruments can be beneficial in many ways, including in academic achievement (Damaianti et al., 2020).

Another corroboration comes from a study showing that the implementation of multiple intelligences strategy in the class can optimize students' learning skills (Derakhshan & Faribi, 2015). They claim that multiple intelligence strategy should be applied in classes to boost up the students' learning skills. Thus, tutors are expected to come up with ways to deal with problems arising from the implementation of MI-based learning strategy. Besides, a tutor is also urged to be able to organize class management, establish good interaction, communication, and relationship with their students (Adedigb & Sulaiman, 2020).

Several studies have been conducted to identify the multiple intelligences of students. Some of them have shown that: (1) lecturers' pedagogical competence, intellectual intelligence and also self-efficacy simultaneously influence the students' learning motivation (Lumbantobing, 2020); (2) lecturers have adequate behavior and abilities so that they can develop students' abilities completely (Haerazi et al., 2020); and (3) lecturers regularly update their skills and knowledge to maintain effective teaching activities in the context of professional development (Orakci, 2020).

Multiple intelligence theory (MI) is a relatively new theory formulated by Howard Gardner. Gardner defines intelligence as an ability to solve problems and produce a product in certain settings and in real circumstances (Kelelufna & Masan, 2019). Intelli-

gence is not one's ability to answer test questions in a closed room detached from their environment. Rather, intelligence represents one's ability to solve real problems in various situations (Chotib, 2018). A person is intelligent when they can solve real life problems, not just in theory. The more able and more ingenious someone in solving various complex problems, the more intelligent they are.

Intelligence is one of several main factors that determine the success or failure of students. Students with a low or subnormal intelligence level are more likely to have low motivation. However, having high intelligence is not an absolute analogy to academic success. According to Yasmine (2012), the theory of multiple intelligences is the highest validation of the notion that individual differences are noteworthy. Its implementation in education is highly dependent on identification, recognition and appreciation toward each and every student's way of learning, in addition to individual student interests. The theory of multiple intelligences does not only recognize these individual differences for practical purposes, such as teaching and assessment, but also consider and accept them as something normal, natural, even interesting and priceless (Sukitman, 2016).

Essentially, each individual has a number of intelligences, including language/linguistic, logical-mathematical, visual spatial, kinesthetic, interpersonal, intrapersonal, musical, and naturalist intelligence (Rofiah, 2016). The theory is based on the reasoning that using IQ test to measure intellectual aptitude is very limiting, since IQ test emphasizes only on logical capability (mathematics) and language (Kurniawan, 2015). In fact, everyone has their own unique way to solve the problems they face. By implementing multiple intelligences, teaching activities are likened to water that fills spaces for students. By considering and looking closely at the most suitable way of learning from each individual, an educator/parent is expected to be able to act wisely and prudently in choosing a teaching style that suits a student's learning style.

When carefully observed, the theory of multiple intelligences is actually a representation of functions of two hemispheres of the

human brain: right hemisphere and left hemisphere. The brain hemisphere has the ability and potential to solve mathematical, logical and phenomenal problems, while the right brain hemisphere has the ability to respond to things that are qualitative, artistic and abstract, though it should be noted that all this is still within the framework of the outside world capability, not including the knowledge and understanding of oneself (Sukmaangara & Prabawati, 2019). Agustin (2013) said that Gardner's findings on multiple intelligences are widely adapted by various parties because of their function as early detection of gifted and artistic talents. It is not less that the theory quantum learning which also makes reference to this intelligence pattern. Likewise, owing to Gardner's theory, various fields can filter and welcome gifted individuals who in the future are expected to make a significant contribution to human excellence and motivation (Chaerunnisa et al., 2017).

Multiple intelligence-based learning, in general, can be defined as a learning process that offers "wiggling room" to every individual student to expand upon their intelligence potentials. Students are encouraged to be able to learn comfortably, without feeling compelled, and have high motivation. Basically, multiple intelligence-based learning can also be defined as a method that constantly encourages students to be creative. Indeed, the creativity refers to a form of creativity that can support the sustainability of the learning process by producing a proud academic motivation target (Sari et al., 2018).

Thus, in this study, the researchers establish nine construct of multiple intelligences for primary education tutors of Universitas Terbuka, namely: (1) physical/kinesthetic, (2) existential/spiritual, (3) interpersonal, (4) intrapersonal, (5) logical thinking, (6) musical/rhythmic, (7) naturalistic, (8) verbal, and (9) visual. Therefore, this study is aimed at retesting a valid, consistent and reliable instrument related to multiple intelligences previously developed by McClellan & Conti, because research instruments are an important factor in a study in which the truth of researched results lies that determines the conclusion.

Method

This research is designed as educational research, which is a systematic study of developing educational interventions (such as programs, strategies and learning materials, products, and systems) as a solution to solve complex problems in educational practice, that also aims to put forward our knowledge of these interventions as well the design and development process (Plomp & Nieveen, 2007). This study aims to produce an instrument of tutor multiple intelligence. A questionnaire was used to collect data (Creswell, 2012). The questionnaire was developed with nine scales, conforming with the nine constructs of multiple intelligences theory, namely: (1) physical/kinesthetic, (2) existential/spiritual, (3) interpersonal, (4) intrapersonal, (5) logical thinking, (6) musical/rhythmic, (7) naturalistic, (8) verbal, and (9) visual (McClellan & Conti, 2008), whose validity and reliability levels are assessed to create a quality and functional instrument. This was necessary to ensure the generalizability of the instrument in evaluating multiple intelligences since the study was conducted in Asia, especially in Indonesia that has distinctive ethnic characters.

This study used probability sampling with simple random sampling. The researchers select respondent (or unit, such as open university tutors) for the sample so that any individual has an equal probability of being selected from population. Thus, simple random sampling technique is used to choose individuals involved to represent the population (Creswell, 2012).

This study involved 140 respondents of primary education tutors of Universitas Terbuka at Pekanbaru from the total of 180 tutors, using Krejcie and Morgan Formula. The researchers used stratified and random sampling to ensure that every population member has equal probability to be chosen as part of the sample. Once the data were collected by questionnaire distribution, it was then processed using SPSS version 23.00 for Windows to see the extent of the quality of the instrument being developed. Instrument validity was used, obtained from corrected item total correlation with the number itemless scores follows the dimensions or constructs and

from expert, while the reliability index was obtained from the use of Cronbach Alpha.

Findings and Discussion

Instrument Development

The development of the instrument of multiple intelligences for primary education tutors employed three stages of approach, namely: stage 1: starting with scale identification; stage 2: involving writing individual items on a scale; and stage 3: involving field testing items followed by item analysis and validation procedures (Creswell, 2012). The following would present a description of the steps undertaken by the researchers.

Stage 1 – Scale Identification and Development

Stage 1 consisted of three steps leading to identification and scale development. The first step was to review the literature related to multiple intelligence instruments. The main source of elements in multiple intelligences was largely adapted from the theory of multiple intelligences consisting of nine constructs (McClellan & Conti, 2008) and other relevant materials. This important step was intended to identify main components to be considered by researchers, educators, and practitioners as multiple intelligences needed in this challenging era. The second step was to conduct a focused group discussion with a group of experienced lecturers to elicit recommendations regarding multiple intelligences to fix part of instrument. In addition, the researchers also sought for approval and validity of the constructs and item being developed in the instrument. The third step was to classify and reorganize the newly-developed scale regarding multiple intelligences as per experts' recommendations.

Stage 2 - Drawing Up Individual Items

Based on the instrument of multiple intelligences, the researchers developed a questionnaire where each component of multiple intelligences consisted of constructs to guide the recognition of the multiple intelligences. Table 1 shows all multiple intelligences items presented to the expert panel to ensure construct validation and instrument content.

Table 1. Instrument Construct of Multiple Intelligences

Construct	Item	Question Item
Physical/kinesthetic	1	I have an active lifestyle
	10	I enjoy outdoor games
	18	I like working with tools
Existential/spiritual	2	Meditation practice is beneficial
	11	Questions about life meaning are important for me
	19	I like discussing questions about life
Interpersonal	3	I am a "team player"
	12	I learn better by interacting with others
	20	I enjoy clubs and extracurricular activities
Intrapersonal	4	Fairness is important for me
	21	I learn better if I have emotional bond with the subject
Logical thinking/mathematics	5	Structures help me succeed
	13	Unorganized people frustrate me
	22	Step-by-step instructions are very helpful
Musical/rhythmic	6	I enjoy many kinds of music
	14	I have always been interested in musical instruments
	23	I memorize song lyrics easily
Naturalistic	7	My house has a recycling system
	15	Animals are important for me
	24	I enjoy hiking
Verbal/linguistic/language	8	I keep a journal
	16	I write for fun
	25	I am interested in foreign languages
Visual/spatial	9	I love doing three-dimensional puzzle
	17	I can remember things with images in my mind
	26	I can imagine ideas in my mind

Stage 3 – Validity and Reliability Analysis of the Instrument

One of the important steps in this study is the design of measurement instrument that is completed with validity and reliability test. The construct validity indicated the extent to which the measuring instrument expresses a theoretical construct that was to be measured and obtained by conducting trials (Setyawati et al., 2017). A number of methods can be utilized in order to measure construct validity, such as correlation assessment between research data and existing measurement method, convergent discriminant technique, factor analysis, and also multi method analysis (Emory & Cooper, 1991; Fahrana & Fahmi, 2017).

Instrument Validity Analysis

The ethnicities of the respondents included in this study consisted of Malay, Minang, Javanese, and Batak and others. The respondents of Malay ethnic are 56 (40%) re-

spondents; respondents from Minang ethnic are 38 (27%) respondents; from Javanese ethnic are 28 (20%) respondents, and then from Batak and others are 18 (13%) respondents. Therefore, it is clear that the majority of the respondents came from Malay and Minang ethnicity.

In addition to the data of the respondent based on gender and ethnicity, the researchers also conducted an analysis in order to determine the instrument validity using the corrected item-total correlation value. The results of the instrument validity test are presented in Table 2.

As seen in Table 2, the value of the corrected item total correlation above of 0.3 obtained a degree of freedom (df) of 138 out of 27 questionnaires that were distributed. From the overall calculation, all items are declared valid since the r -count value $>$ r -table that all question items can be used to measure the multiple intelligences of primary tutors of Universitas Terbuka.

Table 2. Instrument Validity Using Item Correlation with Corrected Item-Total Correlation

Construct	Item	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Physical/kinesthetic	1	0.816	0.829
	10	0.845	0.81
	18	0.867	0.809
Existential/spiritual	2	0.848	0.837
	11	0.920	0.810
	19	0.893	0.823
Interpersonal	3	0.831	0.834
	12	0.881	0.810
	20	0.855	0.811
Intrapersonal	4	0.822	0.887
	21	0.846	0.847
Logical thinking/mathematics	5	0.778	0.792
	13	0.650	0.802
	22	0.794	0.786
Musical/rhythmic	6	0.881	0.812
	14	0.880	0.816
	23	0.828	0.832
Naturalistic	7	0.733	0.806
	15	0.767	0.803
	24	0.774	0.792
Verbal/linguistic/language	8	0.761	0.823
	16	0.817	0.805
	25	0.844	0.802
Visual/Spatial	9	0.664	0.841
	17	0.866	0.791
	26	0.874	0.791

The analysis result using the corrected item total correlation must have a minimum value of 0.3 (Nunnally, 1978). Validity coefficient value ranged from +1.00 to -1.00. The coefficient value of +1.00 indicated that individuals in the instrument test or criteria test have relatively similar results while validity coefficient of 0 indicated that there is no correlation between the instruments and the criteria. The higher the validity coefficient value of an instrument is, the better the instrument is (Yusup, 2018). Correlation between items with a score above 0.25 is considered as a high score and, therefore, can be used to measure the constructs involved in a study (Nunnally, 1978).

Instrument Reliability Analysis

In the development of the instrument of multiple intelligences, each item was analyzed to attain internal consistency. This was a

measurement of the extent to which items in the scale that are measured constructs identically with other items in the same scale. Table 3 presents the results of the reliability analysis using the Cronbach Alpha coefficient for the questionnaire based on the instrument of the multiple intelligences for primary education tutors at Universitas Terbuka.

As presented in Table 3, the overall Alpha values for each construct, such as physical/kinesthetic, existential/spiritual, interpersonal, intrapersonal, logical thinking, musical/rhythmic, naturalistic, verbal as well as visual constructs are 0.860; 0.869; 0.863; 0.897; 0.832; 0.865; 0.841; 0.853; and 0.851, respectively. In the present study, it is known that the reliability values (α) with total construct of 0.859 are greater than 0.60 for all of the constructs studied (Hair et al., 2006) in order to produce an excellent and also quality instrument.

Table 3. Cronbach Alpha Reliability Index for Each Construct

Construct (N = 140)	Overall Alpha Cronbach Value
Physical/kinesthetic	0.860
Existential/spiritual	0.869
Interpersonal	0.863
Intrapersonal	0.897
Logical thinking/mathematics	0.832
Musical/rhythmic	0.865
Naturalistic	0.841
Verbal/Linguistic/language	0.853
Visual/spatial	0.851
Total Construct	0.859

Cronbach's Alpha is a general measure used to measure the reliability of a set of indicators of two or more variables (Fahrana & Fahmi, 2017). The reliability of this study's instrument was tested by looking at the composite block reliability indicator value measure construct and Cronbach's Alpha coefficient. Cronbach's Alpha values ranged from 0 and 1 where high alpha value shows high reliability among indicators (Straub & Gefen, 2004). Composite reliability value is considered satisfactory if it is above 0.7 (Indrayani et al., 2017). In this study, an Alpha value for an instrument to measure multiple intelligence tutors higher or equals to 0.80 is accepted in most of implementations in social sciences field. However, Mónus stated that for behavioral research, researches in general can accept a Cronbach's Alpha greater than or equals to 0.60 (Mónus, 2020).

Therefore, it can be said that all constructs used in this study are declared reliable. This means that this instrument can measure what it is supposed to measure and can be used to measure and evaluate the instrument of multiple intelligences of primary education tutors of Universitas Terbuka.

From the questionnaire distributed online, it is known that the most dominant intelligence in the primary tutors was intrapersonal intelligence (79.17%) and existential/spiritual intelligence (77.8%). For the lowest intelligence, the naturalistic intelligence came first (62.17%) that is followed by musical intelligence (67.14). There were a number of efforts that could be undertaken in order to improve students' ability in nurturing their multiple intelligences in learning process. One of them is that educators need to provide sufficient time for students to reflect and think (Sari, 2014).

Through the development of multiple intelligences, students can participate in the process of maximizing their ability to think, solve problems, and practice the role playing activities contained in learning activities. This is in line with a study showing that multiple intelligences can collaborate to bring about skills in students (Sanderson, 2016). Besides, for school literacy movement (SLM) to take place optimally, this must also involve collaboration between tutors and students. In addition, the teacher must be an example for students during SLM activities (Antoro, 2017). A tutor should be able to influence student morale by setting examples to earn their trust. Learning activities done continuously would be able to improve students' reading and writing abilities. It is understood that writing ability will improve after engaging in writing lesson (Zulaeha, 2013). Leveraging multiple intelligences in solving problems in class can support the achievement of the goals of the SLM. Careful learning planning, selection of the right media, and the right learning steps will be of tremendous significance in providing positive support for the implications of the model being developed.

As shown by the results, the questionnaire of the primary tutors' multiple intelligence had value of corrected item total correlation above of 0.3 (valid constructs) and Cronbach Alpha result have a value above 0.6 and below 1 (high reliability). Thus, the instrument of multiple intelligences is considered good to be employed in a research to identify the multiple intelligences among tutors in the context of learning and teaching process.

A study further corroborated that a valid and reliable instrument could be used as a measuring instrument (Suratno et al., 2016). Moreover, an assessment instrument should



meet validity, reliability and feasibility requirements (Pinilih et al., 2013). The development the assessment instrument of multiple intelligences represented the implementation of education standardization policy contained in the Government Regulation No. 19 of 2005, stating that education assessment at the tertiary level is regulated by each tertiary institution in accordance with applicable laws and regulations (Astuti et al., 2015).

This research gives an alternative in the form of an instrument that can measure what is supposed to measure and evaluate the multiple intelligences for primary education tutors of Universitas Terbuka. This policy demanded the tutors to produce several instruments of multiple intelligence assessment to realize the ideal teaching and learning process in accordance with set competencies.

Conclusion

The instrument of multiple intelligences that are developed in this study is feasible theoretically to be used to measure the intelligence of the primary education tutors of Universitas Terbuka. Furthermore, this excellent and quality assessment instrument also meets empirical feasibility criteria in validity and reliability tests. All of the question items in the questionnaire are valid, and the reliability test shows that Cronbach's Alpha (α) count values are greater than Cronbach's Alpha (α) value, which is $0.763 > 0.60$. In this study, it is known that the total reliability value (α) of the instrument construct of 0.859 is utilized to measure what should be used to measure and evaluate the multiple intelligence instrument of open tertiary education tutors effectively.

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