Differential Item Functioning (DIF) with Multiple Indicator Multiple Causes (MIMIC) Model on Attachment Scale Between Muslim Orphanage Adolescents and Caregivers Based on Demographic Factors

Alma Yulianti[1], Neviyarni[2], Netrawati[3]

Abstract

This research aims to see how the model of attachment between Muslim teenagers and their caregivers is based on demographic factors, namely gender. The Attachment Scale in this study is the Inventory of Parent and Peer Attachment-Revised (IPPA-R), which was compiled by Gay Armsden and Mark T. Greenberg in 2004 and revised by Gullone & Robinson (2005). This measures various qualities of the child's relationship with parents (mother, father, or caregiver) and friends. The quality of the relationship is seen from things such as trust, quality of communication and feelings of anger and alienation. Each statement in the research questionnaire has been adapted to the research context. This questionnaire has 25 items consisting of 3 subscales, namely trust consisting of 10 items, communication consisting of 9 items and alienation consisting of 6 items. This research involved 203 Muslim teenagers from 12 special Muslim orphanages in Pekanbaru City. DIF testing in this study uses MIMIC Model analysis. Based on the results of the first order CFA on a set of attachment items, there are 23 valid items. Then the results of the MIMIC model analysis based on gender found that the model fit the data where the RMSEA value = 0.012, so it was known that two items contained differential item functioning (DIF), namely item 7 (0.137, P = 0.002) and item 8 (0.309, P = 0.000).

Keywords: *Attachment, Adolescents, Construct Validity Test, MIMIC Model.*

1. Introduction

Adolescence is a period of change or transition from childhood to adulthood. During this period they are required to carry out developmental tasks. Developmental tasks are tasks that arise at or around a certain period in a person's life, successful achievement of which leads to happiness and success in the next task, while failure causes the individual to complain about difficulties in carrying out the next task. (Havigurst in Yusuf, 2011). From this opinion it can be seen that a developmental task is a task that appears at a certain period in an individual's life span, which if the task can be successfully completed will bring happiness and success in completing subsequent tasks, while if it fails, it will cause unhappiness in oneself. Alone. the individual concerned, and cause community rejection, as well as difficulties in completing subsequent tasks. So the task of adolescent development is focused on efforts to improve childish attitudes and behavior and strive to achieve the ability to think and behave in an adult manner.

[1] Department of Guidance and Counselling, Universitas Negeri Padang, Indonesia
[2] Department of Guidance and Counselling, Universitas Negeri Padang, Indonesia
[3] Department of Guidance and Counselling, Universitas Negeri Padang, Indonesia

Adolescence is known as a period of storm and stress or a psychological condition full of shocks accompanied by rapid physical growth and varied psychological growth. In going through phases of life that are full of turmoil, teenagers need support, guidance, and love from their families to help them complete their developmental tasks. According to Papalia (2001) the family does have a very big role in the development of children in the future. The reality shows that not every teenager can be fortunate enough to live and be raised in a complete family environment with backgrounds including being fatherless, motherless, orphaned, having economic difficulties, etc., which causes teenagers to have to live in orphanages.

Separation from attachment figures (parents) that occurs in adolescents in orphanages makes them feel lost and gives rise to feelings of loneliness (Weiss, in Peplau & Perlman, 2010). Separation from an attachment figure affects an individual's personality. Research related to attachment conducted by Erozkan (2011) explains that life and personality greatly influence attachment to themselves. In line with research by Marusic et al. (2010), they explained that there are implications for personality in both domains and characteristics that are directly related to attachment to caregivers and adolescents.

In reality, not all individuals can pass through their teenage years with parental assistance because they have to live in an institution called an orphanage. Orphanage institutions are institutions tasked with providing substitute services for parents or family for children and are responsible for meeting the physical, mental, and social needs of foster children (Ministry of Social Affairs, 2020). Vansteenkiste, Maarten, et al. (2013) explain that attachment to caregivers and adolescents is an important issue to be studied seriously in light of current identity development. Based on the consideration that achieving attachment is the basis for becoming a perfect adult in determining attitudes, making appropriate decisions, and being consistent in determining and implementing the principles of truth (Fleming, 2005) and goodness (Johnston, L.M., 2016).

Studies on developmental issues related to attachment in caregivers and adolescents are due to the fact that developmental phenomena in society, especially the culture of eastern societies such as Indonesia, are often misinterpreted. For example, attachment is sometimes interpreted as restraint because, in reality, teenagers who begin to develop attachment often begin by displaying behavior that is not in accordance with family rules (Steinberg, 1995). On the other hand, parents apparently want teenagers to have the potential to be independent, in fact, they hope that when they grow up, they will no longer be emotionally dependent on their parents.

In its development, the attachment scale continues to grow. However, there is still little development of tools to measure attachment between caregivers and adolescents in foster care. Therefore, in this study, an attempt was made to test the construct of the caregiver attachment scale with teenagers in orphanages. Many of the constructs or attributes measured in the fields of psychology and education are latent variables. Latent variables are constructs that cannot be observed or measured directly. Measuring a latent variable requires an operational definition of the construct or attribute being measured. The operational definition process is carried out by determining the dimensions, indicators, and item arrangement of the construct or attribute being measured (Fox, 2010).

Since 1960, there have been additional requirements for a test instrument to be said to be good, namely that the test items must be fair, where the test does not contain biased items or points (Cheng, Shao, & Lathrop, 2016). Items are said to be biased when they contain content or language that benefits or harms certain subgroups. When the test instrument used favors or disadvantages certain subgroups, the test contains item bias or differential item functioning, or what is abbreviated as DIF. DIF is an item characteristic that can cause the probability of respondents having the same ability but producing different probabilities of answering correctly. For example, the difficulty or ease of an item is

influenced by various factors, such as democratic factors consisting of ethnicity, culture, language, religion, or gender (Tutz & Schaunberger, 2013). DIF is important to test if there is doubt that two groups will not receive fair treatment even if they receive a stimulus in the form of the same item. With an in-depth methodological study of the caregiver attachment scale with institutionalized adolescents, a valid measuring tool will be produced.

1.1 Attachment

The term attachment was first put forward by a psychologist from England in 1958 named John Bowlby. John Bowlby (1907–1990), an English psychiatrist, explained that "maternal deprivation" or a lack of maternal love often causes anxiety, anger, delinquency, and depression. Then a more complete formulation was put forward by Mary Ainsworth in 1969 (McCartney and Dearing, 2002). Attachment is a strong emotional bond that children develop through interactions with people who have special meaning in their lives, usually parents (McCartney and Dearing, 2002).

Bowlby (Haditono et al., 1994) stated that this relationship will last quite a long time in the human life span, starting with the child's attachment to the mother or another figure who replaces the mother. This understanding is in line with what Ainsworth put forward regarding attachment. Ainsworth (Hetherington and Parke, 2001) said that attachment is an emotional bond that an individual forms with another person of a specific nature, binding them in a closeness that is eternal over time, a relationship that is supported by attachment behavior that is designed to maintain these relationships (Durkin, 1995).

The structure of internalization within individuals is determined by the experience of affective conditions with attachment figures. Confirms the existence of a form of subjective experience of emotional bonds and produces psychological responses. Bowlby believed that early behavior was biologically programmed. The baby's reaction in the form of crying, smiling, or sucking will bring about the mother's reaction and protection for the baby's needs. This process will improve the relationship between mother and child. On the other hand, babies are also prepared to respond to signs, sounds, and attention given by the mother. The result of this programmed biological response is that the child and mother will develop a mutually beneficial attachment relationship. Ethological theory also uses the term "psychological bonding,", namely the relationship or psychological bond between mother and child, which lasts throughout the life span and has connotations with social life (Bowlby, 1981).

According to John Bowlby, the pioneer who coined the term attachment in child development in the 1940s, attachment is warmth, intimacy, and a sustainable relationship between mother and child, and this relationship gives rise to satisfaction and happiness (Centre for Parenting & Research, 2006; Malekpour, 2007). Parents, in this case, caregivers, act as central figures in the adolescent development process.

Caregiver as a "secure base" for exploration (Bowlby, 1981). Adolescent exploration is greater when caregivers are present because of the attachment system. If the caregiver is responsive, stronger attachment behavior is shown, and conversely, if the caregiver is not responsive and open, attachment will be low or even disappear and cause emotional and mental problems.

Mental-emotional problems that are not resolved well will have a negative impact on the adolescent's development in the future, especially on character maturation, and trigger mental-emotional development disorders (Santrock, 2007). Figure 1 below confirms the concept of attachment in this research.
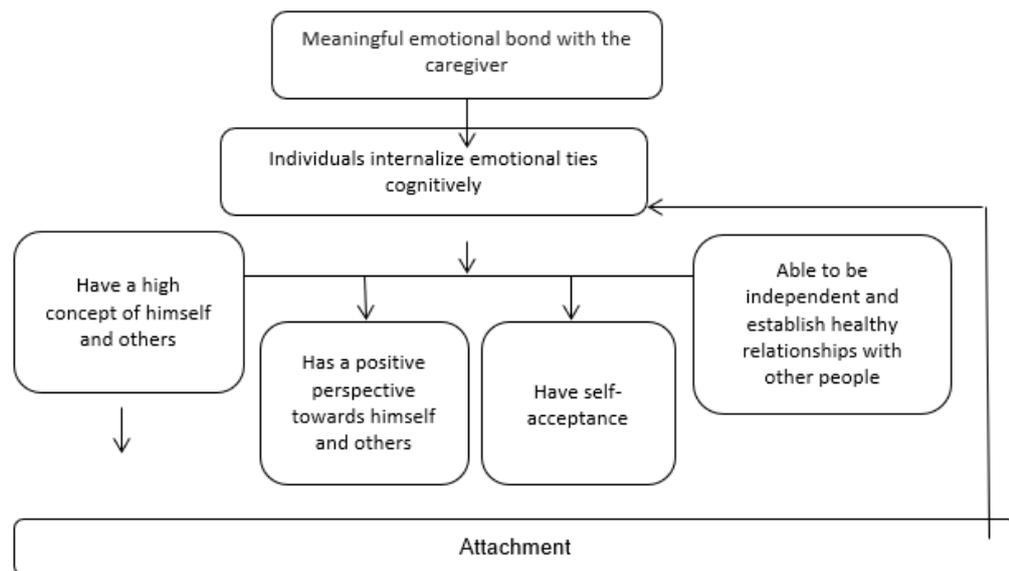
Figure 1. Attachment Concept

(Bowlby, 1981); (Hazar & Shaver, 1987)

1.2 Attachment Aspects

An affectionate bond in a person that is directed at certain people is called an attachment figure and lasts continuously. Every child develops an attachment to their parents or substitute parents. This attachment develops in the first year of a child's life and continues according to interactions between parents and children (Appleyard & Berlin, 2007).

Attachment to parents is measured based on the attachment dimensions in the Parent and Peer Attachment Inventory (IPPA), as has also been done by Guarnieri, Ponti, and Tani (2010). The indicators measured in aspects of the Inventory of Parent and Peer Attachment-Revised (IPPA) (Armsden and Greenberg, 2009) are:

1.	Trust, namely trust between children and parents, refers to a sense of mutual understanding and respect for the child's needs and desires.

2.	Communication, namely communication between children and parents, which refers to verbal communication and the involvement of children with their parents.

3.	Alienation, namely alienation from parents, refers to children's feelings of isolation, anger, and experiences of not being close to their parents. So, there are three aspects of attachment, namely trust, communication, and alienation.

1.3 Construct Validity Test with Confirmatory Factor Analysis (CFA)

Because of its "confirmatory" nature, CFA can be used to test the construct validity of a psychological or educational test or measuring instrument. With CFA, it can be confirmed to what extent all the items from the test actually measure or provide information about just one thing, namely what is being measured. As an illustration, suppose there is a "verbal ability" test that consists of 20 questions (items), which means "it is theorized that all 20 questions only measure one thing (factor)" namely "verbal ability". This means that if this theory is true, then the "one-factor model" should "fit" the data. One-factor models are also called "unidimensional models", and every measuring instrument must fulfill this principle. In a psychological measuring instrument, all items must measure only one thing, namely the construct to be measured. If one or some of the items measure something else, then that means the item is invalid.

Differential Item Functioning (DIF)

Since the 1960s, there have been additional requirements for items to be considered good, namely that the items must be fair. Testing to see whether the items act fairly or not is called differential item functioning (DIF) testing. Conceptually, DIF is said to appear on an item if test takers who have the same ability on the construct measured by the test and come from different groups have different probabilities of answering the item (Hulin, Drasgow & Parson, 1993; Woods, Oltmanns & Turkheimer, 2009; and Tutz & Schaunberger, 2013).

Differential item functioning (DIF) can be divided into two types, namely uniform DIF and nonuniform DIF (Scott et al., 2010). Uniform DIF occurs when an item shows the same DIF magnitude, even though the magnitude at the θ level is different. Meanwhile, non-uniform DIF shows different DIF magnitudes tested at different θ. Detection procedures must attempt to assess both uniform DIF and non-uniform DIF, although in practice not all methods can detect non-uniform DIF (Scott et al., 2010).

MIMIC Model

MIMIC Model Before detecting DIF on the Inventory of Parent and Peer Attachment-Revised (IPPA-R) measuring instrument, construct validity testing was first carried out in this study using the factor analysis method, namely confirmatory factor analysis (CFA) with a one-factor (first order) model. carried out to test the unidimensionality of the measuring instrument. After obtaining valid items through construct validity testing via CFA, the researcher will then carry out DIF detection using the MIMIC model approach on a set of valid items. Where there are covariates that will be tested for their influence on items proven to measure the Inventory of Parent and Peer Attachment-Revised (IPPA-R), The covariate referred to in this study is gender, which consists of two categories, namely men who are coded 0 and women who are coded 1. If the direct effect of gender gives significant results, then this indicates that DIF occurred in the items tested because there were significant differences between the male gender group when compared with the female gender group.

2. Methodology

Research Design

This research is non-experimental research with a quantitative approach. This is because this research did not manipulate or condition variables and did not treat the research participants, so the data obtained from the participants was based on ex post facto (Simon & Goes, 2013).

Population and Method of Sampling

The population in this study was all orphanage adolescents in Pekanbaru City, namely 1211 (Riau Province Social Service Data). The sampling in this research was carried out using a non-probability sampling method with convenience sampling techniques, where sampling was adjusted to the aims and objectives of the research. The samples in this study were teenagers from 12 orphanages.

Instrumentation

The measuring tool used in this research is the Inventory of Parent and Peer Attachment-Revised (IPPA-R), which was compiled by Gay Armsden and Mark T. Greenberg in 2004, then adapted into Indonesian and adapted to the context of this research. This measuring tool consists of three parts of the questionnaire, namely trust, communication, and relationship. The assessment procedure uses Likert's Rating Scale, which lists the selected categories. Each item provides five answer choices, namely Never, Rarely, Sometimes, Often, and Always.

3. Results and Discussion

3.1 Results

Researchers tested whether the 25 items were unidimensional, meaning they only measured attachment. From the results of the CFA analysis carried out with a one-factor model, it turned out that it was not fit, with Chi-square = 500.255, df = 252, P-value = 0.0000, and RMSEA value = 0.055. Therefore, the researcher made modifications to the model, where the error measurements on several items were free to correlate with each other, so a fit model was obtained with Chi-square = 413.186, df = 247, P-value = 0.0000, and RMSEA = 0.046. After obtaining an RMSEA value < 0.05, it can be stated that the model with one factor is acceptable. This means that all items only measure one factor, namely attachment. Then the author looks at whether the item measures the factor that is to be measured significantly and, at the same time, determines whether the item needs to be dropped or not. The test is carried out by looking at the z value for each factor loading coefficient.

Table 1. CFA 1st Order Factor Loadings

Item	Estimate	Standard Error	Z-Value	Information
1	0.392	0.059	6.655	Valid
2	0.547	0.046	11.773	Valid
3	0.454	0.061	7.463	Valid
4	0.004	0.072	0.062	Invalid
5	0.341	0.060	5.660	Valid
6	0.392	0.066	5.961	Valid
7	0.290	0.070	4.172	Valid
8	0.313	0.071	4.405	Valid
9	0.249	0.066	3.743	Valid
10	0.277	0.086	3.213	Valid
11	0.502	0.056	8.971	Valid
12	0.570	0.051	11.195	Valid
13	0.421	0.066	6.419	Valid
14	0.516	0.071	7.244	Valid
15	0.228	0.074	3.073	Valid
16	0.452	0.067	6.799	Valid
17	0.210	0.071	2.975	Valid
18	0.584	0.054	10.899	Valid
19	0.681	0.046	14.883	Valid
20	0.417	0.060	6.9	Valid
21	0.697	0.040	17.608	Valid
22	0.194	0.066	2.934	Valid
23	0.238	0.056	4.241	Valid

24	-0.001	0.066	-0.010	Invalid
25	0.321	0.051	4.324	Valid

The z value for the factor loading coefficients on 22 items is significant because z > 1.96, while two items, namely item 4 and item 24, are invalid because they do not meet the criteria. Next, the author looked at the factor loadings of the items to determine whether there were negative loadings or not, and it was discovered that there were items that had negative factor loadings, namely item 24. So, in the analysis that would be carried out to test the subsequent models in this research, these items were excluded because they are invalid. After obtaining 23 valid items through first-order CFA testing, the results showed that there were two invalid items, namely items 4 and 24. Next, the researcher will carry out DIF detection using the MIMIC model on a set of valid items. Testing is carried out by looking at the coefficients, which will be explained next.

Table 2. MIMIC Model Parameter Estimation Results

Item	Estimate	Standard Error	Z-Value	Information
1	0.389	0.059	6.590	Valid
2	0.545	0.046	11.769	Valid
3	0.452	0.061	7.433	Valid
4	0.288	0.063	4.555	Valid
5	0.394	0.065	6.053	Valid
6	0.315	0.070	4.288	Valid
7	0.252	0.071	4.444	Valid
8	0.275	0.066	3.818	Valid
9	0.499	0.087	3.182	Valid
10	0.563	0.056	8.891	Valid
11	0.425	0.051	10.985	Valid
12	0.515	0.065	6.508	Valid
13	0.235	0.071	7.292	Valid
14	0.453	0.075	3.154	Valid
15	0.210	0.066	6.852	Valid
16	0.588	0.071	2.973	Valid
17	0.681	0.054	10.895	Valid
18	0.421	0.045	15.189	Valid
19	0.697	0.060	7.079	Valid
20	0.216	0.040	17.581	Valid
21	0.129	0.066	3.299	Valid
22	0.361	0.061	2.107	Valid
23	0.445	0.123	3.47	Valid

From the results of the simultaneous analysis, there are fundamental differences in the MIMIC model when compared with the two previous models. In this model, there are covariates that will be tested for their influence on items proven to measure attachment in

adolescents. The covariate in question is gender, which consists of two categories, namely men who are coded 0 and women who are coded 1. If the direct effect of gender gives significant results, then this indicates that DIF occurred in the items tested because there are significant differences between the male gender groups. when compared with the female gender group.

The estimation method used in the MIMIC model is the robust maximum likelihood (MLR) estimation method, which will produce estimation results with robust model fit indices. What is meant by robust is that this estimation method can still function well even if basic assumptions are violated, and then this method produces model fit indices that are much better and corrected. Based on the table above, information on the significance of each item is obtained from the MIMIC model, which is theorized to measure one factor, namely attachment, so that after proving it using the first-order model described previously, attachment can have its variance constant set to 1 to test whether gender is the only one. The reason for the variation in existing items is that this aims to test DIF, and the test results are explained in the table below:

Table 3. DIF Testing with the MIMIC Model on Attachments

Item	Estimate	Standard Error	Z-Value	P-Value
Attachment ON Gender R2 = 0.018, p=0.000				
Attachment ON Gender	0.343	0.045	7,581	0.000
Item 7 ON Gender	0.137	0.052	2.623	0.000
Item 8 ON Gender	0.309	0.041	7.449	0.000

Based on table 3, there are 2 items that contain DIF, namely items 5 and 23. The test criteria are based on looking at the estimation results obtained by creating a model where there is a direct effect of gender on each item. Significant estimation results indicate that the item functions differently between male and female groups; in other words, the item contains DIF. Then looking at the direct influence of gender on the latent variable attachment, there is a significant influence with a significant amount of $R^2 = 0.018$ and a regression coefficient of 0.343, which is significant in a positive direction, which means there is a mean difference between men and women in the context of responding to attachment items.

The analysis of items containing DIF does not stop here; one by one, the items containing DIF need to be content analyzed to get an idea of how these items can function differently between two different gender groups. Based on table 3, gender has a significant positive influence (0.137, p = 0.009) on item 5, which implies that women tend to have higher scores compared to men. Apart from that, gender also has a significant positive influence (0.309, p = 0.000) on item 23. This means that female participants tend to have higher scores than men, where women are more likely to feel a high attachment to their caregivers when compared to teenage boys.

3.2 Discussion

This research illustrates how the MIMIC model detects DIF in one of the attachment measuring tools, namely the Inventory of Parent and Peer Attachment-Revised (IPPA-R). In this study, the results showed that female adolescents were more attached to their caregivers compared to male adolescents. This difference in attachment to caregivers between adolescent girls and boys can be influenced by emotional and intellectual differences between boys and girls. Indonesian culture, which places more emphasis on women being able to love, care for, and be more responsible for their family, makes parents instill boundaries in adolescent girls (Monks, Knoers, & Hadinoto, 2014).

This research also found that attachment to parents in early and middle adolescence was no different. This is because when someone enters adolescence, they have gained a number of experiences and undergone a series of developments. Individuals experience changes, including socio-emotional changes where individuals begin to demand independence, conflict with parents, and spend more time with peers (Santrock, 2007).

The results in this study also show how the MIMIC model is effective and practical to use to detect DIF because parameter estimation in the measurement model was not carried out in each group. However, covariates are included in the CFA model, where the covariates in this study are nominal variables that describe known group levels (for example, gender: 0 = male, 1 = female). This is in line with previous research conducted by Gallo, Anthony, and Muthen (2004), which stated that the MIMIC model tends to be practical to use in detecting specific DIF at the item level. Furthermore, research conducted by Finch (2005) and Woods (2009) also proved the same thing: that the MIMIC model is an effective way or method for detecting DIF at the item level.

4. Conclusion

Based on the explanation of the results of this research, it can be concluded that:

1.   The results of the first-order CFA on the attachment tool contained 23 items that were suitable for measuring attachment.

2.   Based on the detection of differential item functioning (DIF) using the multiple indicator multiple causes (MIMIC) model approach, there are two items that contain DIF, namely item 7 and item 8.

3.   Based on the results of the research that has been conducted, it can be concluded that there are differences in attachment to caregivers among adolescents in terms of gender.

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