INCREASING EFFECTIVENESS OF NUMBER
HEAD TOGETHER (NHT) MODEL THROUGH
INTEGRATION OF MULTIPLE INTELLIGENCES
THEORY IN CHEMISTRY LESSON

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Abstract. This study aimed to improve the effectiveness of cooperative learning model which
tends to be conventional as Number Head Together (NHT), through the integration of
Multiple Intelligences (MI) theory in the syntax. The study was conducted by using a quasy
experimental design. Experimental group used NHT-based on MI model , while control
group used NHT model. The data of students’ achievement were analyzed by t test, while
the data of students’ multiple intelligences, especially interpersonal intelligence, were
analyzed by using chi-square. The results showed that integration of Multiple Intelligences
theory in chemistry lesson improves the effectiveness of NHT model, with the following
indicators. (1) Compared to the control group, interpersonal intelligence of students in
experimental group develops better. Students’ interpersonal intelligence in experimental
group increased by 25%. (2) Students in experimental group reach higher achievement.
Students’ achievement increased by 48.63%.

Keywords: Multiple Intelligences, Interpersonal intelligence, NHT model, chemistry.

I. INTRODUCTION

Many people assume that the IQ (intelligence quotient) is a decisive factor in the success of
learning and someone’s life (Suparno, 2004). The results showed that in reality the statement is not
always true. The study conducted by Hidayani in SMK Ardjuna 1 Malang (2007) found a significant
relationship between emotional quotient (EQ) as well as spiritual quotient (SQ) and student achievement.
Thus, it was realized that although very important, IQ is not everything. Other factors such as emotional
quotient (EQ) and spiritual quotient (SQ) also have an important role in determining someone’s success.

According to Gardner (1983), IQ measurement only emphasize logical-mathematical and
linguistic intelligences, whereas it is found that at least eight intelligences exists in every person, namely
(1) verbal linguistic, (2) mathematical logic, (3) visual spatial, (4) musical, (5) kinesthetic (6)
interpersonal, (7) intrapersonal, and (8) naturalistic.

Moreover, the teaching system in schools just put intelligence models that emphasize
mathematical logic and linguistic. Teachers teach with a rational approach applying logical-mathematical
intelligence, and explain all the lesson materials with the lecture method that is more relevance with
linguistic intelligence. Consequently, it will benefit students who have a dominant logical-mathematical
intelligence and linguistics, but it does not help students who have other dominant intelligences. Whereas,
according to Gardner (1983), students need to be helped to develop all of their multiple intelligences -not
only logical mathematical and linguistic- by integrating multiple intelligences theory in learning process.

Lwin (2008) stated that one kind of intelligences that plays an important role in the someone’s
success is interpersonal intelligence. A person who has interpersonal intelligence usually easy to adapt,
success in work, and have a good emotion. In one study, researchers of the Harvard Business Review
found that the winner of the best achievements in the AT & T Bell Labs, a community of smart engineers
in New Jersey, not the one who has the highest IQ, but the one who collaborate easily with others, and
popular among his/her friends. Then, in a study conducted on a number of Fortune 500 companies by
scientists behaviorists Morgan McCall and Michael Lombardo disclosed that, the most important factor in determining the success or failure of an executive is the ability to connect, understand and cooperate with others. Actually, 80 percent of those who fail in the workplace, due to poor social skills (Lwin, 2008). Therefore, learning process should also be directed to improve interpersonal intelligence.

Learning model that supports the development of interpersonal intelligence is cooperative learning. Cooperative learning is very conducive to develop interpersonal intelligence because it can develop relationships among students of different ethnic backgrounds and different religions, and between students who are academically fall behind their classmates (Slavin, 2008).

This model can also be applied to all types of classes such as special classes for gifted children, special education classes, classes with an average level of intelligence, and is indispensable in heterogeneous classes with different levels of ability. Besides, cooperative learning can also be applied to a variety of subjects such as math, language, social studies, biology, physics, and chemistry.

Cooperative learning applied to chemistry lesson is intended not only to develop interpersonal intelligence, but also to solve the classic problem in chemistry learning, such as the lack of students understanding due to the characteristics of chemistry concepts. Concepts in chemistry consist of macroscopic, microscopic and symbolic level concept. To understand the chemistry concepts well students must understand the aspect of macroscopic, microscopic and symbolic level of the concept.

In addition to improve learning outcomes, in line with Gardner's theory of multiple intelligences, learning chemistry should also be a medium to improve students’ intelligence. In this study, Number Head Together (NHT) was selected as a learning model that is expected not only to improve students’ learning outcomes, but also develop students intelligence, especially interpersonal intelligence.

NHT learning model is part of a cooperative model. This model is the kind of cooperative learning designed to affect the pattern of student interaction, as well as to involve more students in studying the subject matter and check their understanding of the lesson material (Trianto, 2009). The syntax of NHT model is quite simple. Integration MI theory in the syntax of NHT model is intended to improve the effectiveness of NHT model.

So far, research on the development of NHT learning model to improve student learning outcomes have often conducted, but the research that is specifically study the development of multiple intelligences has not been conducted yet. Based on the research in eleventh grade of Junior high school students in Balikpapan conducted by Handayani (2007), it was reported that by using cooperative learning, students multiple intelligences can be increased. NHT learning model has also been implemented by Wijayati (2008) and Adriyani (2010) in chemistry and the researches found that implementation of NHT model was able to improve students’ learning outcomes. Based on the background and the preview researches, this study investigated the effect of integration Multiple Intelligences theory on NHT learning model toward the development of interpersonal intelligence and learning outcomes of students on chemistry.

II. METHODS

The method used in this study was a quasi-experimental design by applying nonequivalent pretest-posttest control group design. Control group consisted of 33 students and experimental group consisted of 32 students of MAN 2 Banjarmasin South Kalimantan. Experimental group conducted chemistry lesson by integrating MI theory in NHT model, while control group learnt chemistry by applying NHT model without integrating MI theory. The sample was selected by using cluster random sampling technique. The data was taken by multiple intelligence test developed by Armstrong (2004), and McLelland & County (2008) and achievement test. Salt hydrolysis was the lesson material being taught in this study. The differences of multiple intelligences data of both groups were tested using chi-square, while the difference of students’ achievement on chemistry was tested using the independent t-test.

III. RESULTS

The Development of Multiple Intelligences

The development of students’ multiple intelligences before and after learning can be seen on Table 1 as follows.
Table 1. Students Intelligences Before and After Learning

<table>
<thead>
<tr>
<th>Intelligences</th>
<th>Control Group</th>
<th></th>
<th></th>
<th>Experimental Group</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number Before</td>
<td>% Before</td>
<td>Number After</td>
<td>Number Before</td>
<td>% After</td>
<td>Number Before</td>
</tr>
<tr>
<td>Linguistic</td>
<td>12</td>
<td>36,4</td>
<td>19</td>
<td>21</td>
<td>59,4</td>
<td>65,6</td>
</tr>
<tr>
<td>Mathematical</td>
<td>10</td>
<td>30,3</td>
<td>3</td>
<td>4</td>
<td>9,4</td>
<td>12,5</td>
</tr>
<tr>
<td>Musical</td>
<td>20</td>
<td>60,6</td>
<td>14</td>
<td>21</td>
<td>43,8</td>
<td>65,6</td>
</tr>
<tr>
<td>Visual spatial</td>
<td>1</td>
<td>3,0</td>
<td>8</td>
<td>12</td>
<td>35,7</td>
<td></td>
</tr>
<tr>
<td>Kinesthetic</td>
<td>27</td>
<td>81,8</td>
<td>25</td>
<td>25</td>
<td>78,1</td>
<td>78,1</td>
</tr>
<tr>
<td>Interpersonal</td>
<td>26</td>
<td>78,8</td>
<td>12</td>
<td>12</td>
<td>37,5</td>
<td>37,5</td>
</tr>
<tr>
<td>Intrapersonal</td>
<td>32</td>
<td>97,0</td>
<td>30</td>
<td>30</td>
<td>93,8</td>
<td>93,8</td>
</tr>
<tr>
<td>Naturalistic</td>
<td>20</td>
<td>60,6</td>
<td>17</td>
<td>24</td>
<td>53,1</td>
<td>75,0</td>
</tr>
</tbody>
</table>

The development of multiple intelligences is also followed by the development of students' dominant intelligence in some types of multiple intelligences. The distribution of the dominant intelligence of students can be seen in Table 2 below.

Table 2. The Distribution of Students’ Dominant Intelligences in Control and Experimental Groups

<table>
<thead>
<tr>
<th>No</th>
<th>Intelligences</th>
<th>Before</th>
<th></th>
<th></th>
<th>After</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>Experiment</td>
<td>Control</td>
<td>Experiment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Σ</td>
<td>%</td>
<td>Σ</td>
<td>%</td>
<td>Σ</td>
<td>%</td>
</tr>
<tr>
<td>1</td>
<td>Linguistic</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3,125</td>
</tr>
<tr>
<td>2</td>
<td>Matematic</td>
<td>1</td>
<td>3,03</td>
<td>1</td>
<td>3,125</td>
<td>1</td>
<td>3,03</td>
</tr>
<tr>
<td>3</td>
<td>Musical</td>
<td>4</td>
<td>12,12</td>
<td>1</td>
<td>3,125</td>
<td>2</td>
<td>6,06</td>
</tr>
<tr>
<td>4</td>
<td>Visual-spatial</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>9,75</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>Kinesthetic</td>
<td>2</td>
<td>6,06</td>
<td>6</td>
<td>18,75</td>
<td>3</td>
<td>9,09</td>
</tr>
<tr>
<td>6</td>
<td>Interpersonal</td>
<td>5</td>
<td>15,15</td>
<td>2</td>
<td>6,25</td>
<td>10</td>
<td>30,3</td>
</tr>
<tr>
<td>7</td>
<td>Intrapersonal</td>
<td>17</td>
<td>51,52</td>
<td>15</td>
<td>46,875</td>
<td>16</td>
<td>48,48</td>
</tr>
<tr>
<td>8</td>
<td>Naturalistic</td>
<td>4</td>
<td>12,12</td>
<td>4</td>
<td>12,5</td>
<td>1</td>
<td>3,03</td>
</tr>
</tbody>
</table>

Table 2 shows that the intelligences of control group develop around 15.15%, while in experimental group, students’ intelligences improve around 25%. Based on the result of normality and homogeneity test of the data it can be concluded that students’ multiple intelligences data were homogeneity but not normally distributed. Therefore, the differences of both groups were tested by chi-square.

Table 3. The Result of Chi-square Test of Experimental and Control Groups

<table>
<thead>
<tr>
<th></th>
<th>EXPERIMENT</th>
<th>CONTROL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-Square</td>
<td>14.500</td>
<td>18.121</td>
</tr>
<tr>
<td>df</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Asymp. Sig.</td>
<td>.013</td>
<td>.006</td>
</tr>
</tbody>
</table>

CE-3
It can be assumed from the Table 3 that asymp.Sig of experimental group is 0.013 < 0.05, so that Ho is rejected. It means that the difference of students’ interpersonal intelligences in experimental and control groups exists. In the other word, interpersonal intelligences of students who learn chemistry by using NHT based on MI model different from NHT model only.

**Students’ Achievement**

The data of students’ achievement before and after implementation of the learning model can be seen as follows.

**Table 4** Means and Standard Deviation of Students’ Achievement

<table>
<thead>
<tr>
<th></th>
<th>Experimental Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>Lowest Score</td>
<td>15</td>
<td>60</td>
</tr>
<tr>
<td>Highest score</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>Mean</td>
<td>35,47</td>
<td>83,4</td>
</tr>
<tr>
<td>Std Deviation (S)</td>
<td>11,48</td>
<td>10,18</td>
</tr>
</tbody>
</table>

The result of the t-test of post-test data from both groups can be seen on Table 5 below.

**Table 5. The Result of t-test**

<table>
<thead>
<tr>
<th>Type of Data</th>
<th>N</th>
<th>$\bar{X}$</th>
<th>Varian</th>
<th>$t_{hit}$</th>
<th>$t_{Table}(\alpha = 0.05)$</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>32</td>
<td>76.67</td>
<td>107,16</td>
<td>2,22</td>
<td>2,00</td>
<td>Significant different</td>
</tr>
<tr>
<td>Control</td>
<td>33</td>
<td>68,10</td>
<td>80,73</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on the calculation of t-test it can be assumed that H0 was rejected. On the other word, it can be said that there is a significant difference between the experimental and control group shown by $t_{cal}$ > $t_{table}$ (2,22 > 2,00 with db = 63 and $\alpha = 0.05$).

**IV. DISCUSSION**

Viewed from multiple intelligences test result, the development of student intelligence was happened, both in the control and experimental groups before and after learning. The following diagram illustrates multiple intelligences percentage scores of the control and experimental groups before and after implementation of the model.
Figure 1 and 2 above show that interpersonal intelligence of both groups were increased, but the increase of experimental group is higher than control group. It’s supposed to be happened because both of class applied cooperative learning model which make students actively learn.

Then, based on the distribution of 4 dominant intelligences determined by the highest score, the development of dominant intelligences of students in both classes before and after learning activity distributed among all types of intelligences. It can be seen in Figures 3 and 4 as follows.
Figure 3 and 4 show that the number of students who have interpersonal intelligence increased after being given the treatment, both in control and experiment groups. However, the number of students who increase in experimental group is higher than control group. It means that the integration of MI theory in NHT model are more effective to increased student interpersonal intelligence than NHT model only. It’s accordance with research conducted by Wahyudi (2011) which found that integration of interpersonal activities in learning increased students’ interpersonal intelligence.

Nevertheless, the development of students’ interpersonal intelligences is not big enough, considering this research only carried out for 2 weeks. While the research of Posciak and Settles (2007) found that to develop student dominant intelligence takes about 10 weeks.

The result found that the development of students’ interpersonal intelligence happened both in control and experimental groups, but experimental group develop higher. It also proves that the improvement of students’ interpersonal intelligence not only due to integration of MI theory in NHT model but also because of implementation of cooperative learning model. It accords with research conducted by
Handayani (2007) which found that implementation of cooperative learning improves students multiple intelligences, especially interpersonal intelligence.

Viewed from students’ achievement, the improvement of control class (48,4) is almost the same with experimental class (48,6). It can be argued that the integration of MI theory in NHT model helps students in mastering material of Salt Hydrolysis, although the differences are relatively small.

The improvement of students’ achievement on both groups due to learning activities who let students to discuss difficult concepts of the lesson materials. Yet, unlike the control group, students in experimental group were given more opportunities to interact each other through learning activities which is integrated with MI theory such as chain messages, forming groups based on the same dominant intelligence. That’s why students’ mastery concept and interpersonal intelligences of experimental group improve better.

Indeed, integration of MI theory in NHT model was conducted by modifying the syntax of NHT, such as making chain messages relates to the material that will be taught at the initial stage. In this stage, 6-8 students are asked to stand up in front of the class and deliver the message chain, with the following statement:

"The salt formed from a weak acid and weak base is totally hydolized. The nature of this solution depends on the relative strengths of acids (Ka) and alkaline (Kb)"

This activity will be considered successful if the message read by the last students is correct. Another modification of the syntax was conducted in division of the group by considering various dominant intelligence and students’ learning outcomes. Similarly, in the presentation of material phase, teacher asks students who understand better to tutoring another student. It is a kind of teaching strategy in multiple intelligences, where students trying to teach the lesson material to others need to be more actively communicate each others. By doing these activities, at the same time students’ achievement as well as interpersonal intelligences improve better. It shows that integration of Multiple Intelligences theory in Number Head Together (NHT) model increases the effectiveness of NHT model proven by the improvement of students’ interpersonal intelligence and concept mastery.

V. CONCLUSION

Based on the research, it can be concluded that integration of Multiple Intelligences theory in chemistry lesson improves the effectiveness of NHT model, with the following indicators.

(1) Compared to the control group, interpersonal intelligence of students in experimental group develops better. Students’ interpersonal intelligence in experimental group who learn chemistry by NHT-based on MI model increased by 25%.

(2) Learning outcome of both groups is almost the same, but compared to the control group, learning outcome of experimental group students who learn chemistry by NHT based on MI model was slightly higher. Students’ achievement of experimental group increased by 48,6%, while control group increased by 48,4%.
REFERENCES


