The Difference of The Enhancement of Students’ Mathematical Disposition as an Impact of ARCS-based Learning Model and Conventional Approach

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Abstract This study aims to identify the enhancement of Students’ Mathematical Disposition as an impact of ARCS-Based Learning Model approach. The learning model based on Attention, Relevance, Confidence and Satisfaction (ARCS) theory. This study is a quasi experimental study. The study sample consisted of 76 students from 2 classes mathematics in the seventh semester in Universitas Negeri Medan. Instrument used in this study is mathematical disposition scale. Data were analyzed using Mann Withney, ttest, correlation analysis, one way and two way ANOVA followed by posthoc test. The result showed that the enhancement of students disposition of high initial ability group is significantly higher than middle and low initial ability group. This shows that ARCS-Based Learning Model provides the highest enhancement of students’ mathematical disposition in the high initial ability group compared to the middle and low ones. Overall, based on students initial ability, ARCS-Based Learning Model approach is significantly able to enhance students’ mathematical disposition.

Keywords: ARCS-based learning model, students’ mathematical disposition.

1. Introduction
At the end of every exam, there is always a problem of students’ lack of confidence in their own abilities. When facing the exam, students are very anxious, especially in mathematics. Students have no confidence. They trust answers that they get instantly from texts or other unusual ways more than themselves. This indication can be seen by number of leaks and dishonesty of students in each exam. Some students are not sure they can successfully learn mathematics. Mathematics disposition is an attitude and tendency that shows interest in mathematics, confidence to solve mathematics problems, dare to communicate ideas, and have perseverance to do mathematics tasks. [1] stated that mathematical disposition is an attraction towards mathematics, self-confidence, pleased by mathematics, and diligently working on mathematics tasks. Mathematical disposition is very important since it can develop self-confidence and improve students’ achievement motives. This is in accordance with opinions by [2-6] that essentially said that from affective aspect, having mathematical power and disposition and high mathematical reading abilities give students opportunity to develop self-confidence, increase achievement motives, appreciate the beauty and regularity of mathematics and respect different rational reasons.

Furthermore, [7-9] stated, developing mathematical power, disposition and reading abilities become increasingly important when connected with demands of science and technology progress and more competitive atmosphere of graduates at every school level. In NCTM (1989), there are 10
curriculum standards and evaluations for school mathematics. One standard that must be fulfilled is mathematical disposition. To assess students’ mathematical disposition can be done through a questionnaire that traces information about students’ attitudes regarding following matters:

a) Show self-confidence in learning mathematics (Confidence)
b) Show perseverance in solving mathematical problems (Perseverance)
c) Show flexibility in exploring mathematical ideas (Flexibility)
d) Show high curiosity in learning mathematics (Curiosity, Interest)
e) Able to apply mathematics in daily life (Application)
f) Do reflection to monitor mathematics learning (Reflection)
g) Show cooperative attitude and respect for others in learning mathematics (Appreciation)

[10] essentially stated that more than 50% students see mathematics an uninteresting memorization lessons. Moreover, [11] said most students don’t like mathematics and 40% of them feel frustrated. Meanwhile, [12] stated that students show high motivation learning mathematics if they use computer so they can enjoy learning situation with excitement. This condition shows well-designed learning methods can enhance students’ mathematical disposition. Based on those opinions above, learning method seems to hold significant role to improve students’ mathematical disposition. Therefore, perhaps, ARCS based learning model approach could be applied to enhance students’ mathematical disposition.

2. Method

2.1 Research Design
This study is a quasi-experiment research using pretest-posttest control group design. The research design is:

\[
\begin{align*}
O_1 & \quad X_1 & \quad O_2 \\
O_1 & \quad X_2 & \quad O_2
\end{align*}
\]

\(X_1\) is learning process using ARCS based learning model
\(X_2\) is conventional approach
\(O_1\) is initial mathematical disposition
\(O_2\) is end mathematical disposition

Linier model of this research is:

\[Y_{ijk} = \tau + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \epsilon_{ijk}; \quad i = 1, 2, 3; \quad j = 1, 2; \quad k = 1, 2, ..., 76.\]

\(Y_{ijk}\) = k student’s mathematics disposition score, in i-th IMA, with j-th learning model.
\(\tau\) = mathematics disposition average score (without treatment)
\(\alpha_i\) = additive effect of i-th IMA
\(\beta_j\) = additive effect of j-th learning model
\((\alpha\beta)_{ij}\) = interaction effect of i-th IMA and j-th learning model
\(\epsilon_{ijk}\) = effect of experimental deviation from the score of k-th student, in i-th IMA, with j-th learning model.

Statistic hypotheses that will be tested are:

\(H_0: \alpha_1 = \alpha_2 = \alpha_3 = 0\) \quad opponent
\(H_1:\) one of \(\alpha_i \neq 0; \quad i = 1, 2, 3\)
\(H_0: \beta_1 = \beta_2 = 0\) \quad opponent
\(H_1:\) one of \(\beta_i \neq 0; \quad i = 1, 2, 3\)
\(H_0: (\alpha\beta)_{ij} = 0\) \quad opponent

\(H_1:\) at least one pair of: \((\alpha\beta)_{ij} \neq 0; \quad i = 1, 2, 3; \quad j = 1, 2\)

2.2 Population and Sample
Population of this research is 6 classes mathematics students in the seventh semester in Universitas Negeri Medan, while sample of this research is two classes in the seventh semester.

3. Result and Discussions

Analysis data in this research was comparing N-gain of students’ mathematical disposition from experiment class and N-gain of students’ mathematical disposition from control class using analysis of variants. Post Hoc Test was done to identify which pair of IMA affected student’s mathematical disposition the most. Data processing was done using SPSS program 17.0 version. Table 1 shows that average score of students’ mathematical disposition before ARCS based learning model and conventional learning (CL) applied is relatively similar, but after the learning is done, there are various enhancement of student’s mathematical disposition. Those variations can be seen from average score of N-gain (5th column).

**Table 1.** Initial score, final score and enhancement of students’ mathematical disposition (SMD) of two learning approaches

| Class | Learning approach | Initial Mathematics Ability (IMA) | Average of students’ Mathematical disposition (SMD) | Significance |
|-------|-------------------|----------------------------------|----------------------------------------------|--------------|
|       |                   | Initial | Final | N-Gain |                          |              |
| B     | ARCS              | High    | 96,19 | 109,17 | 0,21                      | significant  |
|       |                   | Medium  | 94,95 | 106,87 | 0,18                      | significant  |
|       |                   | Low     | 93,83 | 104,80 | 0,17                      | significant  |
| C     | Conventional learning | High  | 95,89 | 101,67 | 0,09                      | significant  |
|       |                   | Medium  | 93,69 | 99,78  | 0,09                      | significant  |
|       |                   | Low     | 90,57 | 100,43 | 0,11                      | significant  |

ARCS is learning model approach based on Attention, Relevance, Confidence and Satisfaction

IMA is initial mathematics ability

Based on the results of the research stated above shows that the application of ARCS learning model can improve students’ mathematical disposition. The ARCS learning model is a learning model that provides opportunities for students to discuss and exchange ideas with their coworkers to find solutions to problems that are given with guidance received from the lecturer. ARCS learning model is a method where students determine for themselves what information they can receive from a problem. Table 2 shows differences and interaction between learning approaches and initial mathematics ability towards enhancement of students’ mathematical disposition.

**Table 2.** Differences and interaction between learning approaches and initial mathematics ability (IMA) towards enhancement students’ mathematical disposition

| Sources of variation | Number of squares | df | Average of squares | F   | Sig  | Decision |
|----------------------|-------------------|----|--------------------|-----|------|----------|
| Learning approaches   | 0,377             | 1  | 0,377              | 17,37 | 0,00 | H0 rejected |
| IMA                  | 0,015             | 2  | 0,0075             | 0,345 | 0,160 | H0 accepted |
| Interaction          | 0,017             | 2  | 0,0085             | 0,391 | 0,127 | H0 accepted |
| Error                | 1,50              | 69 | 0,027              |      |      |           |
| Total                | 6,28              | 75 |                    |      |      |           |

In table 2, it can be seen that there are significant differences of enhancement of students’ mathematical disposition based on the learning approaches. It means that ARCS approach provides a more significant enhancement of students’ mathematical disposition than the other approach. But, the
enhancement is not significantly different considered from initial mathematics ability (IMA) and interaction between them. In other words, learning approaches offer an effect towards the enhancement of students’ mathematical disposition, meanwhile initial mathematics ability (IMA) and interaction between learning approaches and initial mathematics ability (IMA) don’t offer a significant enhancement. Figure 1 shows the difference average score of enhancement of students’ mathematical disposition taught by ARCS approach and Conventional Learning (CL).

![Figure 1. The difference average score of enhancement of students’ mathematical disposition based on interaction between groups of IMA and learning approach (CL).]

The enhancement of students’ mathematical disposition is higher on high level of IMA compare to medium or low ones. It shows that ARCS approach offers the highest improvement on high level IMA students. To find out the pair of most dominant groups of IMA (high, medium, low) towards the enhancement, we used the post hoc test using two ways ANOVA. Summary of the result can be seen in table 4. From table 3, it can be seen that probability score (sig) for the difference of the enhancement of high and medium level IMA students are 0.072, lower than 0.5, so it can be concluded that $H_0$ is rejected.

| Between The Groups Of IMA | Difference of Average | Deviation Standard | Sig   | Decision |
|---------------------------|-----------------------|--------------------|-------|----------|
| High – Medium             | 0.072                 | 0.020              | 0.001 | $H_0$ rejected |
| High – Low                | 0.074                 | 0.031              | 0.017 | $H_0$ rejected |
| Medium – Low              | 0.002                 | 0.026              | 0.931 | $H_0$ accepted |

$H_0$: there is no significant difference of enhancement of students’ mathematical disposition between groups of IMA

The rejection of $H_0$ also happens between high – low level of IMA. It means that there is significant difference of enhancement of students’ mathematical disposition between high – medium level of IMA and also between high – low level of IMA. Meanwhile between medium – low level of IMA there is no significant difference.

Based on the results of the research stated above shows that the application of ARCS learning model can improve students’ mathematical disposition. The ARCS learning model is a learning model that provides opportunities for students to discuss and exchange ideas with their coworkers to find solutions to problems that are given with guidance received from the teacher. ARCS learning model is a method where students determine for themselves what information they can receive from a problem. To strengthen the results of the study, researchers compared with relevant previous research conducted by [13-16], "draws the conclusion that the ARCS method can improve the quality of science learning materials mathematical statistics. The application of ARCS learning model can improve students'
mathematical disposition. This is evidenced by [17-22], the achievement of students’ mathematical disposition in natural science subjects.

Based on the description above, it can be concluded that the ARCS learning model is an alternative that can be used in improving students’ mathematical disposition, especially the material mathematical statistics in a class mathematics in the seventh semester. Because the indicators of success in this study have been achieved, the objectives of this study have been reached. Thus based on the results of observations and tests of students mathematical disposition it can be concluded that the application of ARCS models can improve students’ mathematical disposition on the material mathematical statistics [23].

4. Conclusion
Based on the result and discussion described above, it can be concluded that the learning process using ARCS approach can enhance students’ mathematical disposition overall, either based on class category or students’ initial mathematics ability. Besides that, learning with ARCS approach offers a very significant effect towards the enhancement of students’ mathematical disposition.

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