

Multiple Intelligences In The Classroom

(The Development of Chemistry Learning Devices Using Collaborative Strategy based on Multiple Intelligences)

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Abstract—“Based on Gardner's multiple intelligence theory, each student has the unique and distinctive intelligences that make him/her are different one from another. Students will learn more easily if learning activities are in accordance with their respective intelligence. This study aims to develop the chemistry learning devices which are valid, practical and effective for improving students' multiple intelligence on Hydrocarbon material using collaborative strategy based on multiple intelligences. This study is a Research & Developmental research (R & D) using 4-D model. The subjects were 35 students at SMAN 10 Banjarmasin. The data were collected by questionnaires and multiple intelligence tests. The results of the research showed that (1) based on expert and student's readability test, the learning devices are valid, (2) based on the practicality test, consisting of chemistry teacher convenience using the lesson plan, student book and student worksheets as well as the ease of the students follow the learning activities, the learning devices are practical, and (3) the learning devices are effective viewed by the improvement of students' multiple intelligence after learning, especially on linguistic, visual-spatial, and interpersonal intelligence in the classroom. It was found that Collaborative strategy combined with Multiple Intelligence is effective to improve students' multiple intelligences. Based on the results, it can be concluded that the developed learning devices are valid, practical, and effective to improve students' multiple intelligences.

Keywords— *learning device, collaborative, multiple intelligence*

I. INTRODUCTION

There has been a change of learning paradigm from the process of knowledge transfer by teacher to student, becoming effort of teacher to fulfill requirement of various students. Awareness of the diverse characteristics of students in the classroom, both in terms of learning style and the type of intelligence [1] makes learning more personal than classical. According to [1], everyone has eight different intelligences, logical-mathematical, kinetic, linguistic, musical, visual-spatial, interpersonal, intrapersonal, and naturalistic intelligences, known as multiple intelligences. Based on the theory of multiple intelligences, each student has a unique and distinctive intelligence, which makes them different from

others. Based on the theory, students will learn more easily if the learning activities are in accordance with their respective intelligence. The theory of multiple intelligences is relevant to current education policies that focus on the learning process that meets the needs and characteristics of students. Therefore, the theory of multiple intelligences should be applied to learning because it corresponds to differences in characteristics and can maximize student learning potential.

According to [2], there are at least three important roles of education in developing intelligence. First, education recognizes the intelligence of each learner early. Second, an educational service model appropriate to that intelligence is provided by education. Third, education plays role to hone and develop the intelligence of all learners optimally. Based on this opinion, the theory of multiple intelligences seems appropriate to apply together with collaborative strategies. Collaborative strategies not only take into account the potential of each individual, but also prioritize classical cooperation.

Studies that demonstrate the advantages of collaborative strategies and multiple intelligences have been previously conducted. Ref [3] [4] found that the application of multiple intelligences improves student learning outcomes. Research by [5] showed that the longer the application of multiple intelligences in the classroom is, the higher the increase of student learning outcomes is. Research by [6] suggested that collaborative learning enhances critical thinking skills. Similarly, research conducted by [7] and [8] found that collaborative learning improves student learning outcomes and activities.

Research that specifically combines collaborative strategies and multiple intelligences in chemistry classroom has never been previously conducted, so learning devices (lesson plan and students worksheets) that combine these two strategies do not exist yet. Chemistry, that has special characteristics consisting of abstract concepts, mathematical calculation, and symbolic, requires special intelligence to learn it. Visual spatial, mathematical logic, interpersonal and naturalistic are some of intelligences that need to be involved to learn chemistry. Therefore, multiple intelligence is the most important thing in learning chemistry. Therefore, this study

intends to develop a collaborative learning device integrated with multiple intelligences on chemistry especially on hydrocarbon material with the aim of developing student's multiple intelligences.

II. METHOD

This research used research and development study with 4-D development model by [9]. The study consisted of (1) define stage, (2) design stage, (3) development stage. The dissemination stage was not conducted because of limited resources and time. The study was conducted from January to July 2017. The subjects were 35 of 10th grade students at SMAN 10 Banjarmasin. The data were collected using questionnaire and test. The questionnaires include validation of learning devices and observation of the practicability. The tests used multiple intelligence test prepared by Terry Armstrong and the Multiple Intelligence Assessment Test by Thomas Armstrong which were adapted to the culture of Indonesia.

III. RESULTS AND DISCUSSION

This study developed learning devices on hydrocarbon material consisted of lesson plan, student worksheets and student book. Student activities in the lesson plan and student worksheet were designed based on collaborative learning and multiple intelligences theories. The student book has specific features linked to collaborative and multiple intelligences activities.

A. Define stage

The results of the preliminary analysis indicate that chemistry learning activities in schools are still classical regardless the students' characteristics. This is not in line with the K13 principle that expects learning to focus on students' potential, development, needs, and interests. Learning activity places students in a central and active position [10]. The theory of multiple intelligences takes into account the characteristics of students by adapting learning activities to students' multiple intelligences [11]. Therefore, it is necessary to integrate learning devices with multiple intelligences. The application of multiple intelligences is perfect if it is combined with collaborative strategies because in collaborative strategies, individual work is conducted alternately with group work that can develop students' intrapersonal and interpersonal intelligence simultaneously [12].

The result of students' multiple intelligence test shows that intrapersonal, naturalistic, and kinesthetic are the dominant intelligences which the most students have. By contrast, the least intelligence students are logical-mathematical. The results of the multiple intelligence tests will be used in selecting the member of student team. In the learning activities, students with the same dominant intelligence will be gathered in the same group. The results of students multiple intelligence tests are presented in Table 1.

TABLE 1. THE DATA OF STUDENT MULTIPLE INTELLIGENCES

Multiple Intelligences	Amount
Linguistic	5

TABLE 1. cont.

Matematic	1
Musical	4
Visual-spatial	4
Kinesthetic	14
Interpersonal	11
Intrapersonal	20
Naturalis	17

Based on the analysis of the subject matter, the developed learning devices contain concepts on hydrocarbon matter, namely: (1) the uniqueness of carbon atoms, (2) hydrocarbons, (3) isomers, (4) properties of hydrocarbons, (5) oil and natural gas, (6) quality of gasoline and the impact of fuel use, (6) daily hydrocarbons.

The student tasks were designed based on multiple intelligences that stimulate students' multiple intelligences. The tasks for each group differs depending on the type of intelligences, but is still aimed at facilitating students to understand the concepts.

B. Design

In the design phase, the lesson plan, the student worksheets, the instruments, the teaching materials, and the learning media were prepared. Learning activities in the lesson plan, student worksheet, and student assignments are designed based on multiple intelligences that stimulate the development of students' multiple intelligence. The task for each group differs depending on the type of intelligence, but it is relevant to the concepts being taught.

The explanation of subject matter in teaching materials is combined with activities that are linked to the eight types of intelligences. At this stage, the learning media supporting the development of multiple intelligences is also designed such as (1) the simple molymod, (2) the pictures, (3) the games, and (2) the videos.

C. Development

At this stage, the validity of learning devices was examined. The validators consisted of 3 lecturers and 2 chemistry teachers. Based on the validators' review, the validity of the lesson plans is very good with the mean score > 52. The validities of student worksheets 1, 2, 3, 4, and 6 are very good, while the validities of student worksheet 5 and 7 are good. The average validity score of student book is 53.8 (very good). Based on the description, it can be concluded that the developed learning devices are valid.

The practicality of the learning devices are viewed from: (1) the legibility and the attractiveness of the learning devices, (2) the observation of the learning implementation, and (3) the ease of students to use the student worksheets. The legibility and attractiveness tests consisted of two phases, namely stage 2 and stage 2. The mean scores of the legibility and attractiveness of the student worksheet are 3.28 with good category in the stage 1 and 3.36 in the stage 2. Besides, the mean scores of the legibility and attractiveness of the student

book are 3.21 in the stage 1 and 3.32 in the stage 2. Both are in good category. Validator suggested fixing the use of the font on student worksheets. Based on the description, student worksheets and students book are practically developed in terms of legibility and attractiveness.

From the learning observation it was known that the use of learning devices at the first meeting consumes a lot of time allocation. The revision of the learning device succeeded in increasing the implementation learning scores from 44.5 (practical) at first to 51 at the second and 51.5 at the third meeting (very practical). Thus, it can be concluded that the developed learning devices are practical to be used.

The effectiveness of the developed learning devices was viewed from the development of students' dominant intelligence after learning by using the developed learning devices. Comparison of the students' multiple intelligence scores before and after learning can be seen from Table 2.

TABLE 2. STUDENTS' MULTIPLE INTELLIGENCES BEFORE AND AFTER LEARNING

Dominant Intelligences	Amount Before learning	After learning
Linguistic	5	9
Visual-spatial	4	6
Kinesthetic	14	10
Interpersonal	11	17
Intrapersonal	20	20
Naturalistic	17	17

The types of increasing dominant intelligences are linguistic, visual spatial, and interpersonal. Conversely, while the declining dominant intelligence is kinesthetic. Naturalistic and intrapersonal intelligences tend to remain.

The development of students' linguistic intelligence occurs because many of student activities involve and train linguistic intelligence, such as reading student worksheet activities, teaching materials, and listening to teacher explanations. The student book provides the written information that requires students to read in order to understand the lesson. Verbal explanations of teachers also contribute to the development of linguistic intelligence. This is in line with [1] and [2] opinion that reading, listening, and writing develop students' linguistic intelligence.

The development of interpersonal intelligence is predicted to be influenced by group discussion activities when students work on students' worksheet. Collaborative strategies conducted by individual-group-individual patterns also contribute to the development of students' interpersonal intelligence. This is supported by the findings of [2] and [5] which states that group discussion activities, games, and other activities undertaken together can develop interpersonal intelligence.

The development of visual spatial intelligence in classes is due to several of some activities in student worksheet that have been adapted to the characteristics of spatial visual intelligence. In addition, the learning of hydrocarbon materials uses many illustrations and spatial visual activities such as drawing and naming hydrocarbon structures. The use of

pictures, illustrations and drawing activities will indirectly develop students' visual-spatial intelligence [1][2][3]

Naturalistic and intrapersonal intelligence are relatively stable. This also means that the learning design is not sensitive to both intelligences. Indeed, the design of learning activities does not much involve the natural surroundings. That's why the naturalistic intelligence is not well developed. To increase naturalistic intelligence, activities related to the nature such as outbound or study tour need to be added. Paintings or pictures of natural scenery, as well as indoor house plants can also be displayed in the classroom to bring students closer to the nature. According to [1] and [2], these activities can develop naturalistic intelligence.

The intrapersonal intelligence which is not well developed may be due to the individual activities in a collaborative strategy were not working well. Collaborative strategies require students to do individual tasks first before grouping [8]. In this study, the students prefer to do the tasks in groups, so that individual patterns do not running effectively. To overcome this problem, students need to be given the opportunity to work independently by providing homework. In addition, it is necessary to provide a self-reflective journal filled by students to reflect on student activities after learning. Activities are able to develop students' interpersonal intelligence [1], [2].

IV. CONCLUSION

Based on the research, it can be concluded that: (1) the developed learning devices are valid based on the validator reviews, (2) the developed learning devices are practical based on the feasibility of the usage, (3) the developed learning devices are effective in improving students' multiple intelligences.

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