Student's Motivation in Learning Chemistry and Implementation of Chemmo Configuration as A Learning Media in Periodic System Materials

Profil Motivasi Peserta Didik dalam Pembelajaran Kimia dan Penerapan Permainan Chemmo Configuration sebagai Media Pembelajaran pada Materi Sistem Periodik Unsur

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Abstract. The aim of this research are to know the motivation level of student in learing chemistry and the implementation of Chemmo Configuration game as a learning medium in periodic system of elements materials. The type of this research is preliminary research that is descriptive. Data collected by using questionnaire and interview method. The sample of this research are 35 student of 2nd-grade class in Senior High School 3 Jombang. The reliability test on the motivation questionnaire instrument obtained Cronbach's Alpha value of 0,916 so that is reliable. The result of correlation test showed significant result with the significance level of 0,01. Motivation indicators that used in the questionnaire are the seriousness of student in following learning activity, the attention of student in listening to their teacher's explanation, the activeness of student in doing individual or group assessment, desire of the student to get the best score and the involvement of student in discussion activity. The result of filling motivation questionnaire obtained that students have high motivation categories, 21 student were moderate and 7 others were low. Based on the interview with students obtained that 86,7% likes playing game, but only 1 student have ever used the game to study chemistry subject. Hence, it is necessary to use the Chemmo Configuration game as a learning medium, aspecially in the periodic system of elements materials.

Keywords: Student's Motivation, Game, Chemmo Configuration, Periodic System of Elements.

Abstrak. Penelitian ini bertujuan untuk mengetahui profil motivasi peserta didik dalam pembelajaran kimia dan penerapan permainan *Chemmo Configuration* pada materi sistem periodik unsur kelas X. Jenis penelitian yang digunakan adalah penelitian pendahuluan yang bersifat deskriptif dengan metode pengumpulan data dilakukan melalui wawancara dan pengisian angket. Sampel dalam penelitian ini adalah 35 siswa kelas XI di SMAN 3 Jombang. Uji reliabilitas pada instrumen angket motivasi yang digunakan memperoleh hasil nilai alfa Cronbach sebesar 0,916 sehingga dinyatakan reliabel. Hasil uji korelasi menunjukkan hasil yang signifikan dengan taraf signifikansi sebesar 0,01. Indikator motivasi yang digunakan antara lain keseriusan peserta didik dalam mengikuti pembelajaran, perhatian peserta didik dalam mendengarkan penjelasan dari guru, keaktifan peserta didik dalam mengerjakan tugas individu maupun kelompok, adanya keinginan untuk meperoleh hasil terbaik dan keterlibatan peserta didik dalam kegiatan diskusi. Hasil pengisian angket motivasi peserta didik diperoleh sebanyak 7 orang memiliki kategori motivasi yang tinggi, 21 orang sedang dan 7 orang lainnya rendah. Berdasarkan wawancara peserta didik sebanyak 86,7% senang bermain *game*, namun hanya terdapat 1 orang yang pernah menggunakan permainan untuk belajar kimia. Untuk itu diperlukan penerapan permainan *Chemmo Configuration* sebagai media pembelajaran khususnya pada materi sistem periodik unsur untuk meningkatkan motivasi belajar.

Kata kunci: Motivasi peserta didik, Permainan, Chemmo Configuration, Sistem Periodik Unsur.

1. Introduction

Based on Minister of Education and Culture's regulation in 2016, the learning process in educational units is held interactively, inspirational, fun, challenging, motivates students to play an active role and provides sufficient space for independent creative initiatives according to the talents, interests, physical, and psychological development of students. The rapid development of technology is expected to be able to support the learning activities of students in the digital era. Along with this, teachers must have innovations in the use of teaching methods to create a pleasant learning atmosphere for students without forgetting the learning objectives to be achieved. The use of technology for learning media can support the realization of fun learning. If the learning atmosphere is fun, students will be motivated to learn. According to Sumiharsono and Hasanah, learning media is anything that can be used to transmit messages in the form of learning materials, so as to stimulate the attention, interest, thoughts and feelings of learners in learning activities to achieve learning objectives [1].

One of the uses of technology as a learning media that can create a pleasant learning atmosphere for students is games. There is term a *gamification* which is a method of using game elements and mechanisms with the main purpose other than entertainment. Based on Hidayatno, the use of this method in education can increase activity and motivate students in the learning process. Even games can replace traditional learning methods that are less effective in teaching complex problems [2]. In this case the use of games by students will make them learn through the challenges and questions in it. The game itself has several levels that can make students curious and motivated to finish until the end. This indirectly encourages students to continue learning until they can complete the game mission.

One of the learning theories that support learning while playing is the constructivism learning theory. Students become the center of learning activities using game media. That way students actively build their knowledge through experience in completing game missions. Besides, information processing theory can also explain the benefits of using games as a learning media. Information stored in students' short-term memory will be used repeatedly when trying to complete game challenges. This repetition can make the information in short-term memory will be transferred to the long-term memory system for storage [3]. This process will make it easier for students to recall information about the material being taught.

Chemistry is a branch of natural science. In chemistry, there are three representations, namely macroscopic, submicroscopic, and symbolic. One of the materials in chemistry subject is the periodic system of elements. Based on interviews with students, information on the use of media used by teachers in the periodic system of elements material was the periodic table and whiteboard. The use of these media is still classified as conventional so that students feel bored. Game media can be used as an alternative to increase the motivation of students in learning the chemistry material. According to Hidayah, the use of the Catic Box Chemistry game can affect students' learning completeness on the material periodic system elements by up to 75% [4]. This shows that the increase in the motivation of students from using games as a learning medium will affect the achievement of their learning outcomes.

Chemmo Configuration is an adventure game, which presents a periodic system of elements for 1st-grade class of senior high school. This game has four levels with each of the learning objectives that are tailored to the basic competencies that have been determined. Based on research conducted by Qonaatun in 2019, the results show that the development of the game *Chemmo Configuration* has been tested for its feasibility to be applied as a learning medium in elemental chemistry material [5]. This game is expected to be able to help increase the motivation of students in learning chemistry, especially in the material periosic system of elements in 1st grade class of senior high school.

In this study the researchers wanted to know the motivation profile of students at SMAN 3 Jombang in chemistry learning and the application of games *Chemmo Configuration* as a learning media to increase motivation learners.

2. Metodology

This research is a descriptive preliminary research. Data collection was carried out using interview and questionnaire methods. Interviews were conducted with 35 students of 2nd-grade class and one of the chemistry teachers at SMAN 3 Jombang. The questionnaire used in this study was a motivation questionnaire given to students. This research was conducted in July 2020.

2.3 Student's Motivation Questionnaire

The motivation of students was known by using a motivation questionnaire instrument. The questionnaire contains statements related to predetermined motivation indicators. According to Darmadi, indicators of motivation that can be used include the seriousness of student's participation in learning, the attention of students in listening to explanations from the teacher, the activeness of students in doing individual and group assignments, the desire to get the best results and the involvement of students in discussion activities [6]. The researcher develops each motivation indicator into four statements. Assessment of student responses refers to a Likert scale. According to Ismail, it is necessary to determine a scoring system because in filling out questionnaires by respondents there is a tendency to choose number 3 which means hesitant or neutral [7]. For this reason, researchers used scores of 1 to 4 in students' motivation questionnaires. The score determined for the student motivation questionnaire based on the Likert scale is seen in the Table 1:

Table 1. Score of student's motivation questionnaire.

Statement	Score
Totally disagree	1
Disagree	2
Agree	3
Strongly agree	4

The data results of filling out the student motivation questionnaire was tested for normality to find out whether the data obtained was normally distributed. According to Arifin, the interpretation of the normality test of the results of filling out the motivation questionnaire of students is through the calculation of the coefficient of variance. The data is normally distributed if the variance coefficient is less than 30%. In addition, if the sig value > 0.05, the sample is normally distributed [9]. The coefficient calculation formula is:

$$\text{Coefficient of variance} = \frac{\text{Standard deviation}}{\text{Mean}} \times 100\%$$

In addition, the student motivation questionnaire that has been made is tested for reliability and validity through the SPSS application. According to Sarmanu, a valid instrument is an instrument that can measure what is being measured [8]. To determine the validity of the instrument can be done by using the Pearson correlation test. Furthermore, the instrument is tested for consistency through reliability testing. An instrument is said to be reliable if it produces a consistent measure. Reliability test in quantitative research can be done using Cronbach's alpha. The instrument is said to be reliable if the results show a Cronbach's alpha value of more than 0.7. The data obtained from students' motivation questionnaires were analyzed through index calculations. The index value of each statement in the motivation questionnaire can be calculated using a formula:

$$\%Fa = \frac{n_a}{N} \times 100\%$$

With the following information:

%Fa   = Percentage of the frequency of respondents who chose a score of 1, 2, 3 or 4.

n_a = Number of respondents who chose a score of 1, 2, 3 or 4.

N = Total number of respondents

Statement's index = ((%F1x1) + (%F2x2) + (%F3x3) + (%F4x4)) : 4

By following information :

%F1 = Frequency of respondents who chose a score of 1

%F2 = Frequency of respondents who chose a score of 2

%F3 = Frequency of respondents who chose a score of 3

%F4 = Frequency of respondents who chose a score of 4

$$\text{Indicator's index} = \frac{\Sigma \, \text{Statement index}}{Total \; of \; statement \; in \; the \; indicators}$$

The step to determine the index category for each indicator of motivation is use the *Three Box Method* . According to Ferdinand, the range of scores is divided into three boxes so that it will produce three categories, namely low, medium and high [10].

Table 2. Category based on three box method.

Requirements	Category
71-100	High
41-70	Moderate
10-40	Low

Based on Jaya, to categorize the motivation of each student, the mean and standard deviation of the data obtained were used [11]. The data conversion to determine the category of students' motivation levels can be seen in Table 3 below:

Table 3. Category of motivation's level.

Requirements	Category
> Mean + Std	High
(Mean + Std) until (Mean – Std)	Moderate
< Mean – Std	Low

2.4 Student's Interview

Interviews of students were conducted to find out information and their opinions about learning that had been done in school. Through the questions in this interview, it can be seen that students' learning problems and their responses regarding games as a learning media.

2.5 Teacher's Interview

An interview with one of the chemistry teachers was conducted to find out the methods that have been used in teaching chemistry, especially the periodic system elements of 1st garde class of senior high school. In addition, It can also be seen what constraints, strategies and media have been used by the teacher during learning. Through this interview, it can also be seen that the teacher's responses and suggestions to the use of games as a learning media.

3. Result and Discussion

3.1 Student's Motivation Questionnaire

Data from the results of students' motivation questionnaires were tested for normality to determine whether the data was normally distributed or not. The normality test is carried out through the SPSS application with the following results.

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Skor Motivasi	.118	35	.200[*]	.945	35	.079

a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

Figure 1. The normality test result of student's motivation questionnaire.

The variance coefficient value is calculated using a predetermined formula which produces a value of 12,217%. This value is less than 30% so that the data is said to be normally distributed [9]. In addition, when viewed from the Sig. Kolmogorov-Smirnov and Shapiso-Wilk showed a value of more than 0.05, which indicates that the data were normally distributed. The results of the validity and reliability test of the students' motivation questionnaire used showed good results. The test was carried out through the SPSS application.

Reliability Statistics

Cronbach's Alpha	N of Items
.916	20

Figure 2. Reliability test result of student's motivation questionnaire

Based on the results of the reliability test, the Cronbach alpha value was obtained of 0.916 where the value was greater than 0.7. This shows that the student motivation questionnaire instrument used is reliable or produces a consistent measure [8]. The validity test of the instrument was carried out through the correlation test. The test shows significant results with a significance level of 0.01. The following table is the result of the instrument's correlation test.

Table 4. Correlation test result of student's motivation questionnaire.

	Valid	Not valid
Number of item	1,2,3,4,5,6,7,8,9,10,11,12,14,15,16,18,19,20	13, 17

To determine the motivation's level of students who have filled out the motivation questionnaire, an analysis is carried out to make high, medium and low categories. The total score data for each student was analyzed through the SPSS application to obtain the mean and standard deviation.

Descriptive Statistics

	N	Mean	Std. Deviation
Total Tiap Siswa	35	63.3714	7.74249
Valid N (listwise)	35		

Figure 3. Result of mean and standard deviation.

From the total score data of 35 students who filled out the motivation questionnaire, the mean value of the data was 63.3714 and a standard deviation of 7.74249. Through these two values, the categories for the level of motivation of each student are obtained as follows:

Table 5. Result of motivation's level category.

Score	Motivation's level	Total students
> 71,11	High	7
71,11 - 55,63	Moderate	21
< 55,63	Low	7

The results of filling out the motivation questionnaire of students showed that 7 students had high motivation, 21 were moderate and 7 others were low. This shows that the motivation of students in learning chemistry is still in the moderate category. Hence, it is necessary to make an innovation to increase the motivation of students. The index value of each indicator is calculated according to a predetermined formula. The three-box method was used to determine the category for each indicator. Because each indicator consists of four statements, the index will be divided by four as in Table 6.

Table 6. Index value of indicator's motivation.

No	Indicator	Statement index (%)				Total	Indicator index (%)
		1	2	3	4		
1	Seriousness of student's participation in learning	82,84	87,14	80,70	82,86	333,54	83,39
2	The attention of students in listening to explanations from the teacher	89,29	67,01	70,72	81,40	308,42	77,11
3	The activeness of students in doing individual and group assignments	86,41	81,44	79,99	74,29	322,13	80,53
4	Adanya keinginan untuk hasil yang terbaik	67,14	71,43	85,71	85,72	310	77,50
5	the desire to get the best results and the involvement of students in discussion activities	69,28	84,29	82,85	74,99	311,41	77,85

From this table it can be seen that each indicator used to measure the level of motivation of students is included in the high category. This is also in accordance with the results of the teacher's interview where students, especially in class X, felt that chemistry was new material so it was interesting for them. In addition, the teacher also gives assignments to observe the ingredients in food products that students eat to be used as examples of chemistry in the daily life.

3.2 Student's Interview

Based on student interviews regarding the material of the periodic system of elements, only five people said that the material was easy to understand. The only media used by chemistry teachers to explain the periodic system of elements is the blackboard and the periodic table. There are learning styles of students who like groups and independently. Their difficulty with the material is memorizing the material. Of the 35 students, there were 4 students who didn't like playing games. This shows that most of them enjoy playing games. However, only 1 student has ever used chemistry games to study. The enthusiasm of students in using games as a medium for learning was high, as much as 90% agreed. This shows that it is necessary to apply games as learning media for students in the material periodic system elements in order to make it easier for them to learn and increase motivation.

3.3 Teacher's Interview

The results of an interview with one of the chemistry teachers said that the method used for teaching depends on the difficulty level of the material. If the material is easy, students read the material in the book first and then do a question and answer. If the material is difficult, the teacher explains it up front. The constraints in teaching are usually the different abilities of students. To overcome these obstacles the teacher usually put the students who have more abilities with students who are less able to receive the material well. This is intended so that these students interact with each other to discuss so that they can understand the material well. In the periodic system material, the teacher use the periodic table media. The teacher has never used media in the form of games. The response from the teacher regarding the existence of computer-based games for learning chemistry was very interested. The teacher is very supportive when the game is applied as a learning media for students' chemistry.

3.4 Discussion

Based on the results of the scores on each student, 7 people only have a high level of motivation, 21 people are moderate and 7 others are low. This is because the characteristic of chemical matter itself is abstract. One of the materials that students find difficult to understand is the periodic system of elements. In teaching this material the teacher only uses the periodic table as a media. For that, we need media innovation that can help students in learning these materials. Games are an alternative that can be chosen as a learning media. The game creates competition between individuals and groups to win and this will increase motivation so that students will enter the phase of deep-level *learning* in learning [2].

The use of games as a learning media in addition to increasing motivation also has the advantage of improving student learning outcomes. Research conducted by Hidayah shows the results of using games as a learning media on the periodic system material that affects students' learning completeness by up to 75% [4]. Based on Suryana's research on the development of educational games in chemistry learning, the results of students' classical completeness reached 71% [12]. The results of these studies indicate that the use of games as a learning media influences students' learning completeness.

One of the games that can be used as a learning media by the teacher on the element periodic system material is the *Chemmo Configuration*. This game has been tested for its feasibility so that it can be used as a learning media in the element periodic system material for 1st-grade class of senior high school [5]. The game can also increase student activity because it has 4 different levels of difficulty. The activity of students reached an average of 94.07% so that this game was very practical to use as a learning medium on the material periodic system elements. According to Thendar, active learning will have a positive effect on students' motivation and learning outcomes [13]. This shows that the use of the game *Chemmo Configuration* can increase the activities of students so that their motivation and learning outcomes will also increase.

Based on research conducted by Lutfi, the use of games *Chemmo Configuration* in chemistry learning can improve learning outcomes and student motivation [14]. This shows that the media is very effective for increasing motivation because it creates fun learning. The response of students shows a positive response. Students find the game interesting, easy to operate, and easy to use for learning. This is an advantage of the game to make students feel happy in learning chemistry. Students will also feel motivated to compete with friends in completing missions at each level of the game. If they fail, they have to try again until the mission is complete. This indirectly helps students to store and remember material information. Papadakis in his research shows that the use of games in learning can increase the activity of students and their knowledge compared to conventional classes [15].

The use of computer-based games as a learning medium also has several advantages. According to Watson, the use of computer-based learning media can improve students'

conceptual understanding and self-confidence compared to classes that do not use computer-based learning media [16]. Besides, the use of games can make learning fun. Yenikalayci's research shows that the use of games can make students feel happy and increase their motivation to learn [17]. Research conducted by Papadakis shows the use of games in learning can provide a pleasant feeling when compared to conventional methods [18]. Latief in his research shows that game as a media in learning chemistry increase the student motivation in the averages score to be very good or very high in all aspects [19]. Based on the results of several studies, it is necessary to use games as a media for learning chemistry to increase student motivation and improve learning outcomes.

4. Conclusion

Based on the results of data analysis, several conclusions can be drawn as follows :
a. The motivation profile of students at SMAN 3 Jombang in chemistry learning is still relatively moderate. This is evidenced by the results of filling out a motivation questionnaire which shows that 7 people have high motivation, 21 are medium and 7 others are low.
b. The use of games as a medium for learning chemistry at SMAN 3 Jombang has not been done. This is due to the lack of information from the teacher about games that can be used as a medium in learning chemistry.
c. It is necessary to use the game *Chemmo Configuration* as a learning media for chemistry, especially the periodic system material for 1st grade class of senior high school to increase student motivation.

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