Effectiveness of Chemscrabb Media Games on Fundamental Laws of Chemistry Towards for Students' Learning Outcomes

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Abstract

The research aims to determine the effectiveness of Chemistry Scrabble (Chemscrabb) games as Instructional Media on Fundamental Laws of Chemistry to Students Learning Outcomes. This research is a research and development (R&D) with designed by Posttest Only design, in which the design is based on the Thiagarajan technique. The research held on SMAN 10 Padang. Sampling selection was done by Random Cluster Sampling with the result that students of X-Science 2 as the experiment class and students of X-Science 4 as the control class. The data instruments used were a Post-test, questionnaire, and interview of two classes of the sample. The data analysis technique was a Hypothesis test by an Independent T-test sample. Based on Independent T-Test, the obtained t_{count} is 1.833, where the score is in the curve area, which means that accept H0 (there is no significant difference between the two samples). From the data, the research inference is that the utilization of Chemistry Scrabble (Chemscrabb) games as instructional media on Fundamental Laws of Chemistry for 10th-class sciences students is not effective for 10th-class sciences students' learning outcomes. However, students' activeness in the experiment class in the strengthening process (exercise) is higher than in the control class.

Keywords: chemistry scrabble (chemscrabb); effectiveness; fundamental laws of chemistry; learning outcomes

Abstrak

Tujuan dari penelitian ialah menentukan efektivitas dari Permainan *Chemistry Scrabble* (*Chemscrabb*) sebagai media pembelajaran materi Hukum-Hukum Dasar Kimia terhadap hasil belajar Peserta Didik. Jenis penelitian ini yaitu *Posttest Only Design* yang didasarkan kepada teknik Thiagarajan. Penelitian dilakukan di SMAN 10 Padang. Teknik pengambilan sampel yaitu *Random Cluster Sampling* dengan sampel yaitu peserta didik kelas X-MIPA 2 sebagai kelas eksperimen dan peserta didik kelas X-MIPA 4 sebagai kelas kontrol. Instrumen penelitian menggunakan soal posttest, kuesioner, dan wawancara pada kedua sampel. Teknik analisis data yaitu Uji Hipotesis dengan menggunakan Uji Independent T test. Berdasarkan hasil dari uji Hipotesis Independent T test yaitu didapatkan nilai t_{hitung} sebesar 1,833, dimana hasil uji hipotesis berada pada kurva two tailed yang berarti terima H_0 (tidak ada perbedaan yang signifikan antara kedua kelas sampel). Kesimpulan yang dapat diambil dari penelitian adalah penggunaan permainan Chemistry Scrabble (Chemscrabb) sebagai media pembelajaran pada materi Hukum-Hukum Dasar Kimia kelas X MIPA di SMAN 10 Padang tidak efektif terhadap hasil belajar peserta didik. Tetapi, keaktifan dan semangat peserta didik dalam melakukan latihan pada proses pemantapan konsep lebih tinggi daripada kelas kontrol.

Kata kunci: chemistry scrabble (chemscrabb); efektivitas; hukum-hukum dasar kimia; hasil belajar peserta didik

Introduction

One of the Chemistry materials studied in X-class sciences is the Fundamental Laws of Chemistry. The concept of Fundamental Laws of Chemistry is based on principles concept and mathematics concepts (calculations). This material is a basic material that students must understand before studying Stoichiometry, Thermochemistry, Chemical Equilibrium, and Reaction Rate materials (Keenan, 1999). If the concepts contained in the material of the Fundamental laws of chemistry have not been understood by students, in that case, it might cause difficulties in the next learning process, especially when solving calculation problems. Therefore, it takes proficiency in understanding concepts and applying them in mathematical calculations (Zairida et al., 2019).

After the distribution of questionnaires at SMAN 5 Padang, SMAN 10 Padang, and SMAN 16 Padang, it was found that in studying the Fundamental laws of chemistry, teachers had provided a solidifying the concepts /exercises in the form of LKPD, which were carried out by students individually or in groups. However, students had not been actively involved in working on the exercise, so it had a negative impact on strengthening and mastering concepts in students.

Sanjaya (2012) states that the learning interest of learners largely determines their success in the learning process. Interest in learning can be obtained if we can attract the attention of students to study. One way is to prepare learning media because one of the benefits of learning media is to increase passion and motivation to learn and have practical value, namely overcoming the limitations of the experience that students have and can overcome the limits of the classroom. One of the efforts to involve students' activeness in doing exercises is to use fun instructional media. Azhar (2017) states that Instructional media is learning media is a tool in the learning process both inside and outside the classroom. The instructional media in the form of games is considered effective for establishing the concept of a material that is a concept based on principles concept and mathematics concept that is difficult to explain in words. Game media needs to be developed to increase student activity (Aura, 2021). Game media will become more exciting and challenging if there is an element of competition, and competition, at the same time, can be an element of entertainment. Games can be used as learning media that can arouse students' interest in learning and according to the characteristics of students. With the game, students feel enthusiastic and happy to follow the learning process (Kristy, D., 2020), (Humaira, 2021), (Batri, V, 2021), (Mardani, 2020), (Wahyuni, 2020).

Chemistry Scrabble (Chemscrabb) is one of the instructional media in the form of games that previous researchers have developed. Chemistry Scrabble (Chemscrabb) is a modification of the Scrabble game. The modification is on the game rules. At first, one group contain 4/5 students. One student is a coordinator and the other students as gamers. The coordinator gives 20 letters to each gamer. Then, the gamer should combine the word from the letters given in the game based on the keyword game, which implies the fundamental laws of chemistry material. After collecting the word, the student tries to answer the questions based on the word collected before. For example, one of the students successfully collects and combines the word 'Lavoisier,' so they have to answer the question from the question card about Lavoisier's Law.

Based on the results of validity and practicality tests, it is stated that Chemistry Scrabble (Chemscrabb) media has a very high level of validity with a very high category based on the function of the media and a level of practicality with a very high category based on the characteristics of practical media. After testing the validity and practicality, then the learning media in the form of games is carried out in a trial of effectiveness.

Effective is related to the implementation of the required task,

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purpose achieved, active participation of a group, and punctuality (Mulyasa, 2002). Instructional media can be effective if seen from students' learning outcomes, activities, and the ability to think critically. According to Sari (2016), an effectiveness test is a feasibility test that exists in development research; the purpose is to see the extent of the effectiveness of the product that has been developed. If the game media used to support the learning process proves to be effective, then the learning media can be used properly. The word effective will have different meanings to other research (Aulia, 2022).

This study aims to determine the effectiveness of the Chemistry Scrabble (Chemscrabb) game as an instructional media for the Fundamental laws of chemistry material on students' learning outcomes in 10th-grade Science class. The effectiveness of the media can be determined from students' learning outcomes and activities in the class. It is advanced research from Dinda Purnama Kristy and Fajriah Azra (Kristy, 2020).

Method

The research design used was Within class post-test only. The design was based on Thiagarajan et al. (1974) evaluation design. The structure of the research is shown in Figure. 1.

Figure 1
Research Design Structure
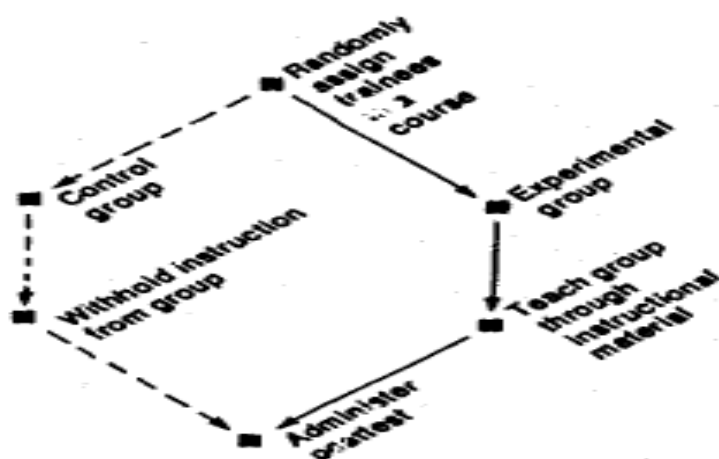
(Thiagarajan et al., 1974)

From Figure 1, it can be seen that two groups are selected randomly, one group is learning from instructional media (experiment group), and the other is learning without instructional media (control group). Next, both groups do a post-test after two groups finish the learning process.

The research population is 10thclass students, even semester at SMAN 10 Padang. The sample selection used was Random Cluster sampling. The class chosen as the experiment class is X-Science 2, and the control class is X-Science 4.

The initial treatment between the two classes was the same: doing the learning process to find the concepts. Then the difference is in strengthening the concepts. In the experiment class, students were given Chemistry Scrabble (Chemscrabb) as an exercise. While in the control class, students were given the usual student worksheets used at school.

Data collection methods used primary data. The primary data was obtained from the students' post-test result and the students' interviews. The post-test contains questions in the form of multiple choice about Fundamental Laws of Chemistry material. Before giving the post-test, the instrument's questions on the test had to be examined. The examination was done for the students who finished learning

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about the material. Based on Latisma (2011), the instrument used for students in the form of questions should be tested the Validity test, Reliability test, Discrimination Index test, and Difficulty Index test if the tests are completed so the question can be used. Validity and reliability test are related to each other. On the reliability test using Kuder Richardson 21, the equation is below:

$$r_{11} = \left(\frac{n}{n-1}\right)\left(1 - \frac{M_t(n - M_t)}{(n)S_t^2}\right)$$

Note:

r_{11} = coefficient of reliability test
k = the number of questions
1 = constant number
M_t = Mean of total scores
S_t^2 = total variance

Then, the perfect test means the questions of the test are not very hard and very simple. For the Discrimination Index test, if the discrimination index is higher, the tester who can answer correctly is more. On the other side, if the discrimination index is lower, the tester who can answer correctly is more. The equation of the discrimination index test based on Latisma (2011):

$$D = P_A - P_B$$

$$P_A = \frac{B_A}{J_A} \text{ and } P_B = \frac{B_B}{J_B}$$

Note:
D = discrimination index
P_A = top group tester who answers the right item
P_B = bottom group tester who answers the right item
B_A = number of top testers who answer correctly
B_B = number of bottom testers who answer correctly
J_A = number of top testers
J_B = number of bottom testers

For Difficulty Index Test means the proportion of testers who can answer correctly for an item (Kunandar, 2013).
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$$P = \frac{N_P}{N}$$

Note:

N_P = the number of testers who can answer correctly

N = tester

P = difficulty index test

Afterward, if the post-test result is taken, it should be analyzed. The normality test uses Kolmogorov and Smirnov. Meanwhile, the homogeneity test uses the Bartlett test.

Then, analyzing the Hypothesis test might use a parametric test or non-parametric test, according to the result of the normality and homogeneity test.

Result and Discussion

Based on the research, the goal is to determine the effectiveness of Chemscrabb games as instructional media. The effectivity could be determined from the students' post-test results and supported by students' questionnaires.

For the perfect instrument, the post-test question should be examined with the validity test, reliability test, discrimination index test, and difficulty index test. After the examination of the question to the students who had already learned the material, from 30 questions in the form of multiple choice, there were 23 questions obtained. Therefore, 15 questions were chosen as an instrument for the post-test. The questions include five sub-topics of Fundamental Laws of Chemistry material. Each sub-topic contains three questions. The post-test was held after strengthening the concept process in the class.

At first, students did a concept discovery process guided by the teacher in the experiment and control class. The concept discovery was in 3 class hours (1 x 45 minutes). While doing the concept discovery activity in the experiment class, students were more active because students focused on doing discussions with the teacher and answering questions until the learning process was done. In contrast, at the

beginning of the learning process in the control class, students were active and focused on the teacher, but after that, they did not focus because the break time would be held. When continuing the learning process after break time, some students focused and answered the questions in the discussion. For each class, the teacher reminded the students to learn and try to understand the material after the learning process because the following week would be a strengthening process.

In the following meeting, the strengthening process in the experiment class was conducted using Chemscrabb, while the control class used the student's worksheets. The time limit was 60 minutes. The strengthening process (exercise) was done by the group. One group consisted of five students, one student as coordinator of the group, and four students as members. During the strengthening process (exercise), students in the experiment class were very happy and enthusiastic to answer the questions from the Chemscrabb games media. Until the time was over, there were five groups of experiment class that could finish the games and answer all the questions on the game, even though they tried to answer some questions together. After checking the answers, half of the students answered correctly. Otherwise, the students were not active during exercise in the control class. No groups finished answering the question in doing the exercise. The group members only relied on the smart students to answer the questions. The students stated that they were hungry and did not focus. According to Dimyati & Mudjiono (2006), students' physical and spiritual condition will impact learning motivation and attention to studying.

The following week, students were given a post-test using the same instrument for each class. From the post-test result of the experiment and control classes, the high average test was obtained by the experiment class, which was 49.29. On the other side, the average for the control class was 42.06. Next, students filled out the questionnaire given. According to Thiagarajan, the questionnaire

was used as a proponent in the effectivity test.

According to the data (post-test result), the normality and the homogeneity should be tested to know what kind of hypothesis test should be used. The Normality test used Kolmogorov Smirnov test. The normality is symbolized by D (Usmadi, 2020). From data processing, the Dcount was 0.3891, while the Dtable was 0.3973. The interpretation of the result is that the data distribute normally. Since $D_{count} \leq D_{table}$, H_0 was accepted (normally distributed).

Then, the homogeneity test used Bartlett's method. The decision-making for this method is if $X2_{count} \geq X2_{table}$, H_0 is rejected, and if $X2_{count} < X2_{table}$, H_0 is accepted (Nuryadi et al., 2017). H_0 is the variance of the data population which is homogenous. According to data processing, $X2_{count}$ was 0.1407 while $X2_{table}$ was 3,841. Since the result states that if $X2_{count} < X2_{table}$, the interpretation was that the data population variance was homogenous.

Because the data were normally distributed and population data with Homogeneous variance, the suitable test for testing the Hypothesis was the parametric test; the test might use Independent T-test. The hypotheses were, namely,

H_0 = two independent samples have an equal average

H_1 = two independent samples that do not have an equal average (different significantly)

The decision-making for the hypotheses test if $t_{count} > t_{table}$, H_0 was rejected (two independent samples do not have an equal average (different significantly). In contrast, if $t_{count} < t_{table}$, H_0 was accepted (two independent samples have equal average). The results of the hypothesis test with the Independent T-test were obtained as follows:

Hence, from Table 1, the value of significance 5% was 1.8332, which was in the curve of the Hypothesis area. Therefore, H0 was accepted, and it concluded that the two independent samples had equal average, and the average was not significantly different. It means that Chemistry Scrabble

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was not effective for students learning outcomes.

Table 1

Hypothesis Test Result

t_{count}	t_{table} **with Sig. 5% (two-tailed)**
1.8332	-1.997 / 1.97

The game of chemistry scrabble was used as an instructional media in the process of training (strengthening concepts) on the material of the basic laws of chemistry. This research was conducted in 2 classes, namely the experiment class and the control class. The aspect as the basis for making research conclusions is the significant difference in the students learning outcomes from both classes. As previously described from students learning results, the average learning outcomes in the experiment class is higher than the control class. However, the hypothesis test state that the students learning results is not significantly different. Even though the procedure between the two samples is the same, some factors caused the results to be not significantly different, in which there is a different situation in doing the post-test.

Before the post-test was held in the experiment class, students looked busy and panicked because they must collect the task from another subject during the day, whereas most did not finish the task. This problem could be an internal factor that influenced the students' learning results. Hallen (2002) states that two factors might influence students' learning results: internal and external factors. Internal factor comes from the lack of student motivation in learning and emotional situation. In contrast, external factor comes from the social environment, which does not support them in learning. In case, students said that they did not pay attention in learning for post-test preparation because of an urgent task. Slameto (2003) claims this action describes inefficient students' time management. Thus, it affected the learning time and learning results. On the other side, the post-test is running smoothly. Because there was no external influence on the students, they did not have preparation before doing the post-test.

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A similar study to this research is conducted by Wulandari et al. (2018). The study explained that there was an increase in student learning outcomes in the pre-test and post-test. There was a larger value increase in the experiment class than in the control class. Thus, it can be concluded that there was an influence of the mysterious card box media (KOKAMI) on the learning outcomes of basic chemical laws in class X students of SMA Negeri 12 Banjarmasin because the mysterious card box media (KOKAMI) could have a positive impact on learning outcomes. Then, Juliansyah's (2019) research about domino games in mathematics learning states that the games affected the students' learning results. It was supported by the learning process that was conducted in three meeting times. Because of the learning time duration, students could prepare and maximize time to understand the material given by the teacher.

During the study of Chemistry Scrabble's effectiveness, there were weaknesses in the research process, namely that students had limited time to learn and understand the material of Fundamental Laws of Chemistry. Since the learning process at school was conducted only in one meeting, students were hurried in learning the material. It was because the final exam was held in the following two weeks. Thus, the teacher should accomplish all the chemistry material in an even semester. To overcome the problem, the teacher should properly allocate time for the learning process and prioritize the urgent material in chemistry.

Then, students were confused because they did not know the scrabble game before, so they needed repeated explanations about the procedures for the scrabble game. In using Chemscrabb, weaknesses can be overcome by explaining to students the rules for using learning

media in the form of Chemscrabb games on the day before using the learning media. Thus, students really understand the rules of Chemscrabb, and the process of training using Chemscrabb can run smoothly. Last, the questions given on the card should be modified to get more varieties of questions.

Conclusion

Based on the research data analysis, it can be concluded that Chemistry Scrabble (Chemscrabb), as an instructional media on Fundamental Laws of Chemistry material, can improve students' activeness and spirit. It is provable from the students' activeness in doing exercise in the experiment class is higher than students in the control class. However, the Chemistry Scrabble (Chemscrabb) as an instructional media is not effective for students' learning outcomes. It can be seen from the hypothesis result that there are no significant differences in students' learning outcomes between the experiment class and the control class.

Acknowledgment

References

Aura, S. M., & Azra, F. 2021. Pengembangan Permainan Tic-Tac-Chem sebagai Media Pembelajaran Kimia pada Materi Hukum-Hukum Dasar Kimia Kelas X SMA/MA. *Entalpi Pendidikan Kimia*, 2(1), 97-107.

Azhar. 2017. *Media Pembelajaran*. Jakarta: Rajagrafindo Persada.

Batri, V., & Azra, F. 2021. Pengembangan Permainan Chemistry Backgammon (Chemmon) sebagai Media Pembelajaran Kimia pada Materi Sistem Koloid Kelas XI SMA/MA. *Entalpi Pendidikan Kimia*, 2(1), 77-87.

Dimyati & Mudjiono. 2006. *Belajar dan Pembelajaran*. Jakarta: PT Rineke Cipta

Hallen A. 2002. *Bimbingan dan Konseling*. Jakarta: Ciputat Pers.

Humaira, S., & Azra, F. 2021. Development of Chemistry Scrabble Game as Learning Media in Thermochemistry Material for Class XI SMA or MA. *Edukimia*, 3(1), 58-64.

Keenan, C. W. 1999. *Kimia untuk Universitas*. Erlangga. Jakarta

Kristy, D., & Azra, F. 2020. Pengembangan Permainan Chemistry Scrabble (Chemscrabb) sebagai Media Pembelajaran pada Materi Hukum-Hukum Dasar Kimia Kelas X SMA/MA. Entalpi Pendidikan Kimia, 1(1), 19-28.

Kunandar. 2013. *Penilaian Autentik (Penilaian Hasil Belajar Peserta Didik Berdasarkan Kurikulum 2013)*. Jakarta: Rajawali Pers.

Latisma. 2011. *Evaluasi Pendidikan*. Padang: UNP Press.

Mardani, M., & Azra, F. 2020. Pengembangan Permainan Chemistry Backgammon (Chemmon) sebagai Media Pembelajaran Kimia pada Materi Hukum-Hukum Dasar Kimia kelas X SMA/MA. Entalpi Pendidikan Kimia, 1(1), 93-101.

Mulyasa. 2002. *Manajemen Berbasis Sekolah*. Bandung: Remaja Rosdakarya.

Nuryadi, Astuti, T. D., Utami, E. S. & Budiantara, M. 2017. *Dasar-Dasar Statistik Penelitian*. Yogyakarta: Gramasurya.

Sanjaya, W. 2013. *Strategi Pembelajaran Berorientasi Standar Proses Pendidikan*. Jakarta: Kencana.

Sari, L. Y. & Susanti, D. 2016. Uji Efektivitas Media Pembelajaran Interaktif Berorientasi Konstruktivisme Pada Materi Neurulasi Untuk Perkuliahan Perkembangan Hewan. *BioCONCETTA: Jurnal Biologi dan Pendidikan Biologi*, 2 (1), 158-164.

Slameto. 2003. *Belajar dan Faktor-faktor yang Mempengaruhinya*. Jakarta: PT Rineka Cipta.

Thiagarajan, S., Semmel, D. & Semmel M. I. 1974. *Instructional Development for*

Training Teachers of Exceptional Children: A Sourcebook. Indiana: ERIC.

Usmadi. 2020. Pengujian Persyaratan Analisis (Uji Homogenitas dan Uji Normalitas). *Inovasi Pendidikan*, 7 (1), 50-62.

Wahyuni, R., & Azra, F. 2022. Development of Chemistry Domino Cards as Learning Media of Colloid System Material for XI Grade Students in SMA/MA. *Edukimia*, 4(2), 61-69.

Wulandari, I. A., Mashuri, M. T. & Dony, N. 2018. Pengaruh Media Kotak Kartu Misterius (KOKAMI) terhadap Hasil Belajar Peserta Didik pada Materi Hukum-Hukum Dasar Kimia di SMA Negeri 12 Banjarmasin. *Dalton Jurnal Pendidikan Kimia dan Ilmu Kimia*. 1(2), 1-5.

Zairida, D., Akhyar, O. & Wardhani, A. A. 2019. Pengembangan Media pakapindo (Papan Kantong Pintas Doraemon) pada Materi Hukum-Hukum Dasar Kimia untuk Meningkatkan Motivasi Belajar Peserta didik Kelas X di MA Raudhatusysyubban. *Jurnal Pendidikan Kimia dan Ilmu Kimia*. 2 (2), 6-14.