Original Article

Check for updates

Available online at
https://jurnal.uinsyahada.ac.id/index.php/Lavoisier/index

LAVOISIER: CHEMISTRY EDUCATION JOURNAL

Vol. 3 (1), 2024

"OK KETUK": Improving Students' Understanding of Periodic System of Elements Material Through Learning Media

Sri Supatmi[1*]

[1] Santo Yakobus High School, Kelapa Gading North Jakarta.

*Correspondence: **emikimia@gmail.com**

Article History
Received 05 30th 2024
Revised 06 26th 2024
Accepted 06 26th 2024
Available Online 06 30th 2024

Keywords:
Classroom action research
Learning media
Periodic System of Elements

Abstract
This study aims to improve students' understanding of the material on the periodic system of elements through OK KETUK learning media. OK KETUK is a learning medium for the periodic system of elements that combines element cards and the periodic table. This medium is played by shuffling the cards, determining the electron configuration, period, and group of elements on the front of the card, doing problems on the back of the card, and placing the elements on the periodic table. This research is classroom action research conducted in two cycles. Each cycle consists of planning, implementing, observing, and reflecting. The research subjects were students of class X IPA 1 SMA Santo Yakobus Jakarta for the academic year 2019/2020, with 24 students, consisting of 12 male and 12 female students. The instruments used in this study consisted of learning outcomes tests, teacher and student activity observation sheets, interviews, and field notes. The results showed that OK KETUK learning media could improve students' understanding of the material on the periodic system of elements. The average score increased from 64.79 with 37.50% learning completeness in the first cycle to 83.44 with 91.67% learning completeness in the second cycle at KKM 70.00. Based on the results of the study, the use of OK KETUK learning media can improve students' understanding of the material for the periodic system of elements.

1. Introduction

A study states that chemistry is one of the subjects that some students consider to be less interesting and has a high level of difficulty (Ghalia, 2015). Interpreting the study, there are dominant factors that influence it, namely the lack of variety in teaching methods from teachers and the fact that most of the chemistry material is abstract material (Abdillah, 2015). This is one of the factors that cause students to have difficulty in instilling the concept of understanding chemical material (Saputra, 2015).

One of the chemistry materials that is considered difficult by students is the material of the periodic system of elements (Poedjiastuti, S. A., 2014). This is because, in the 2013 curriculum, the material on the periodic system of elements must be taught in class X, odd semester. The demands of periodic system material in the 2013 curriculum reach group B elements (transition group) using the sub-skin electron configuration. This is certainly not easy for grade X students who are new students from junior high school, where chemistry is incorporated into science subjects (Abdillah, 2015).

Students in class X also experience difficulty, such as the Science Class of SMA Santo Yakobus. Students of grade 10^{th} in the science class of SMA Santo Yakobus are active students with a school culture that encourages student involvement and dares to be creative and express opinions. These student characteristics require innovative teaching patterns involving more enthusiastic students (Poedjiastuti, 2014). This is a challenge for teachers in conducting learning that motivates students to be more enthusiastic about learning.

One of the efforts that can be made to make learning interesting and exciting for students is the use of learning media. Research has been conducted on the use of learning media on the material of the periodic system of elements, namely by using Element Cards (Poedjiastuti L. D., 2016) and Periodic Tables (Saputra, 2015), each of which stands alone, which according to the author is less practical. In previous research, element cards were made by modifying domino cards (Poedjiastuti L. D., 2016), where students only worked on electron configurations, determining periods and groups in group A (Setiyati, 2016).

To overcome this, the author tries to make learning media for the periodic system of elements called OK KETUK. This learning medium utilizes modifications of element cards and periodic tables. 'OK KETUK' is a combination of the words "shake", "do", and "determine". Shuffle here means to make a draw by shuffling the element cards. Meanwhile, what is meant by the word do is to determine the electron configuration,

period, and class of the element listed on the front of the card and work on the questions contained on the back of the card obtained through the shuffle process. Finally, the word determine is where students place the element card on the periodic table board. For more details on element cards and periodic table boards on OK KETUK learning media, see Figures 1 and 2.

Figure 1. Front and Back Side Element Cards

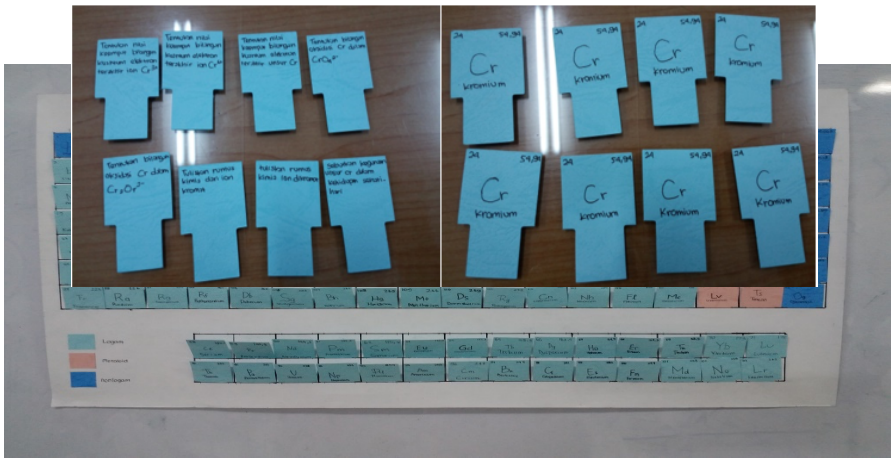

Figure 2. The Periodic Table Board

OK KETUK learning media here combines element cards and periodic tables into one unit. Element cards are made by referring to the form of brigade cards, where each card contains the name of the element, element symbol, atomic number, and mass number. While the periodic table is in the form of a periodic table framework that contains groups and periods through colour modifications, this periodic table will be one unit with element cards. Where the element card is considered a puzzle piece from the periodic table section. This OK KETUK learning medium is used in the form of a game. The use of OK KETUK learning media in the form of this game will certainly involve students actively, which will make students happy and excited about learning and improve learning outcomes (Utami & Amalia, 2019).

Based on the explanation above, to overcome students' difficulties in learning the material of the periodic system of elements and to increase students' motivation in studying chemistry, a teaching pattern with media that actively involves students is needed. In this case, it is expected that the use of OK KETUK learning media in the form of games will be able to make students active and excited about learning and ultimately improve students' understanding of the material of the periodic system of elements.

2. Materials and Methods

The method used in this research is classroom action research. Classroom action research is action research conducted to improve the quality of learning in the classroom (Muslim & Ernilawati, 2016). This research was conducted using the Kemmis and McTaggart design model in two cycles, where each cycle consists of four stages, namely: planning, acting, observing, and reflecting. The research subjects were students of class X IPA1 SMA Santo Yakobus Jakarta in the 2019/2020 school year, with a total of 24 students, consisting of 12 male students and 12 female students.

The instruments used in this study consisted of learning outcome tests, teacher and student observation sheets, interviews, and field notes. The observation sheet was carried out by the chemistry teacher or collaborator as an observer to collect data on the researcher during the learning process. Student observation sheets were used by researchers to find out student activities during the learning process. Interview data is in the form of sentence-shaped information that gives an idea of students' attitudes towards learning chemistry using OK KETUK learning media. Field note data is used to strengthen observation data made by researchers or observers who make observations of the course of classroom action research. The test used to measure student understanding at the end of the action cycle is a written test in the form of 40 questions consisting of 20 multiple-choice questions and 20 true and false questions.

The data analysis technique used in obtaining data on the results of the actions taken is through the class average value and the percentage of classical student learning completeness. The indicator of the success of this research is the increase in students' understanding of the material of the periodic system of elements in cycles 1 and 2, which is seen from the increase in the average student learning outcomes in cycles 1 and 2 and the percentage of students who reach the minimum criteria, with a target of 75% of students scoring above the minimum criteria.

3. Results and Discussions

During the implementation of learning, observations were made of the implementation of learning with OK KETUK learning media both in cycle 1 and cycle 2. Observations were made by two observers, namely the teacher who taught in the classroom as a researcher and a chemistry teacher as a collaborator. The results of the observation of the activity of the implementation of learning with OK KETUK learning media in cycle 1 obtained 88.26%, while in cycle 2 they obtained 92.13%. These results can be seen in Table 1 below.

Table 1. Observation results of student activities in Cycle 1 and Cycle 2

NO	Activities	Percentage of Observation Results	
		Cycle 1	Cycle 2
1	Students listen to instructions from the teacher	100 %	100 %
2	Students sit in groups	100 %	100 %
3	The group leader takes 6 element cards	100 %	100 %
4	The group leader divides the element cards where each student gets 2 element cards	100 %	100 %
5	Students observe the symbol of the element, atomic number and mass number of the element on the front side of the element card	100 %	100 %
6	Students discuss writing electron configurations, determining periods and classes	42 %	75 %
7	Students write electron configuration, determine period and class	100 %	100 %
8	Students read the problem on the back of the card and discuss it	50 %	71 %
9	Students place the element cards on the periodic table correctly	67 %	83 %
	Average	84,26 %	92,13 %

Table 1 shows that the percentage of observation results of learning activities in cycle 2 is higher than in cycle 1, this is related to the number of students who conducted discussions on writing electron configurations in cycle 2 more than in cycle 1. In cycle 2, the accuracy in answering questions on the back side of the card and the accuracy in placing element cards on the periodic table were also more than in cycle 1.

Teacher Activity Observation Results

The teacher activity observation sheet was carried out to observe the activities carried out by the teacher who was teaching as a researcher. The following is the result of the teacher activity observation. This observation was carried out by the collaborator teacher.

Table 2. Teacher Activity Observation Results

NO	Activities	Cycle 1			Cycle 2		
		N	LD	D	N	LD	D
A.	**Introduction**						
1	Communicating learning objectives.			√			√
2	Connecting with past lessons.			√			√
3	Connecting the material with the daily environment to motivate students.			√			√
B.	**Core Activities**						
1	Explain electron configuration, valence electrons, periods and groups.			√			√
2	Giving examples of electron configurations of some elements and their location in the periodic table.			√			√
3	Dividing students into 8 groups, each group consisting of 3 students.			√			√
4	Asking students to sit in groups.			√			√
5	Shuffle the element cards.			√			√
6	Ask the group leader to take an element card, each group gets 6 element cards.			√			√
7	Ask students to discuss the electron configuration of the element listed on the front side of the element card.			√			√
8	Asking students to look at the questions on the back side of the card and discuss with the group.			√			√
9	Controlling the discussion process in the group.			√			√
10	Giving time for students to discuss in their groups			√			√
11	Asking students (groups) who have finished to put the elements into the periodic table.			√			√
12	Discussing with students the results of working on problems and placing elements on the periodic table.			√			√
13	Giving rewards for groups with the most appropriate question and element placement work.			√			√
C.	**Closing**						
1	Guiding students to discuss and make conclusions			√			√
2	Linking the material with the upcoming lesson			√			√
3	Conducting an evaluation			√			√

Description: N = none (not done), D = present (done), LD = less done

Table 2 shows that in both cycles 1 and 2, the teacher taught by the learning flow with the OK KETUK learning media. However, in cycle 2, learning with OK KETUK media was carried out in 2 rounds, so each student in total got 4 element cards that had to be determined by the electron configuration, period, and element group listed on the front side of the card, working questions on the back side of the card, and placement on the periodic table.

Field Notes

The results of observations made during the learning process by both students and teachers as researchers are contained in field notes. The following are the results of field notes in both Cycles 1 and 2.

Student learning outcomes

To see the increase in student understanding of the periodic system of elements with OK KETUK learning media, a test was conducted in the form of 40 questions consisting of 20 multiple-choice questions and 20 true and false questions. Data on student learning outcomes can be seen in Table 4 below.

Table 4. Learning outcomes in Cycle 1 and Cycle 2

Description	Result	
	Cycle 1	Cycle 2
Average	64,79	83,44
Highest score	80,00	100
Number of students who met the Minimum Result Criteria	9	22
Number of students who have not met the Minimum Outcome Criteria	15	2
Percentage who met the Minimum Result Criteria	37,50	91,67

Table 4 shows that the average student learning outcomes in cycle 2 were higher than in cycle 1. The percentage of students who met the KKM in cycle 2 was also higher than in cycle 1. This shows that learning with OK KETUK media in cycle 2 improved student understanding of the material on the periodic system of elements. These results are related to the improvements made in cycle 2 that can improve learning outcomes. The description of the improvements made in cycle 2 can be explained as follows.

Cycle 2 is an action taken based on the results of the reflection of Cycle 1. Based on the results of observations of student activity in cycle 1, the percentage of students who conducted discussions on determining the electron configuration was 42%, namely 10 students, and the percentage of students who conducted discussions on working on problems was 50%, 12 students. This shows that there are still many students who work alone without discussing with their groups. For this reason, in cycle 2, the teacher, as a researcher, provides intensive assistance so that students actively participate in discussing and working together to complete their assignments. This had an impact on the results of observations of student activity in cycle 2. The percentage of students who conducted discussions on determining electron configurations rose to 75%, namely 18

students, and the percentage of students who discussed working on problems was 83%, namely 20 students. The activeness of students in discussing completing tasks with the group had an impact on the results of the accuracy of the elements of cycle 2 being higher than cycle 1 (Ivone, Juliana, & Darma, 2020).

The activeness of students in group discussions will also provide a pleasant learning situation; this has an impact on student learning outcomes in cycle 2 (average score 83.44), which is higher than cycle 1 (average score 64.79). The percentage of students who achieved the KKM score in cycle 2 (91.67%) was also higher than in cycle 1 (37.50). This is related to group discussions encouraging students to exchange information; if they find a problem, they can solve it together with their group mates (Darajat, 1995). It can also stimulate students to think and express their own opinions to develop the ability to think and communicate, increase learning efficiency, and be involved in planning and decision-making (Nasution, 2010). Group discussion also creates a comfortable situation for learning (Munawwarah & Arafah, 2018), which can cause a sense of pleasure, interest, understanding the meaning of cooperation, and not being bored and more motivated to understand the material (Pono & Lutfi, 2012; Setiowati, 2014). This will certainly be able to improve student learning outcomes (Munawwarah & Arafah, 2018; Pono & Lutfi, 2012; Setiowati, 2014).

In cycle 2, the game with OK KETUK learning media was carried out in 2 rounds. In the first shuffle, students got 2 cards to determine the electron configuration, period, and group, answered the questions on the back of the cards, and placed them on the periodic table. After all the cards are attached to the periodic table and the teacher discusses the results, the element cards are re-shuffled, and students get two different element cards to determine the electron configuration, period, and group, answer the questions on the back of the card, and place it on the periodic table again. This shows that more practice in determining electron configuration and answering questions will help students understand more about the material of the periodic system of elements, which will improve student learning outcomes. With two shuffles, students will get more cards as a means to practice determining the electron configuration and working on questions. This will make students actively practice and encourage them to study more actively, and of course, students will understand the material better to produce good learning outcomes (Kuni'ah, 2012; Mukromah, 2015).

Table 3. Field Notes

Things that were observed during the implementation of learning in cycle 1	
Indicators	Description
Student activities	• Students listen to the teacher's explanation. • Students discuss the writing of electron configuration, the determination of period, and the class of elements listed on the front side of the element card (2 element cards). • Students discuss the problem-solving on the back side of the element card (2 element cards). • Students put the elements on the periodic table.
Teacher activities	• The teacher leads the game with OK KETUK learning media; the game is done in one round. • The teacher acts as a facilitator in group discussion activities and the placement of elements on the periodic table by going around the class and monitoring the learning process.
Interaction between students	• Students work together with their group mates in writing electron configurations, determining periods, and groups of elements that are located on the front side of the card, working on problems on the back side of the card, and placing elements in the periodic table. • During the discussion activities and the placement of elements, most students are actively participating in the learning process.
Student interaction with the teacher	• During the discussion and element placement activities, some students were seen actively participating in the learning process. • Students ask about electron configuration during group discussions. • Students ask about the problems on the back side of the card.
Types of assignments done by students	• Students write down the electron configuration, period, and class determination of the elements listed on the front side of the card. • Students answer the questions on the back of the card. • Students place two element cards on the periodic table.
Learning resources	Chemistry textbook class X IPA specialisation group, Michael Purba, Erlangga
Time	The use of time in the teaching and learning process is sufficient because it has been planned in advance
Things that were observed during the implementation of learning in Cycle 2	
Indicator	Description
Student activities	• Students listen to the teacher's explanation. • Students discuss the writing of electron configuration, the determination of period, and the class of elements listed on the front side of the element card (4 element cards). • Students work on the problems found on the back side of the element card (4 element cards). • Students put the elements on the periodic table.
Teacher activities	• The teacher leads the game with OK KETUK learning media; the game is done in two rounds. • The teacher acts as a facilitator in group discussion activities and the placement of elements on the periodic table by going around the class and monitoring the learning process.
Interaction between students	• Students cooperate with their group mates in writing electron configurations, determining periods and classes, and placing elements in the periodic table. • During the discussion and element placement activities, most students actively participate in the learning process.
Student interaction with the teacher	• During the discussion and element placement activities, most students actively participated in the learning process. • Some students asked about electron configuration during group discussion. • Some students asked about the problems on the back side of the card during group discussion.
Types of assignments done by students	• Students write down the electron configuration, determination of period, and class of elements listed on the front side of the element card. • Students do the problems listed on the back side of the element card. • Students place four element cards on the periodic table.
Learning resources	Chemistry textbook class X specialisation group, Michael Purba, Erlangga
Time	The use of time in the teaching and learning process is sufficient because it has been planned.

These results are also reinforced by the results of student interviews in cycles 1 and 2. The following are excerpts from student interviews in cycle 1:

Student 1: "I feel happy learning with OK KETUK media because I learn while playing"

Student 2: "I am happy with working on questions while discussing because I can ask friends for questions that I don't understand"

Student 3: "Learning with OK KETUK media makes me active and not sleepy during learning"

Meanwhile, the results of the interview are quoted in Cycle 2:

Student 4: "OK, KETUK learning media in the form of games makes me like and understand the material of the periodic system of elements more"

Student 5: "With the repetition of the game into 2 cycles, I have more practice in writing electron configurations"

Student 6: "It's good that teachers often use interactive media so that students don't get bored"

The results of the student interviews show that the OK KETUK learning media used in the form of games helps students become more active in the learning process and train cooperation in groups (Utami & Amalia, 2019). Working on configurations and questions on element cards on OK KETUK media in groups also makes students feel comfortable asking questions and sharing information with their group mates (Munawwarah & Arafah, 2018). The use of OK KETUK learning media also makes the learning situation fun and not boring, it motivates students to learn and improves learning outcomes (Novita & Sundari, 2020).

Based on the explanation above, in this study, several findings were obtained: 1) This is related to group discussions, which can stimulate students to think and express their own opinions to develop the ability to think and communicate. This will create a comfortable and pleasant learning situation that makes students more motivated to learn and understand the material. 2) Student learning outcomes in cycle 2 are higher than in cycle 1. This is related to the use of OK KETUK learning media in the form of games that make students feel happy and not bored so that it will motivate students to learn and improve learning outcomes. Shuffling element cards twice also causes students to get more element cards, which can be a means for students to practice more in determining electron configurations and working on problems that make students more active in learning and improve learning outcomes.

Learning media is important in learning because it can help teachers deliver material so that learning objectives are achieved (Harvianto, 2021). Learning media can shape the learning process to be more effective and help students receive

information from teachers to improve learning outcomes (Stanescu, Stoicescu, & Ciolca, 2011). For this reason, it is important for a teacher as a learning manager to use media in the learning process to create comfortable and enjoyable learning conditions to increase student motivation and improve learning outcomes.

5. Conclusions

The percentage of student activity observation in cycle 1 was 84.26%, while the percentage of student activity observation in cycle 2 was 92.13%. This shows that the percentage of student activity in cycle 2 is higher than in cycle 1. In cycle 2, the percentage of students who conducted discussions was higher than in cycle 1, which had an impact on the accuracy of element placement in cycle 2, which was also higher than in cycle 1.

Student learning outcomes in cycle 1 obtained an average score of 64.79 with a learning completeness at KKM 70 of 37.50%, while learning outcomes in cycle 2 obtained an average score of 83.44 with a learning completeness of 91.67%. This shows that student learning outcomes in cycle 2 are higher than in cycle 1. The use of OK KETUK learning media in the form of games makes students feel happy and not bored. Shuffling element cards twice also causes students to get more element cards as a means for students to practice determining electron configurations and working on problems. This increases student activity and learning outcomes.

References

Abdillah, R. (2015). *Pengembangan Multimedia Pembelajaran Interaktif Mata Pelajaran Kimia Pokok Bahasan Sistim Periodik Unsur Kelas X Program IPA di SMAN 1 Slawi.* Semarang: Universitas Negeri Semarang.

Darajat, Z. (1995). *Metodik Khusus Pengajaran Agama Islam.* Jakarta: PT Bumi Aksara.

Ghalia, F. (2015). Penerapan Model Pembelajaran Teams Games Tounament (TGT) dengan Kartu Destinasi untuk Meningkatkan Aktivitas dan Hasil Belajar Siswa pada Materi Sistim Periodik Unsur Kelas X MIA 3 di SMA Batik 1 Surakarta Tahun Ajaran 2014/2015. *Jurnal Pendidikan Kimia, 4(2)*, 115 - 121.

Harvianto, Y. (2021). Pengaruh Media Pembelajaran Interaktif Terhadap Hasil Belajar Pendidikan jasmani Selama Masa Pandemi Covid-19 . *Journal Pendidikan Jasmani Kesehatan & Rekreasi (PORKES), 4(1)*, 1 - 7.

Ivone, Juliana, S., & Darma, A. (2020). Peningkatan Hasil Belajar Siswa Pada Materi Program Linier Dengan Menggunakan Model Pembelajaran Problem Based Learning (Kajian Pada Siswa Kelas XI SMA Negeri 1 Saparua). *JUPITEK, 3 (1)*, 7 - 12.

Kuni'ah. (2012). *Upaya Meningkatkan Hasil Belajar Siswa Pada mata Pelajaran Matematika Materi Penjumlahan Bilangan Bulat Melalui Metodel Latihan.* Cirebon: IAIN Syekh Nurjati.

Mukromah, S. (2015). *Peningkatan Hasil Belajar Matematika Perkalian Melalui Metode Drill Pada Siswa Kelas II MI Miftahul Huda Selandaka Kecamatan Sumpiuh Kabupaten Banyumas Tahun Pelajaran 2014/2015.* Puwokerto: IAIN Purwokerto.

Munawwarah, A., & Arafah, A. (2018). Pengaruh Metode Diskusi Kelompok Terhadap Hasil Belajar Fisika Peserta Didik Kelas XI SMA Negeri 8 Makassar . *Jurnal Sains dan Pendidikan Fisika (JSPF)*, 11 - 15.

Muslim, B., & Ernilawati. (2016). Penerapan Metode Eksperimen Berbasis Lingkungan Dalam Meningkatkan Hasil Belajar Kimia Siswa Pada Konsep Sistem Koloid. *Seminar Nasional Pendidikan IPA-Biologi* (p. 1 - 14). Jakarta: FITK UIN Syarif Hidayatullah.

Nasution, S. (2010). *Dikdatis Asa-Asas Mengajar.* Jakarta: PT Bumi Aksara.

Novita, L., & Sundari, F. (2020). Peningkatan Hasil Belajar Siswa Menggunakan Media Game Ular Tangga Digital. *Jurnal BASICEDU, 4(3)*, 716 - 724.

Poedjiastuti, L. D. (2016). Pengembangan Permainan Kartu Domino Kimia sebagai Media Pembelajaran pada Materi Unsur bagi Siswa SMALB Tunarungu. *UNESA Journal of Chemical Education*, 115 - 119.

Poedjiastuti, S. A. (2014). Kelayakan Permainan Curhatan Kimia sebagai Media Chemoedutainment pada Materi Sistim Periodik Unsur. *UNESA Chemical Education, 3(2)*, 158 - 163.

Pono, N., & Lutfi, M. (2012). Pengaruh Pembelajaran Menggunakan Metode Diskusi Kelompok Terhadap Prestasi Belajar Siswa Pada Pokok Bahasan Geometri Dimensi Tiga Di MAN Kalimukti Kec. Pabedilan Kab. Cirebon. *EduMa, 1 (2)*, 63 - 73.

Saputra, W. A. (2015). *Pengembangan Media Pembelajaran Interaktif Tabel Periodik Unsur Kimia Berbasis Multimedia.* Yogyakarta: Universitas Negeri Yogyakarta.

Setiowati, B. (2014). *Peningkatan Hasil Belajar Siswa Dengan Metode Diskusi Pada Mata Pelajaran IPS Di Kelas V MI Ta'lim Muktadi I Kota Tangerang.* Jakarta: UIN Syarif Hidayatullah.

Setiyati, C. (2016). Pembelajaran Kimia dengan Permainan Kartu Kimia di Sekolah Menengah Atas. *Jurnal Ilmiah Guru "Cope"*, 80 - 90.

Stanescu, M., Stoicescu, M., & Ciolca, C. (2011). Computer use in Physical Education and Sports Teaching. *The 7th International Scientific Conference E-Learning and Software for Education Bucharest, April 28-29.* https://doi.org/10.5958/2249-7315.2015.00086.6.

Utami, A., & Amalia, N. (2019). Meningkatkan Hasil Belajar Siswa Melalui Media Permainan Let's Play. *Jurnal Ilmiah Pendidikan dasar, 2(1)*, 1 - 10.