



Game-Based Learning Media to Improve Students' Understanding in Chemistry Learning

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Abstract

One of the supporting factors for the success of a lesson is an increase in students' understanding of the material being taught. The use of learning media can help students understand the material easily. This literature review discusses the use of game-based learning media to increase high school students' understanding of chemistry. This study uses the narrative literature review method, by analyzing several literature sources related to game-based learning media. The results of the study show that game-based learning media can encourage students to learn actively anywhere and anytime so that they can increase students' cognitive abilities in understanding chemical material. Game-based learning media can be applied to all grade 10 and 11 chemistry materials at the senior high school (SMA) level.

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INTRODUCTION

Education is something that has been agreed upon as a major issue in all countries. The quality of the nation's education is one of the factors to determine the progress of a nation. In other words, the progress of a nation or country can be measured by the quality of education of that nation or country (N. Hidayah, 2022). Our education still governs the view that knowledge is a collection of facts that must be memorized. In the classroom, it is still focused on the teacher as the main source of information and lectures as the most important alternative learning strategy. This has something to do with learning chemistry which focuses on curriculum development in the core curriculum (Kusumawardhani et al., 2017). Judging from the condition of the quality of education in Indonesia is very low when compared to other countries, many factors hinder the progress of education in Indonesia. According to Kurniawan (2016), one of the factors that determine the success of an education system is facilities and infrastructure (Kurniawati, 2022). An example of facilities and infrastructure is learning media.

The word media comes from the Latin *medius* which means intermediary/middle/introduction, so learning is more successful when accompanied by media (Yusuf et al., 2022). Learning media is a tool that can help students convey information that increases students' understanding of the material. This student understanding is reflected in the increase in student learning outcomes before and after using the media (R. Hidayah et al., 2021). The role of learning media in the learning process is an important part that cannot be separated from the world of education. With the help of teaching media

students become more motivated to learn, stimulate students to write, speak and imagine to be more enthusiastic, and with the help of learning media the learning process will also be more effective, efficient, enjoyable, not boring, and can create good relationships between teachers and students (Tafonao, 2018). Learning media can streamline student learning processes and be able to keep pace with rapidly developing technology (Arsyad, 2009). There are lots of technological developments that can be used by teachers and students as learning support, such as computers, laptops, LCDs, and cell phones (Karlina & Abidin, 2022). One of the learning media that can be used to assist the learning process is game-based learning media.

Game media is learning media aimed at increasing knowledge and understanding, as well as making subjects more interesting (Rozi & Kristari, 2020). Game media can be in the form of educational media that functions to evaluate student learning outcomes (Al-mira & Hidayah, 2020). So that this educational game is a game that can stimulate an increase in thinking power because this educational game can provide direct learning that can increase knowledge (Arifah et al., 2022). Educational games as learning media have several advantages and disadvantages. These advantages include being able to be used anywhere and anytime by the user, increasing the interest and activeness of students in the learning process. The lack of educational game media is that the material used in media is limited, and an explanation is needed from the teacher regarding the material before the media is used (Karlina & Abidin, 2022). Based on this description, this article will discuss game-based learning media to increase students' understanding of learning chemistry. The results of this study are very important for teachers to determine the game media that will be used to improve students' understanding of chemistry concepts. It is hoped that this article can also be a reference for the direction of development and the value of research renewal in the field of learning media development.

METHOD

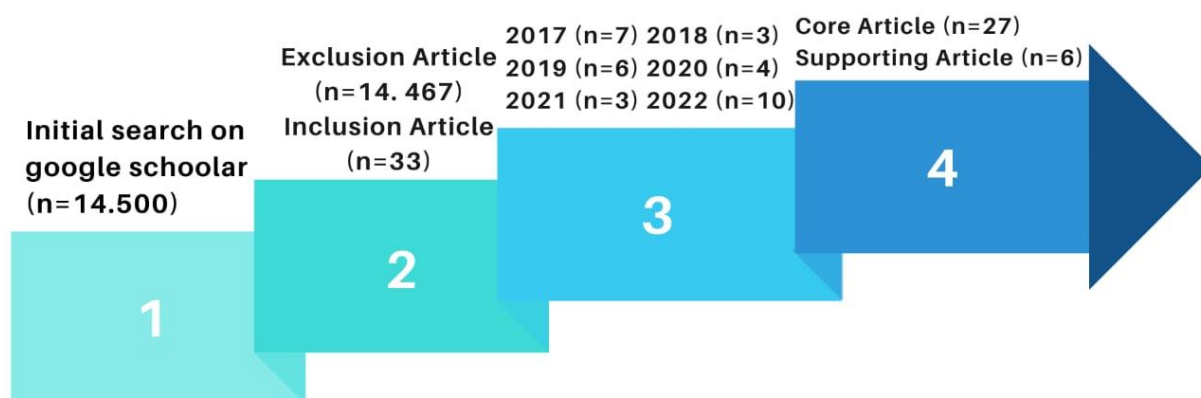


Figure 1. Search Process of Papers

The method used in this literature study is a narrative literature review. The process of searching for articles was carried out using tools in the form of the Google Scholar website using the keyword " game-based chemistry learning media " from 2017-2022 so 14,500 articles were obtained from the search results. Articles This can be categorized based on questions arranged in a matrix (inclusion articles) of 33 articles. This inclusion article is divided into 7 articles in 2017, 3 in 2018, 6 in 2019, 4 in 2020, 3 in 2021, and 10 in 2022. Then the 33 inclusion articles consist of 27 core articles and 6 supporting articles.

RESULTS AND DISCUSSION

Games as Learning Media

Learning media is a tool used to convey information in teaching and learning activities so that it can increase student motivation. Currently, the game has become a part of people's lives. various types of games including educational games. which has the aim of stimulating students' interest in learning the material (Dewi & Lutfi, 2021). The term " game " comes from English which means "game". Where this game can also be defined as a way to get rid of boredom and be able to make connections with the system and conflicts that make the game exciting (Heriyanto et al., 2014 in Suryana et al., 2018).

The reason for doing game-based learning is because teenagers have a tendency to play games either through smartphones or applications, with this also character education in game-based learning is expected to be more organized in social media (Sukirman, 2017). The existence of educational games makes a negative impact on games will be resolved and minimized and can also be useful for students (R. Hidayah & Rahmanah, 2019). The use of learning technology can make students more enthusiastic about learning and need chemistry learning media so that they can attract students' interest and attention to learning and understanding chemical material so that students don't get bored (Aisyah et al., 2022; Yolanda & Iswendi, 2019).

There are several factors that influence the use of game-based learning media, namely the lack of direct understanding from the teacher concerned, resulting in students tending to be less able to use this game-based learning media and also the teacher concerned is worried if the game used cannot overcome the obstacles from students related to difficulties. students in understanding the learning material (Hendrawan & Marlina, 2022). The lack of student interest and also motivation in working on the questions given has an impact on student learning outcomes, because of course a strategy is needed so that learning becomes innovative so students don't get bored, namely by using game-based learning media (Marni & Gazali, 2019) game-based learning can come from the student's own factors both external factors that come from outside the student and internal factors that come from within the student (Novita & Sundari, 2020). Factors that can affect the use of educational games, namely the system of games used should not be much different from games that are played a lot with the aim that students can easily understand the system created in the game, other factors that can help games as learning media are the convenience of audio and audio. the visuals, then there is the arrangement of story scenes and the fun of playing games, and easy game control (Arifah et al., 2022; Ricardo et al., 2022).

Games as learning media offer attractive prospects for innovative learning, by involving students in collaborative activities proposed for writing game scripts, it can stimulate students' critical thinking skills and contribute to the development of other skills. such as communication, problem solving, and media literacy (Chen & Chuang, 2021)

Platforms and Types of Games in Learning Media

As seen from table 1, the game-based learning media used is the Android platform and software at the 10th and 11th-grade levels. Game-based learning media is applied to class 10th materials such as the theory of atomic development, atomic structure, periodic system of elements, the nomenclature of compounds, and chemical bonds, while class 11 materials such as solubility and solubility products, hydrocarbons, redox reactions, chemical equilibrium, colloidal systems. Based on the results of the literature review, it is known that game-based learning media is effective in increasing scientific literacy and student chemistry learning

outcomes. Game-based learning media is also able to help increase students' understanding of chemistry concepts and effectively increase students' chemistry learning motivation.

Table 1. Game Platforms and Applications in Chemistry Learning

10th Grade			
Gaming platforms	Material	Results	Reference
Android and Software	Theory atomic development, atomic structure, system periodic elements, the nomenclature of compound, chemical bonds, and reaction redox	Game-based learning is effective in increasing scientific literacy and chemistry learning outcomes for students	(Astuti & Sugiyarto, 2018; Ayona & Hidayah, 2021; Hidayah et al., 2021; Hidayah & Rahmanah, 2019; Kusumawardhani et al., 2017; Lutfi & Nugroho, 2019; Marni & Gazali, 2019; Pravita & Lutfi, 2019; Ricardo et al., 2022; Pious et al., 2022; Letter et al., 2017)
11th Grade			
Gaming platforms	Material	Results	Reference
Android and Software	Solubility and solubility products, hydrocarbons, chemical equilibrium, colloidal systems	Game-based learning media can help improve students' understanding of chemistry concepts and effectively improve chemistry learning outcomes and student motivation.	(Andiastutik, 2017; Aryani & Hartina, 2017; Dewi & Lutfi, 2021; Hidayani et al., 2020; Hilmiyah & Lutfi, 2017; Nur & Sumarni, 2017; Suryana et al., 2018; Wildana et al., 2020)

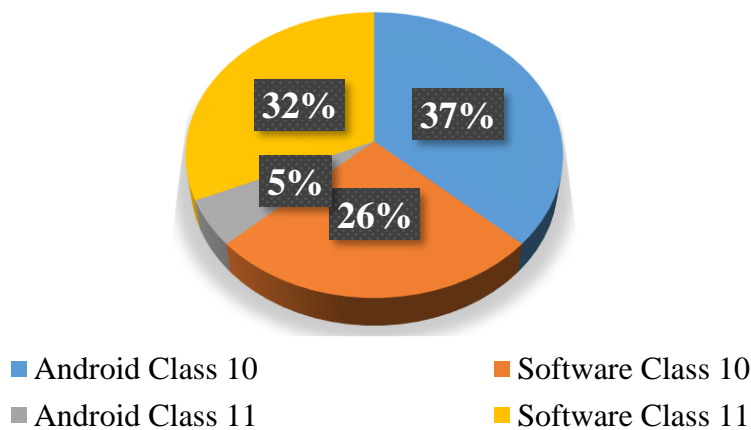


Figure 2 . Type learning media *platforms* based *games*

Judging from Figure 2, the types of game-based learning media platforms that are widely used in grade 10, namely the Android platform and software, are not too large in comparison. Whereas in class 11 the comparison of platforms used is very large, namely software 32% and Android only 5%. Therefore, it is necessary to develop learning media with the Android platform for grade 11 considering that many students now use Android.

Figure 3 shows that game-based learning media has been widely applied by researchers to grade 10 material, namely chemical bonding material of 21% and atomic structure of 16%. Grade 11 material also uses a lot of game-based learning media, but not as much as grade 10 material, for example, hydrocarbon material and redox reactions which are only 11%. This shows that not all chemical material is made in game-based learning media because most of it

is only abstract material while chemical material that is computational is still small. Therefore, in the future, it is necessary to develop game-based learning media on other chemical materials, both abstract and calculation material.

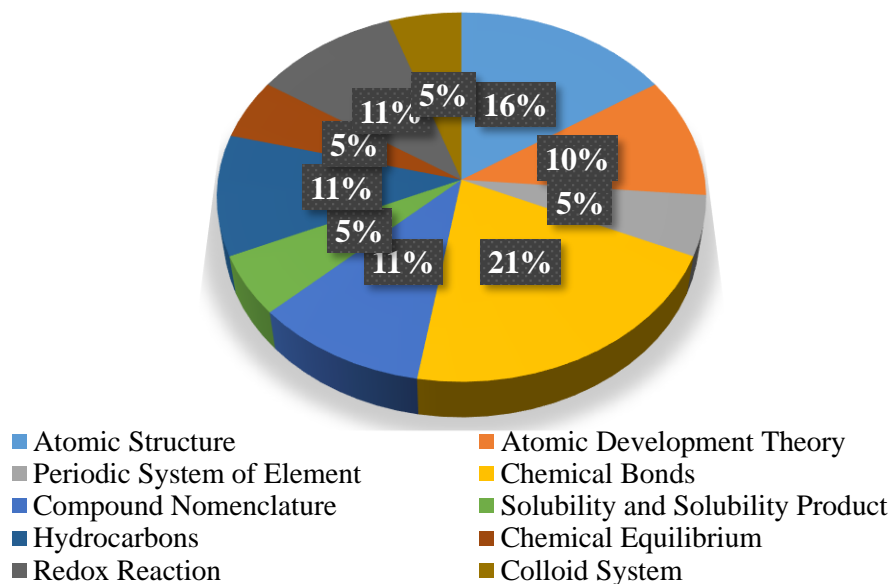


Figure 3 . Trends material chemistry using learning media based games

Game Development as Learning Media

There are several developments in game-based learning media. Where this development uses some additional application assistance in the form of RPG Maker MV software and professional Macromedia Flash. With the help of these applications, the development of game-based media can be modified to make it more educative and better in terms of graphics, images, and audio, as well as being effective in learning (Surati et al., 2017). With this development, making educational games as learning media can be used on smartphones or on computers. So that students can have high motivation to study wherever and whenever (Saleh et al., 2022). According to Darmawan (2011) in Wildana et al. (2020) learning media is easy to develop because there are smartphones that can display interactive animations just like computers.

The development of game-based learning media is necessary because only using learning media that uses visual aids and videos will make students bored so it will be difficult to understand the subject matter (Yuanita et al., 2022). Game-based learning media can improve students' memory because playing can make it easier for students to remember material thereby increasing students' understanding of the material (Hilmiyah & Lutfi, 2017). The use of game media on students' understanding can be tested by the teacher by giving a pretest first and then learning using game-based media. Then a posttest is given to find out how far students understand the material after using game-based media (Andiastutik, 2017).

Advantages and Disadvantages of Games as Learning Media

The use of games as a learning medium certainly has its advantages and disadvantages. The advantage of game-based learning media is that it can attract students' interest in learning the material being taught. The existence of animation can build students' enjoyment of participating in learning activities (Saleh et al., 2022). Students can easily solve problems and solve them (Yuanita et al., 2022; Yusuf et al., 2022), because with games students are used to solving problems from these games. Game media can cause students to be enthusiastic in seeking an understanding which can increase students' cognitive abilities (Arif & Sadiman, 2002, in Almira & Hidayah, 2020). This allows students to play an active role in the learning

process so that students are more motivated and make students compete to win the game (Sadiman, 2012 in (Fauziah & Gazali, 2019). Games can be played online or offline depending on the game being made. Games that are based online or offline make it possible to apply on many platforms (multiplatform) (Wildana et al., 2020). Apart from advantages, game-based learning media also has disadvantages such as when the games being played are too difficult to understand, as a result, students lose interest in learning to use them. the media (Saleh et al., 2022). Not all chemistry subject matter can use game-based learning media, nor are there many variations in the games (Susanti et al., 2022; Yuanita et al., 2022). In addition, most games do not have a cloud feature so data is still stored on local storage by downloading games on smartphones or computers (Wildana et al., 2020).

CONCLUSION

Games as learning media offer attractive prospects for innovative learning. Game-based learning media that is applied in chemistry learning is effective in increasing scientific literacy, understanding students' chemistry concepts, students' chemistry learning outcomes, and increasing student motivation. Types of Android platforms and software are widely used as game-based learning media. The type of material that is widely used in game-based learning media is abstract material. Therefore, it is necessary to further develop game-based learning media on other chemical materials, both abstract and calculation material.

RECOMMENDATIONS

It is hoped that in the future it is necessary to develop game-based learning media with computational chemical material. The development of game-based learning media should use the Android platform because many students now use Android.

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