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Game Based Learning (GBL) in Improving Reasoning Skills of Engineering & Technology Students: Needs, Concepts and Media Factors

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Abstract:
Game-based learning (GBL) is one of the learning systems that we often encounter among students these days. GBL utilizes games as a tool to achieve learning objectives where the games presented can be digital games, traditional games, or role-playing games. Previous research or relevant research has a crucial role in a research or scientific article. This research is useful to strengthen the theory and understand the relationship or influence between the variables studied. This article reviews the factors that influence Game Based Learning (GBL) in improving students' reasoning skills, namely needs, concepts and learning media in engineering and technology. The purpose of writing this article is to build a hypothesis of the influence between variables to be used in further research. The research methodology used is descriptive qualitative with the results of literature review articles in the form of: 1) needs affect game-based learning (GBL) in improving the reasoning skills of engineering and technology students; 2) concepts affect game-based learning (GBL) in improving the reasoning skills of engineering and technology students; and 3) media affect game-based learning (GBL) in improving the reasoning skills of engineering and technology students. This research is expected to provide a deeper understanding of the important role of reasoning skills in engineering and technology learning, as well as the benefits of GBL to improve these reasoning skills.

Keywords: Game Based Learning (GBL), Need Factors, Concept, and Media

Introduction

The needs of society in today's modern era require students to learn in an educational environment that is expected to provide them with space to collaborate, think critically, and analyze both individually and in groups, and can help solve problems or alleviate difficulties in

learning so that in the future they are able to develop innovative projects and products (Sailer & Homner, 2020). he same is true for students. Based on the opinion of Ki Hajar Dewantara (in Harini & Istiq, 2023), students are like students who are in the process of learning, developing their potential, and gaining knowledge, skills, and values to achieve educational goals, with the spirit and characteristics of ideal students (Dewantara, 2011). This statement means that students as learners, especially in the field of engineering and technology, also require the development of 21st century skills in order to improve the quality of learning and succeed in this digital era.

One of the learning skills needed by engineering and technology students is reasoning skills. In general, according to Talib et al. (2019), reasoning is a form of thinking that connects two or more concepts or propositions into new propositions. Ryu et al. (2020) also argue that reasoning is the science and art of correct thinking. Reasoning skills help us to find creative and effective solutions to complex problems. With good reasoning, we can analyze problems from different points of view, consider various options, and the best solution (Aliyu et al., 2019). Game-based learning can help engineering and technology students develop reasoning skills in an engaging and interactive way (Prantil et al., 2020).

Game-based learning (GBL) is one of the learning systems that we often encounter among students these days. GBL utilizes games as a tool to achieve learning objectives where the games presented can be digital games, traditional games, or role-playing games (Adipat et al., 2021). GBL can be used for various courses, such as math, science, language, and many more. According to Kim et al., (2022), uses games as an integral part of the educational process to achieve specific learning objectives. Ifenthaler dan Gibson (dalam Kim et al., 2022) also added that GBL is a type of learning that utilizes digital games to increase a learner's motivation and participation. In addition, GBL uses games for educational purposes, such as to teach skills, knowledge, and others (Mostafa et al., 2021).

Some of Game Based Learning (GBL) media that are often used to improve learning reasoning include puzzles, Scratch, Brain Blast, video games, and Kahoot. Puzzles offer logical challenges that require analytical thinking and problem solving, thus helping students hone their reasoning skills (Falkner et al., 2020). Scratch is a visual programming platform that allows students to create interactive projects, such as games and simulations, in a way that teaches the fundamentals of programming and logic in a fun way (Oluk & Korkmaz, 2016). Video games, especially those containing educational or simulation elements, help students develop reasoning skills through complex scenarios that require strategy and decision-making (Sanchez & Langer, 2020). Kahoot! is an interactive quiz platform that allows teachers to create educational and engaging quizzes, giving students the opportunity to learn and think critically in a competitive yet fun atmosphere (Rosalina et al., 2023). Each of these media offers a unique approach in promoting student engagement and development of reasoning skills in engineering and technology.

GBL offers many benefits by presenting an engaging learning environment and supporting the development of various skills. One of the benefits that can be obtained from the GBL system, namely increasing learning motivation and participation by providing interesting, challenging, and interactive learning experiences (Gabriel, 2018) GBL can help a learner to feel more involved in the learning process, as well as increase the learner's curiosity and enthusiasm for learning materials. Cheng (in Krath et al., 2021), also said that GBL is very helpful for students to understand concepts and learning materials well through simulation and real learning experiences. He also explained about the GBL system that can help develop various skills, such as critical thinking, problem solving, and collaboration. GBL helps learners to develop 21st century skills, such as digital literacy, communication, and creativity, and helps learners prepare themselves to learn independently and effectively in order to face a changing and complex world. The GBL system can also improve learning outcomes that help learners to achieve higher learning achievement and become more successful learners (Shernoff et al., 2020).

Before the GBL system or the era of traditional learning systems, learning was often monotonous and uninteresting which caused students to feel bored and unmotivated to learn (Winatha & Setiawan, 2020). This is also supported by the opinion of Jacobs et al. (2023), the lack of

interaction and stimulation in the learning process can make it difficult for students to focus and concentrate on the material being taught, so that students become passive and less involved in learning. Traditional learning systems generally only rely on text and lectures which make it difficult for learners to understand and connect complex abstract concepts with the real world, especially if learners have different learning styles (Junior, 2018). In addition, traditional learning systems usually focus on memorization and regurgitation of information, which lacks the ability to develop 21st century learning skills that are essential for learners in the era of globalization in order to compete in the competitive world of work (Dahalan et al., 2024). From some of these statements, it can result in low learning outcomes. Unmotivated and disengaged learners may get low grades and not reach their learning potential (Gold et al., 2018). Ineffective traditional learning systems can also lead to significant learning gaps between students (Kiss & Arki, 2017).

Among engineering and technology students, there is a significant increase in gaming, so GBL systems can be a powerful way to engage students in learning as they are driven by the fun factor. The enjoyment of gaming makes the GBL system a tool to support learning environments that require exploration, critical thinking, and reasoning (Danielle, 2022). The use of GBL systems among engineering and technology students is still rare. However, according to (Maimun et al., 2019), parents and teaching lecturers believe that GBL has the potential ability to support and improve very important learning skills, such as reasoning skills among young learners. Such as engineering and technology students not only in, but also in various other institutions.

Although there are several studies exploring the use of GBL media in education, many of them focus on general outcomes such as student motivation and engagement, and not specifically on improving reasoning skills. In the fields of engineering and technology, there is an urgent need for learning methods that can improve analytical and critical reasoning skills. Much of the existing research on GBL media focuses on other fields of study or on more general outcomes such as learning motivation, without deeply evaluating their impact on reasoning skills in engineering and technology. There is a lack of empirical data demonstrating the effectiveness of GBL in the specific context of engineering and technology education. Existing studies often do not provide sufficiently strong or relevant evidence on how GBL improves reasoning skills. There is no comprehensive literature review and synthesis specifically evaluating the influence of GBL on reasoning skills in engineering and technology. A systematic review and synthesis of the existing literature is needed to fill this gap. Some research shows the potential of GBL, but there are no clear guidelines or implementation models proven to be effective in engineering and technology education.

In fact, there are still some students who are not interested or have not found GBL media that suits them and can help hone their reasoning skills. Therefore, the author tries to analyze and discuss the types of learning-based games using relevant descriptions. The author also finds out how the integration of various types of GBL media into learning in engineering and technology courses will improve reasoning skills, problem-solving abilities, and increase creativity to innovate new products, machines, and services for community development.

The results of this study are expected to provide a deeper understanding of the important role of reasoning skills in engineering and technology learning, as well as the benefits of GBL to improve these reasoning skills. The authors also propose an innovative learning approach that integrates GBL into technology and engineering courses. This approach is expected to improve students' reasoning skills, problem-solving ability and creativity. By incorporating GBL media relevant to the learning material, the teaching and learning process in technology and engineering will become more interesting and interactive. This will encourage students to participate more actively, think critically, and find creative solutions to various problems faced. The integration of the GBL system is also expected to improve students' ability to innovate in creating new products, machines, and services. This will certainly make a positive contribution to community development in various fields.

Problem Formulation

Based on the background, problems can be formulated that will be discussed in order to build hypotheses for further research, namely:

1. Does the need factor affect game-based learning (GBL) in improving the reasoning skills of engineering & technology students?
2. Does the concept influence game-based learning (GBL) in improving the reasoning skills of engineering & technology students?
3. Does media influence game-based learning (GBL) in improving the reasoning skills of engineering & technology students?

Literature Review

Game-based learning (GBL)

Game Based Learning (GBL) is a learning approach that uses game elements to increase learner engagement and motivation, and enrich their learning experience. It is designed to meet the individual needs of students. In the context of engineering and technology education, GBL is designed to meet the specific needs of improving students' reasoning skills. (Plass et al., 2019). These dimensions or indicators of GBL include various aspects, such as personalization of the learning experience, enhanced motivation, ability to collaborate, and adjustment of the level of difficulty. GBL allows students to learn in an environment that supports their skill development in a relevant and engaging way, according to their individual learning styles and levels of understanding. By integrating students' individualized needs into game design, GBL aims to increase learning effectiveness and produce better learning outcomes (Plass et al., 2019).

Game Based Learning (GBL) is a learning method that utilizes game elements to teach and facilitate understanding of complex concepts. This approach incorporates game elements such as structured rules, surmountable challenges, and immediate feedback to create an engaging and interactive learning experience for students (Mavromihales et al., 2019). The dimensions or indicators of GBL itself are influenced by the concepts presented, such as abstraction and symbolization which is one of the key factors in the game to simplify complex concepts into representations that are easier for students to understand and apply. This can be achieved through clear visualizations, mathematical models, or simulations that clarify difficult concepts. Context integration is also another dimension influenced by concepts, where games can place students in appropriate situations or scenarios to apply concepts in real or semiotic contexts. In addition, the practical application of these concepts in the context of the game, allows students to not only understand the theory but also see how the concepts can be applied in various situations or problems encountered. Reconciliation and reflection are also indicators that provide opportunities for students to reflect on their experiences, identify errors in understanding, and refine the concepts they have learned (Mavromihales et al., 2019).

Game Based Learning (GBL) is an educational approach that utilizes game elements and mechanics to achieve learning objectives. This method is designed to increase student engagement, motivation, and understanding of the material through an interactive and fun learning experience. GBL not only focuses on the entertainment aspect, but also integrates clear and measurable educational objectives (Adipat et al., 2021). GBL dimensions or indicators include several key aspects that contribute to learning effectiveness. First, interactivity is an important dimension that is enhanced through the use of media. Interactive media allows students to actively participate in the learning process, respond to stimuli, and receive immediate feedback, thus increasing their engagement and motivation. Second, good visual representations, such as high-quality graphics and animation, can clarify complex concepts and help students understand the material better. Third, the accessibility and portability of digital media allow students to learn anytime and anywhere, thus extending the reach of learning beyond the confines of the traditional classroom. Fourth, media customization and adaptation allow for more personalized learning by adjusting content and difficulty levels based on students' individual needs and abilities. Finally, the measurement and analytics provided by digital media help educators track student progress and adjust teaching strategies in real-time (Adipat et al., 2021).

Game Based Learning (GBL) has been widely studied by previous researchers including (Qian & Clark, 2016), (Rodrigues et al., 2021), (Shernoff et al., 2020),(Junior, 2018), (Gomez et al., 2022) dan (Shute & Ke, 2019).

Need Factors

The need for game-based learning (GBL) is all aspects needed to improve students' reasoning skills in engineering and technology is very crucial in this digital era(Kim et al., 2022). Engineering

and technology students are faced with the challenge of understanding and applying complex concepts in practical contexts that require high reasoning and problem-solving skills. Interactive learning that involves game elements can increase student engagement and motivation, which leads to improved learning outcomes. GBL provides an active and participatory learning environment, unlike traditional lecture methods that tend to be passive. In addition, engineering and technology fields require complex problem-solving skills, and GBL can simulate real-world situations that allow students to practice in a safe and controlled environment. Well-designed games can improve students' problem-solving abilities and creativity Fernández (dalam Kim et al., 2020).

The need for game-based learning (GBL) is something that is necessary for the survival of students, especially in the fields of engineering and technology, because it is greatly influenced by rapid technological advances, thus requiring students to always be up-to-date with the latest developments (Vlachopoulos & Makri, 2017). GBL leverages cutting-edge technologies such as augmented reality (AR) and virtual reality (VR) to create immersive and immersive learning experiences. The use of AR and VR in engineering education can enhance students' conceptual understanding and practical applications through better visualization. These technologies enable students to interact with realistic and applicable learning environments, which helps them connect theory to practice more effectively. Collaboration and teamwork are also important skills in engineering and technology. Educational games designed to be played collaboratively help students learn to work in teams, communicate effectively, and solve problems together. revealed that collaborative games can improve students' social and collaborative skills, which are essential in a professional work environment (Vlachopoulos & Makri, 2017).

Need is an important component in the learning motivation process, where individuals are motivated to act based on the expectation that understanding the material will help achieve the desired learning outcomes (Winatha & Setiawan, 2020). Motivation is a key factor in academic success, and GBL can enhance students' motivation to learn. GBL can enhance students' intrinsic motivation, which contributes to increased retention and understanding of the material. With an interactive and fun approach, students are more motivated to engage in the learning process and are more enthusiastic in facing academic challenges. Training and support for teachers are also important factors to ensure the success of GBL implementation. Teachers need to understand how to design and implement games in the learning context and how to evaluate student learning outcomes effectively (Winatha & Setiawan, 2020).

These various needs have been widely studied by previous researchers, including (Hamari et al., 2016), (Gold et al., 2018) dan (Dahalan et al., 2024).

Concept of Game Based Learning (GBL)

The concept is a theory of mentality, where individuals who have a growth mindset see challenges as opportunities to grow and learn (Jacobs et al., 2023). The indicators in this concept are the challenge elements in GBL that are designed to provide challenging tasks that require critical thinking and problem solving. These challenges encourage students to apply the technical concepts they have learned in a more practical and relevant context. The right challenges can increase student engagement and motivation because they feel involved in an active learning process. For example, in an engineering simulation game, students might be tasked with designing a bridge to certain specifications, requiring them to apply physics and engineering principles in a real-world situation (Jacobs et al., 2023).

A concept is a mental connection or relationship that an individual forms between various stimuli or responses in understanding material in learning (Mostafa et al., 2021). One of the indicators in this concept is feedback, which is another important component in GBL that provides students with information about their performance in real time. Fast and specific feedback helps students understand their mistakes and how to fix them, thus accelerating the learning process. Effective feedback can improve conceptual understanding and problem-solving skills. In engineering games, feedback can be given through visual or audio indicators that indicate the

success or failure of an action, allowing students to immediately correct their mistakes. In addition, there is also a reward system in GBL that aims to increase student motivation and engagement through recognition of their achievements. Rewards can be in the form of points, badges, level-ups, or other incentives that encourage students to continue participating and achieving learning goals. A well-designed reward system can increase students' intrinsic motivation, which contributes to increased retention and understanding of the material. In the context of engineering and technology, rewards can be given for successfully completing a project, solving a complex problem, or achieving a certain milestone in the game (Mostafa et al., 2021).

Concepts are complex cognitive structures that develop along with the intellectual development of an individual (Krath et al., 2021)The indicator in this concept is narrative. Narrative in GBL provides context and story that unites the elements of the game, making learning more interesting and meaningful. Narrative helps students understand why they are doing certain tasks and how those tasks are relevant to their learning goals. Strong narrative can increase student engagement and understanding by providing a broader and more interesting context for learning. In an engineering game, the narrative might be a story about an engineer who must save a city from disaster by designing an innovative technical solution. The combination of challenge, feedback, reward systems, and narrative elements in GBL creates a learning environment that supports the development of reasoning skills. Students not only learn technical concepts but also how to apply them in practical and dynamic situations (Krath et al., 2021).

The above concepts have been widely studied by previous researchers, including (Kiss & Arki, 2017), (Obermuller et al., 2023) dan (Killi et al., 2018).

Game Based Learning (GBL) Media

Game-based learning (GBL) media in the field of engineering and technology is a tool or means used to convey information, concepts, or skills interactively to players (Talib et al., 2019). The dimensions or indicators of this media are games with a puzzle system that must be able to present cognitive challenges that are appropriate to the level of knowledge and skills to be taught, so that they can stimulate critical thinking and problem solving in players. This media must be designed with an intuitive and responsive interface to facilitate interaction between players and the content delivered. In addition, the visual and audio aspects of the media must support a fun and interesting learning experience, so that players' motivation to learn and complete the tasks given can be maintained. By considering these dimensions, puzzle game media can be effective in facilitating game-based learning processes in the fields of engineering and technology (Talib et al., 2019).

Game-based learning (GBL) media is a means or tool used to convey information or knowledge to users In game-based learning in engineering and technology, media indicators that can be used are game simulations involving Scratch and programming games. Scratch is a visual programming language used to create animations, games, and other interactions interactively. Users can learn basic programming concepts such as program flow control, variable settings, and decision making through the use of Scratch. Programming games in this context include developing games that are not only entertaining but also facilitate the learning of technical and technological concepts. Through this game simulation, learners can apply theoretical knowledge in a practical and interesting context. Thus, media in the form of scratch and game programming have a crucial role in increasing the effectiveness of game-based learning in engineering and technology, because they allow users to interact directly with learning materials and apply the concepts they learn directly in a controlled simulation environment (Pradja & Saputra, 2023).

Media in the context of game-based learning (GBL) in engineering and technology are tools used to deliver learning materials through interactive experiences (Sanchez & Langer, 2020). The dimensions or indicators offered in the GBL media this time are video games that offer in-depth simulations and visualizations that allow users to explore and actively learn in the context of engineering and technology. On the other hand, there is also the Kahoot! platform which provides a competition-based learning experience and involves interactive quizzes with a focus on user

engagement and responsiveness. These media include the clarity of the information conveyed, the suitability with the relevant engineering and technology curriculum, the level of interactivity that facilitates active learning, and the use of technology that supports dynamic and problem-solving-based learning experiences. By utilizing video games and Kahoot! effectively, GBL can improve understanding and skills in engineering and technology through an interesting and fun approach for students (Sanchez & Langer, 2020).

Some of these media have been studied extensively by previous researchers, including (Putra et al., 2023), (Nuha & Purwanti, 2023), (Obermuller et al., 2023), (Resnick et al., 2019), (Falkner et al., 2020).

Method

This scientific article is written using qualitative methods and library research. This study involves analysis of theories and relationships between variables from various sources, both from books and journals obtained offline in libraries and online through Mendeley, Google Scholar, and other online media.

In qualitative research, literature reviews must be consistent with methodological assumptions, namely used inductively so as not to direct research questions. Qualitative research is conducted because it is exploratory (Creswell & Poth, 2020; Flick, 2022).

Results and Discussion

Based on the study of relevant previous theories and research, the discussion of this literature review article in the concentration of the role of Game Based Learning (GBL) in improving the learning reasoning of engineering & technology students is:

1. The Influence of Need Factors on Game Based Learning (GBL)

It should be understood that the need factor is the elements or conditions that are needed or desired to achieve a certain goal. The need factor influences the implementation of GBL, where the dimensions or indicators of this need factor are such as interactive learning, complex problem solving skills, technological development, collaboration and teamwork, motivation, and training and support (Algarra & Jose', 2022). Here is a further discussion:

a) Interactive learning, where high engagement or long-term connections and increased retention are needed. In this case, engagement can make students more involved and motivated to learn when they actively participate in the learning process. In addition, more interactive learning can increase information retention because students are involved in an immersive learning experience.
b) Complex problem solving skills, by creating a safe learning environment and developing critical skills. Students can practice and experiment in a safe and controlled environment without real risk. Improving analytical skills, critical thinking, and problem solving are also important in engineering and technology.
c) Keeping up with technological developments, where students learn to use relevant and up-to-date technology, which can improve their readiness to face the world of work. Students also become more flexible and able to adapt quickly to new technologies.
d) Collaboration and teamwork that can improve collaboration and communication skills that are important in the work environment, as well as develop team working skills, including conflict management and task coordination.
e) High learning motivation that can increase student involvement and active participation in the learning process. In addition, students feel more satisfied and motivated to achieve their learning goals.
f) Adequate training and support ensures that GBL is implemented effectively and efficiently, and reduces technical and operational barriers that may interfere with the learning process.

Based on several indicators, the need factor in improving the reasoning skills of engineering and technology students has an influence on the dimensions or indicators of GBL implementation, because:

a) Interactive learning includes several important aspects. Games should be designed to encourage active interaction between students and learning content. The use of engaging visual and audio elements can increase student engagement. In addition, the use of technologies such as augmented reality (AR) and virtual reality (VR) to create a more immersive learning experience.
b) Complex problem-solving skills include real-world simulations, where games should simulate complex real-world situations to allow students to practice and test their skills. In addition, the use of realistic scenarios and case studies can develop analytical and problem-solving skills. Games should also have challenges or missions that require sequential and ongoing problem solving.
c) Keeping up with technological developments includes realistic interactions, where games must allow interaction with realistic and applicable learning environments using the latest technology. Integration with the latest software and technology tools relevant to the field of engineering and technology is also important. Regular updating of game content to keep up with technological developments and new knowledge is another significant factor.
d) Collaboration and teamwork include collaborative features, where the game must have features that allow collaboration between students to interact and work together effectively is also important. In addition, games that allow the division of roles and responsibilities within the team are very necessary.
e) Learning motivation includes a reward system, where awards such as points, badges, or level-ups can encourage learning motivation. Healthy competitive elements in games can also increase enthusiasm and passion for learning.
f) Training and support includes training lecturers and students on how to effectively use games in learning. Adequate technical support to address technical issues that may arise during the use of the game is also important. Access to additional resources such as tutorials, guides, and discussion forums to assist in learning is another important factor.

To improve the implementation of GBL in improving the reasoning skills of engineering and technology students by considering the needs factor, what management must do is ensure that the games to be implemented are designed to encourage active interaction and are relevant to the curriculum, provide adequate training and technical support for lecturers and students, and continue to update game content to suit the latest technological developments, which includes the provision of advanced technology facilities such as AR and VR, the development of collaborative features to support teamwork, and the implementation of instant reward and feedback systems that can increase student motivation and engagement as a whole (Linawati et al., 2020).

The need factor influences the implementation of GBL, if the need factor is well perceived by customers or consumers, this will improve the quality of GBL implementation. This is important to ensure the effectiveness and relevance of GBL in Education (Kim et al., 2022).

The need factor influences the implementation of GBL, this is in line with research conducted by: (Kamińska et al., 2017), (Kailani, 2019) dan (Vance, 2018).

2. The Influence of Concepts on Game Based Learning (GBL)

It is important to understand that the concept of GBL is an approach that uses game elements and mechanics to increase student engagement, motivation, and understanding. This concept influences the application of GBL to engineering and technology students, where dimensions or indicators of concepts such as challenges, feedback, rewards and narratives influence the dimensions or indicators of GBL application (Rachman & Ratnayake, 2018). Here is a complete explanation:

a) Challenges are an important element that aims to test and develop students' reasoning skills. In GBL, it is very important to improve students' reasoning skills in engineering and technology.

Challenges should be designed to simulate complex real-world problems, requiring critical analysis and sound decision-making. By facing tiered challenges that increase in difficulty, students will be encouraged to develop effective problem-solving strategies. These challenges should also be relevant to the curriculum and industry needs, so that students gain skills that can be directly applied in their future jobs.

b) Feedback is a crucial component in GBL that provides information to students about their performance. Feedback should be given in real-time and constructively to help students understand their strengths and weaknesses. Good feedback includes explanations of what was done right, what went wrong, and how to improve it. Prompt and clear feedback can help students correct their mistakes immediately and learn from the experience. In the context of engineering and technology, feedback can be in the form of evaluations of technical procedures performed, problem solving, or decision making carried out in the game.

c) Rewards in GBL are motivational tools that encourage students to continue learning and try harder. Rewards in GBL serve to motivate and increase student engagement. The reward system can be in the form of points, badges, level-ups, or other awards given after students achieve certain goals or complete challenges in the game. Rewards must be designed in such a way that they motivate students to continue learning and try harder. In addition, rewards can also be used to recognize achievements and skills developed during the learning process, providing a sense of accomplishment and motivating to achieve more.

d) Narrative is an element that connects the various aspects of a game into a coherent and engaging storyline. It plays a vital role in increasing student engagement and motivation. A compelling story or narrative arc can make learning more enjoyable and entice students to continue to engage in the learning process. A good narrative can also help contextualize a technical or scientific problem, making it more understandable and relevant to students. In engineering and technology, a narrative might be a story about an engineering project, research mission, or industry challenge that students must solve, providing real context for the concepts and skills they are learning.

To improve the implementation of GBL by considering the concept, what management must do is integrate GBL into the curriculum as a whole by designing and developing games that are relevant to the technical and technological materials taught. Management also needs to provide intensive training to lecturers to support effective implementation of GBL, as well as provide adequate technological infrastructure to support the use of games in the learning process. In addition, regular monitoring and evaluation of the effectiveness of GBL in improving students' reasoning skills is needed, by adjusting game content based on feedback and the latest technology (Alsawaier, 2018).

The concept influences the implementation of GBL, if the concept is well perceived by customers or consumers, this will improve the quality of the learning experience in GBL. A positive perception of the concept helps ensure that GBL is not only effective in improving students' reasoning skills, but is also more easily accepted and enjoyed as an innovative and efficient learning method (Krath et al., 2021).

The concept influences the implementation of GBL, this is in line with research conducted by: (Tresnawati & Budiman, 2021), (Rodrigues et al., 2021) dan (Marcella, 2022).

3. The Influence of Media on Game Based Learning (GBL)

GBL media refers to various forms of technology or platforms used to implement or provide game-based learning experiences. This can include software applications, web platforms, virtual simulations, or even educational games specifically designed to facilitate learning through a game-based approach. Media influences the implementation of GBL where some GBL media that are suitable for improving students' reasoning and technical skills include puzzle systems, Scratch, programming games (simulations), educational video games, and Kahoot! (Talib et al., 2019). The following is an explanation of each of these media:

a) Puzzle System
   Puzzle games such as "Portal" and "The Talos Principle" offer logic-based challenges that require problem solving and critical thinking, which are essential in engineering education. Puzzles help students develop the analytical skills and systematic thinking needed to solve complex technical problems.
b) Scratch
   Scratch is a visual programming platform designed by the MIT Media Lab, which allows students to create interactive projects, such as animations and games. Scratch is very effective in teaching the basics of programming and computational logic through a drag-and-drop method, which makes it accessible to beginners and supports creative learning.
c) *Programming Game (Simulation)*
   Simulation games like "CodeCombat" and "Robocode" teach programming concepts through play. CodeCombat uses RPG elements to teach programming languages like Python and JavaScript, while Robocode allows students to write code that controls robots in simulated battles. These games combine hands-on learning with game elements that make the learning process more engaging.
d) Video Game
   Educational video games like "Minecraft: Education Edition" and "Kerbal Space Program" offer simulated environments that allow students to learn about technical and scientific concepts. Minecraft: Education Edition is used to teach everything from mathematics to architectural engineering, while Kerbal Space Program teaches the basic principles of physics and aeronautical engineering.
e) Kahoot!
   Kahoot! is an interactive quiz platform that can be used to create educational and competitive quizzes. Kahoot! allows teachers to test students' knowledge in real-time through engaging multiple-choice questions. This helps in increasing student engagement and motivation to learn.

To improve the implementation of GBL by considering the media used, what management must do is choose and integrate the right GBL media according to the needs of the engineering and technology curriculum. Management needs to develop or choose platforms and applications that support interactive and meaningful learning experiences, and provide training to lecturers to optimize the use of these media in learning. In addition, management must ensure that technological infrastructure and technical support are available to support the smooth and effective implementation of GBL in the educational environment. Continuous evaluation of the effectiveness of the selected media is also needed for adjustment and improvement of learning content and methods (Lathifah et al., 2023).

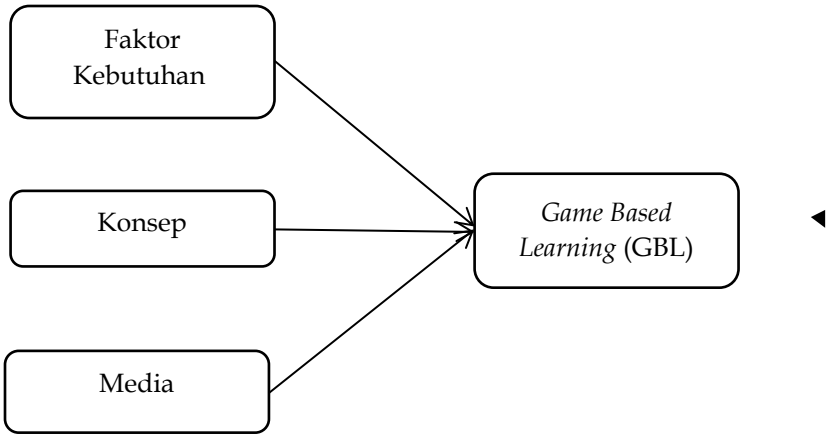
Media influences the implementation of GBL, if the media used is perceived well by customers or consumers, this will improve the quality of the learning experience in GBL. Positive perceptions of media help ensure the effectiveness and acceptance of innovative and interactive learning methods (Chapman & Rich, 2018).

Media influences the implementation of GBL, this is in line with research conducted by: (Licorish et al., 2018), (Danielle, 2022) dan (Oluk & Korkmaz, 2016).

Research Framework

Based on the formulation of the problem, theoretical studies, relevant previous research and discussion of the influence between variables, the framework of this article is obtained as below.

Picture 1
Research Framework



Based on the conceptual framework above, the need, concept, and media factors affect the application of GBL. Apart from these three exogenous variables that affect the application of GBL, there are many other variables that affect it including:

a) Design: (Jacobs et al., 2023), (Gui et al., 2023) dan (Farrell & Moffat, 2018)
b) Implementation: (Kaimara et al., 2021), (Talib et al., 2019) dan (Wardoyo et al., 2021)

Relevant Previous Research

Table 1

No	Author (s)	Previous Research Results	Similarities with this article	Differences with this article
1	Plass et al., (2019)	The need factor in the form of interactive learning, as well as the ability to solve complex problems and the concept of feedback where this has a positive and significant effect on game-based learning (GBL)	The need factor is interactive learning, as well as complex problem solving skills and the concept of feedback which influences game based learning (GBL)	-
2	Kim et al., (2022)	Need factors include technological development, collaboration and teamwork, and motivation. There is also the concept of challenge and reward. Plus the media in the form of Kahoot! which has a positive and significant effect on game-based learning (GBL)	Need factors include technological development, collaboration and teamwork, and motivation. There is also the concept of challenge and reward. Plus the media in the form of Kahoot! which affects game-based learning (GBL)	-
3	Jacobs et al., (2023)	The concept of challenge, feedback and reward. In addition, there is also a design in the form of clear learning	Concepts of challenge, feedback and reward that influence game-based learning (GBL)	Design in the form of clear learning objectives, as well as integration of

		objectives, as well as the integration of educational content that has a positive and significant effect on game-based learning (GBL)		educational content that affects game-based learning (GBL)
4	Mostafa et al., (2021)	Concept in the form of narrative, media in the form of Scratch and programming games (simulation), and design in the form of context, visual and audio design that have a positive and significant effect on game-based learning (GBL)	Concepts in the form of narratives, media in the form of Scratch and programming games (simulation) that affect game-based learning (GBL)	Design in the form of context, visual and audio design that influences game-based learning (GBL)
5	Adipat et al., (2021)	The need factors are collaboration, learning motivation and training. There is also an explanation of the concept in the form of feedback and implementation in the form of infrastructure readiness, curriculum integration, and technical assistance that have a positive and significant impact on game-based learning (GBL)	The need factors are collaboration, learning motivation and training. There is also an explanation of the concept of feedback that affects game-based learning (GBL)	Implementation in the form of infrastructure readiness, curriculum integration, and technical assistance that has an impact on game-based learning (GBL)
6	Talib et al., (2019)	Media in the form of puzzles, Scratch, programming games, video games, and Kahoot!, as well as implementation in the form of adaptations and adjustments that have a positive and significant impact on game-based learning (GBL)	Media in the form of puzzles, Scratch, programming games, video games, and Kahoot! which have an influence on game-based learning (GBL)	Implementation in the form of adaptations and adjustments that have an impact on game-based learning (GBL)

Conclusion

Based on theory, relevant articles and discussion, hypotheses can be formulated for further research:

1. Need factors affect game-based learning (GBL) in improving the reasoning skills of engineering & technology students.
2. Concept influences game-based learning (GBL) in improving the reasoning skills of engineering & technology students.
3. Media has an effect on game-based learning (GBL) in improving the reasoning skills of engineering & technology students.

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