



Using The Minecraft Game To Teach Algorithmic To Secondary School Students In Morocco

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Abstract. The algorithm is considered the heart of computer science, hence the importance of teaching algorithmic concepts to students. Ensuring the full involvement of students in their learning will only be guaranteed through gamification which is based on the use of the principles of games in non-gaming contexts to motivate students and promote learning. Minecraft Education Edition is a special version of Minecraft which is a very popular game. This version is launched by Microsoft, it is used specifically in the educational environment, it offers several educational features and specific tools for teachers and students. In this paper we proposed a new educational world on Minecraft Education Edition dedicated to secondary school students and which transforms the learning of algorithmic concepts into an interactive and creative experience. Through this proposed world we have also presented some examples of activities which promote the acquisition of the targeted skills. The preliminary results of the experimentation of this proposed world show that it is promising for increasing student engagement in activities and ensuring a better understanding of algorithm concepts. We can deduce that the proposed approach is fun and stimulates students' interest while strengthening their key computer skills.

Keywords: Gamification, Minecraft, Algorithmic.

1 Introduction

Gamification is the process of game-thinking and game mechanics to engage users and solve problems [1]. It has been used in various fields, including education to transform learning experiences into more engaging and interactive activities.

Several studies and research have been carried out to evaluate the impact of the use of gamification on learning [2][3]. The results showed that educational practices based on gamification have a positive impact on the success of learners and their attitude towards courses [4].

Recent years have seen the emergence of tools and platforms dedicated to gamification in education. Some of these tools have been specially created and developed to help teachers integrate gaming elements into their lessons easily and effectively. There are several games designed specifically to help learners acquire skills in various areas

for example mathematics [5], computer science [6], chemistry [7], etc. Among these innovative educational tools, Minecraft Education Edition, a special version of the most popular game Minecraft designed for educational use, it offers teachers educational features, allowing the integration of concepts such as collaboration, creativity, programming, coding, etc. in the context of the classroom.

Algorithms are a fundamental component of computational thinking, and teaching algorithmic concepts in an engaging way is a challenge that many educators meet with ingenuity.

In this article we focused on the use of the Minecraft education edition as a teaching aid for algorithmic concepts and we showed how Minecraft, with its immersive and creative environment, can be used effectively to teach the basics of the algorithm, to learners while capturing their attention. 100 students experienced learning the concept of an algorithm in the world we created on Minecraft, the preliminary numerical results show that our proposed educational production was able to achieve the predefined objectives while increasing learner engagement in the activities, we can say that it is a promising didactic production.

2 Problem statement

The algorithm is very important for students because it allows them to solve problems in a structured and efficient way, to think logically and critically, and to develop their creativity by seeking and proposing innovative solutions to complex problems. Unfortunately, traditional algorithm teaching can be boring and frustrating for some students. Classic teaching methods do not integrate the principles of gamification, which makes learning algorithms abstract, uninteresting and uninviting. Therefore, we have considered using the Minecraft Education Edition game as a fun way to teach and learn the concept of algorithms to secondary school students.

3 Research objective

The main objective of this article is to propose a didactic production which makes it possible to increase the engagement of students in learning the concept of the algorithm through Minecraft Education Edition and to verify the effectiveness of this didactic production in understanding algorithmic concepts.

4 Gamification in learning and education

an approach based on the integration of playful elements and game principles in contexts that are not necessarily game-related [8], in order to stimulate engagement [9], motivation [10], learning [11] and also promote collaboration [12].

5 Minecraft Education Edition

Minecraft Education Edition (MEE) is an educational version of the game Minecraft, created by Mojang Studios and Microsoft. It is specially designed for use in school environments. It provides teachers and students with a more engaging and immersive place to learn. In this digital world, students can explore, build and work together, which stimulates their creativity and team spirit.

MEE incorporates education-specific features, such as collaboration tools, classroom management options, and integrated teaching resources. It features pre-built learning worlds and interactive lessons created by educators on various topics, like science, math, programming, history, literature, and more. This allows students to experience the concepts taught in an immersive way. This game encourages creativity, problem solving and collaboration among students.

MEE is secure because it allows teachers, through security and control features, to manage game settings, control student access and create a secure learning environment.

Microsoft provides resources to help teachers effectively integrate MEE into their teaching. These resources include step-by-step guides, video tutorials, and technical support. This allows teachers to maximize the use of MEE in their classrooms and improve the learning experience for students.

Many researches and studies have been conducted to examine the effectiveness of using MEE in the educational context. These studies have examined many aspects of integrating MEE into teaching, including the impact of gaming on learning, student engagement, creativity, collaboration, and other factors. These studies have shown that MEE can be successfully integrated into a variety of disciplines, including:

- Mathematics: the use of Minecraft Education Edition successfully improves fifth graders' understanding of the subject of probability [13] thus it is expected to increase affectivity towards mathematics [14] as it has a significant impact on student learning it allows learners to obtain better results in mathematics [15],

- Programming by developing methods to teach programming in the world of minecraft education edition [16] [17],

- Sciences: it can be used as a learning tool to understand the atomic structure in middle school by making the atomic structure less abstract [18] and thus to promote team work throughout the application process [19],

- Foreign languages such as learning English [20] [21],

- Social sciences by making learners more engaged in learning history for example [22], and many others. Additionally, it can be used at different school levels, from primary school to secondary school.

6 Proposed didactic production

The world we have created in Minecraft Education Edition is unique and specially designed to help students explore and understand the fundamental concepts of algorithms in a fun, interactive and exciting way.

The name of this world (see Fig. 1) is inspired by the Al Quaraouiyyine University of Fez in Morocco, which is one of the oldest universities in the world.



Fig. 1. The entrance to Al Quaraouiyyine University

In this world we tried to guide students using blackboards and NPCs (see).



Fig. 2. The department of learning the algorithm concept

We have locked the doors of each department and the student will be invited to find the entry pass code (see), and continue the adventure.



Fig. 3. Lever pass code to unlock the department door

Each department in this world presents unique challenges that require the application of the notion of algorithm to overcome.

The first challenge is to prepare a cake (see au-dessous): it requires collecting ingredients, putting each ingredient in its box (see au-dessous) and following the steps in order (see au-dessous) to arrive at the result (the cake).



Fig. 4. First challenge: statement of the task to be done

In the proposed world, we used NPCs not only to guide the students in their adventure but also to give them information (see au-dessous) and ask them questions at the end of each challenge (see au-dessous). Subsequently, they could earn additional points and advance to the next stage.



Fig. 8. Learn more about the origin of algorithm



Fig. 9. First question about the first challenge (prepare a cake)

7 Numerical results and discussion

To verify the effectiveness of the world created in teaching and learning the algorithm concept, we tested it with 113 secondary school students (see au-dessous) aged between 15 and 19 (see au-dessous).



Fig. 10. In the Classroom: Teaching Algorithm concept by Minecraft Education Edition

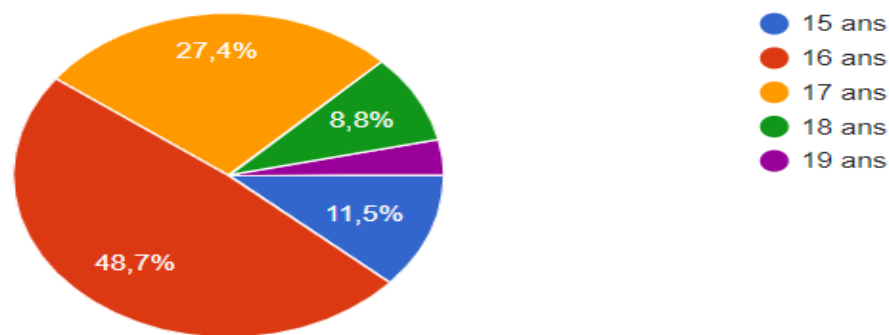


Fig. 11. In the Classroom: Teaching Algorithm concept by Minecraft Education Edition

We took three classes (TCS1, TCS5 and TCS7), each class is divided into two groups because in the computer classroom we have 14 computers reserved for students. The following **Erreur ! Source du renvoi introuvable.** gives more details about the number of students per group.

Table 1. Number of students per group.

Classes	Number of students	Groups
TCS1	37	G1: 19, G2: 18
TCS5	38	G1: 19, G2: 19
TCS7	38	G1: 19, G2: 19

We gave the students the choice of working individually or in pairs.

The table below au-dessous shows the lesson plan using Minecraft Education Edition as a tool to teach the concept of algorithms to students.

Table 2. Lesson plan

Duration	Teacher Activity	Student Activity	Challenges provided in the game
8 min	Present the Minecraft Education Edition game and the rules of the game.	Follow the teacher carefully.	Soft skills.
	Ask students who chose to work in groups to form a group of no more than 2 students.	Choose his partner in the game. Agree on who will be the leader of the group.	
4 min	Ask students to connect via the Minecraft platform and access the algorithm world.	Student must connect to the platform and access the algorithm world.	Successfully connect to the platform and access algorithm mode. Play collaboratively with the partner in the game. Good time management.
25 min	Ask students to start the game and follow the instructions. Guide and direct learners.	Start the challenges.	Successfully open the doors to move on to the other stages of the game. finish tasks ask. Earn points by answering questions in the game.
23 min	Ask the students to stop the game.	Answer the questionnaire.	Speak out.
	Ask students to answer the questionnaire to find out their opinions about the world of algorithms. Collect student responses.		

The questionnaire was conducted using Google Forms and included 30 simple questions designed to be accessible to students.

According to the students' responses we found that 68.1% of students know the Minecraft game (au-dessus) but 83.2% do not know the educational version of this

game (MEE) (au-dessus) and 65.5% did not have the opportunity to play in Minecraft (see au-dessus). We also found that all students don't have knowledge of algorithms (see au-dessus). Despite all this, 56.6% of students were able to open the automatic door the first time algorithms (see au-dessus), and all students felt joy and enthusiasm after successfully completing this challenge algorithms (see au-dessus).

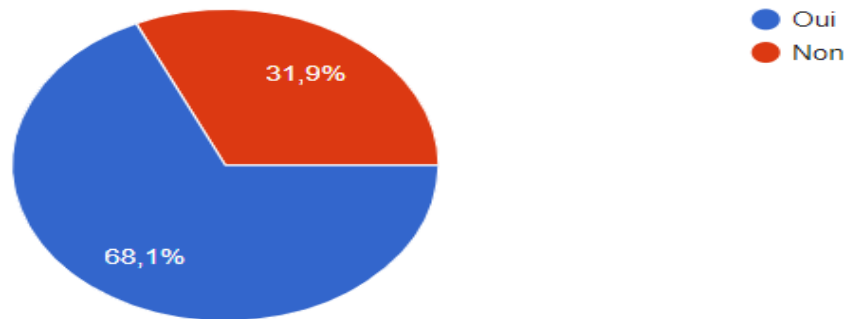


Fig. 12. The percentages of students who know Minecraft

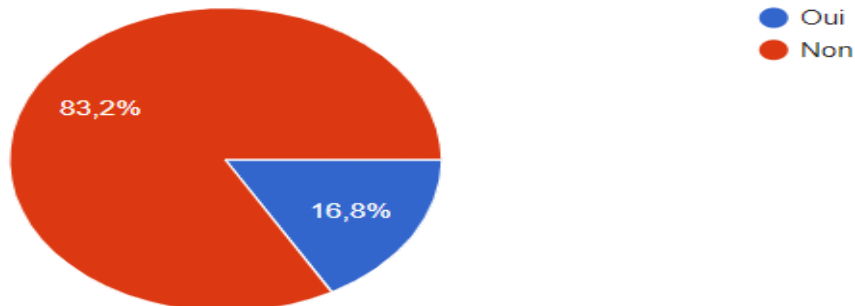


Fig. 13. The percentages of students who know Minecraft Education Edition

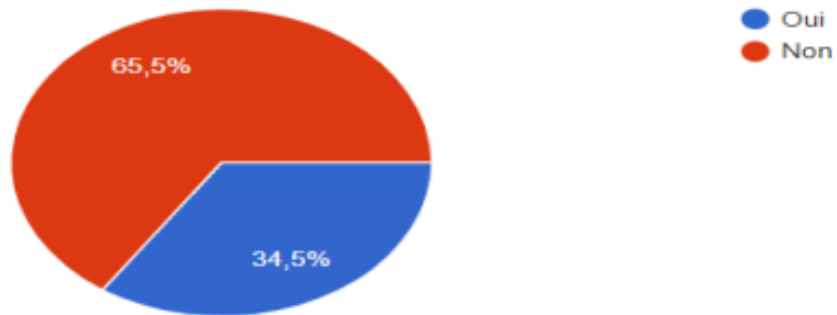


Fig. 14. The percentages of students who have already played on Minecraft

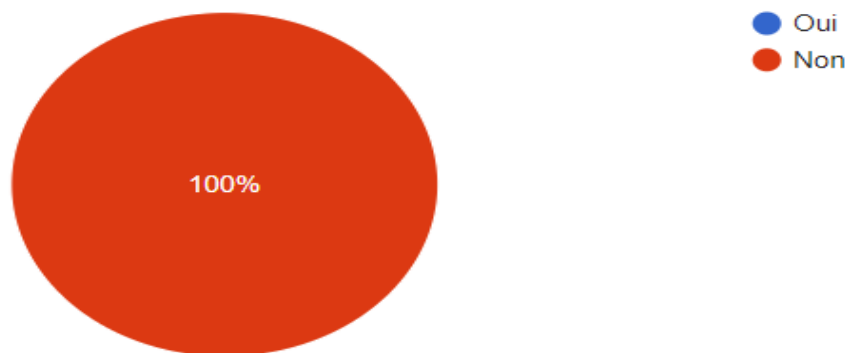


Fig. 15. The percentage of students who have already studied the algorithm

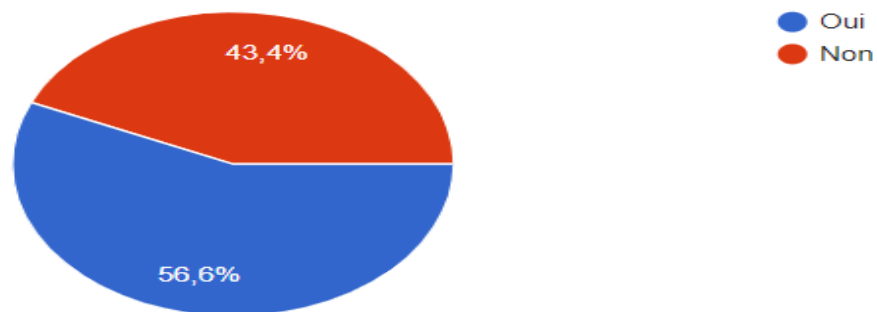


Fig. 16. The percentage of students who successfully opened the automatic door the first time

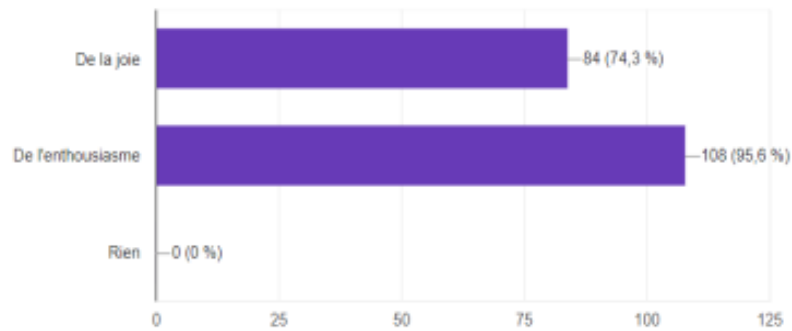


Fig. 17. The percentage of students' feelings after successfully opening the automatic door

97.4% of students found that the first challenge (preparing a cake) was fun or very fun (seeau-dessus). 100% of students found the second challenge (maze) to be fun or very fun (see au-dessus).

100% of students answered the question of the first and second challenge correctly the first time (see au-dessus) (see au-dessus).

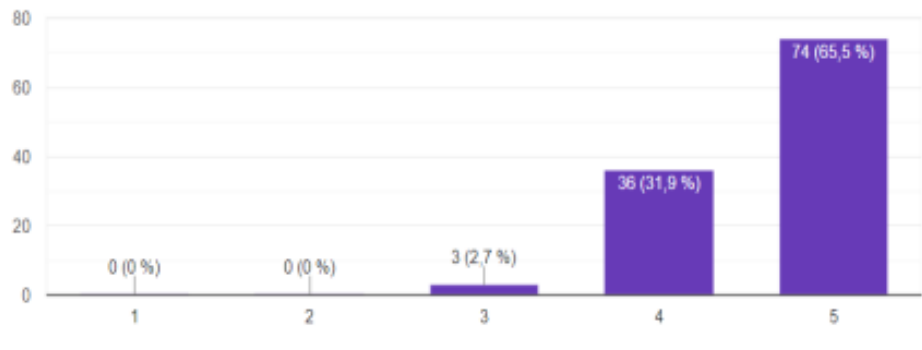


Fig. 18. Linear scale of students' opinion on the first challenge (preparing a cake): from very boring to very fun

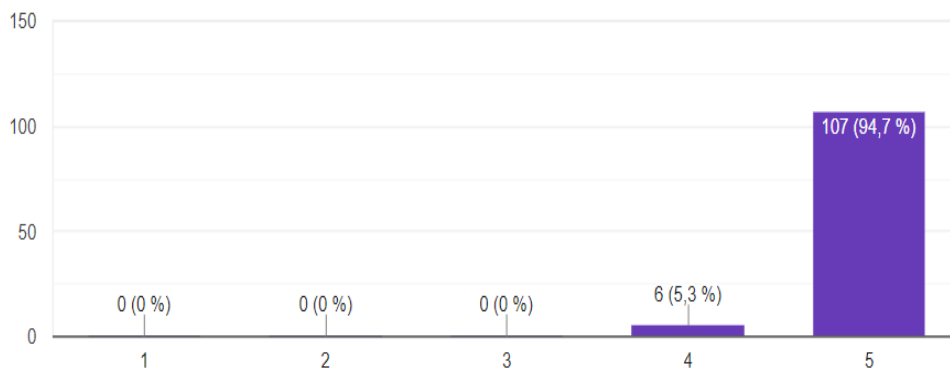


Fig. 19. Linear scale of students' opinion on the second challenge (maze): from very boring to very fun

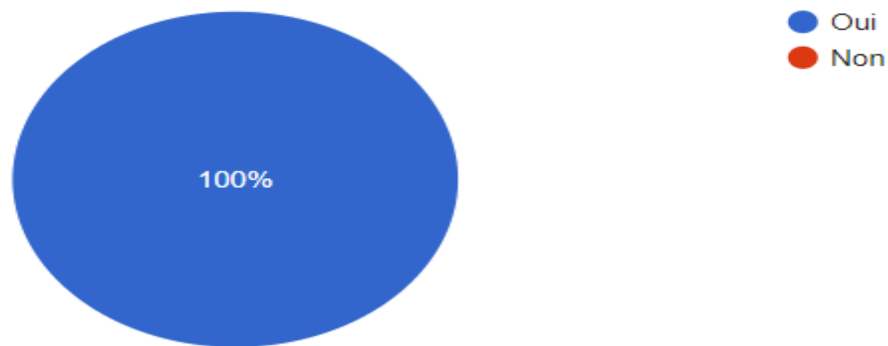


Fig. 20. The percentage of students who answered the first challenge question correctly the first time

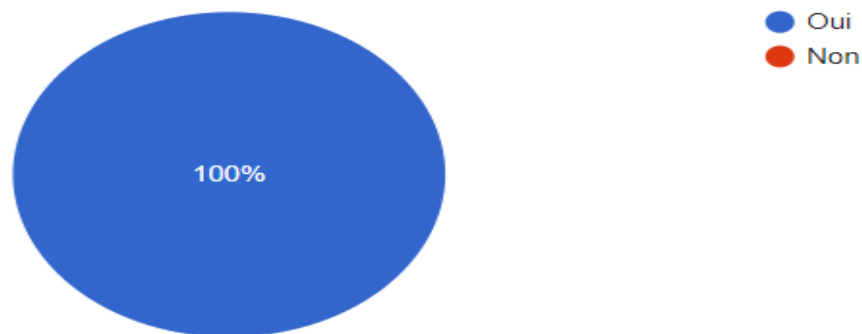


Fig. 21. The percentage of students who answered the first challenge question correctly the first time

95.6% of students answered the algorithm definition question correctly (see au-dessus).

Un algorithme est:

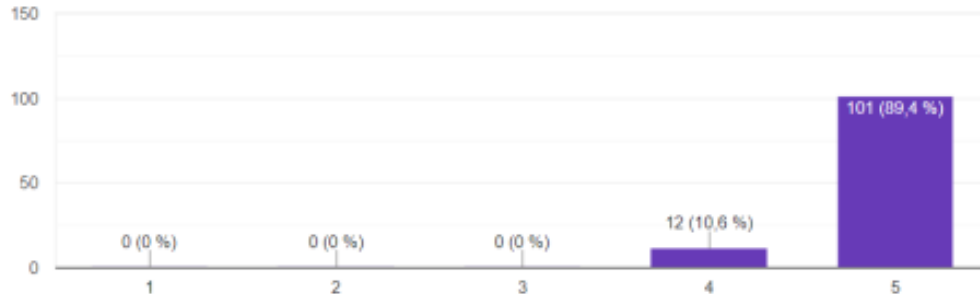
113 réponses

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Fig. 22. The percentage of students who answered the algorithm definition question correctly

100% of students find that learning the concept of an algorithm via this world is positive or very positive correctly (see au-dessus).

**Fig. 23.** Linear scale of students' opinion learning the concept of an algorithm via the algorithm world: from very negative to very positive

From the numerical results obtained we can deduce that the algorithm world that we proposed and created in Minecraft education edition succeeded in attracting the attention of the students and guaranteeing a high degree of concentration of the students and achieving the objective targeted.

8 Conclusion

In this paper we proposed and created a world on Minecraft Education Edition to teach the notion of algorithm to secondary school students, this world has many advantages for high school students, it promotes engagement, collaboration, the development of essential skills, simplification of complex concepts, etc. plus it makes learning more fun and interactive.

As a perspective, we are thinking of improving this world and adding other challenges to teach students the notion of variable and constant...

References

1. Zichermann, G., Cunningham, C.: Gamification by design: Implementing game mechanics in web and mobile apps. O'Reilly Media, Inc. (2011)
2. Hong, G.Y., Masood, M.: Effects of gamification on lower secondary school students' motivation and engagement. *International Journal of Educational and Pedagogical sciences*. 8, 3765–3772 (2014)
3. Alsawaier, R.S.: The effect of gamification on motivation and engagement. *The International Journal of Information and Learning Technology*. 35, 56–79 (2018)
4. Yildirim, I.: The effects of gamification-based teaching practices on student achievement and students' attitudes toward lessons. *The Internet and Higher Education*. 33, 86–92 (2017)
5. Jagušt, T., Botički, I., So, H.-J.: Examining competitive, collaborative and adaptive gamification in young learners' math learning. *Computers & education*. 125, 444–457 (2018)

6. Ibanez, M.-B., Di-Serio, A., Delgado-Kloos, C.: Gamification for engaging computer science students in learning activities: A case study. *IEEE Transactions on learning technologies*. 7, 291–301 (2014)
7. Chans, G.M., Portuguese Castro, M.: Gamification as a strategy to increase motivation and engagement in higher education chemistry students. *Computers*. 10, 132 (2021)
8. Kim, S., Song, K., Lockee, B., Burton, J.: What is gamification in learning and education? In: *Gamification in learning and education: Enjoy learning like gaming*. pp. 25–38. Springer (2017)
9. Reeves, B., Read, J.L.: *Total engagement: How games and virtual worlds are changing the way people work and businesses compete*. Harvard Business Press (2009)
10. Zichermann, G., Linder, J.: *Gamification revolution*. (2013)
11. Dicheva, D., Dichev, C., Agre, G., Angelova, G.: Gamification in education: A systematic mapping study. *Journal of educational technology & society*. 18, 75–88 (2015)
12. McGonigal, J.: *Reality is broken: Why games make us better and how they can change the world*. Penguin (2011)
13. Ming, G.: The use of minecraft education edition as a gamification approach in teaching and learning mathematics among year five students. In: *Proceedings: International Invention, Innovative & Creative (InIIC) Conference*. pp. 44–48 (2020)
14. Garcia, L.R., Herreros, S.H., Puchades, J.M.R.: Use of Minecraft: Education Edition for Teaching Pre-College Mathematics: Design of Educational Reinforcement. In: *Handbook of Research on International Approaches and Practices for Gamifying Mathematics*. pp. 258–275. IGI Global (2022)
15. Ming, G.K.: *Learning Mathematics 3D Objects Through The 5E Instructional Model Lesson: Minecraft Education Edition*.
16. Voštinár, P., Dobrota, R.: Minecraft as a tool for teaching online programming. In: *2022 45th Jubilee International Convention on Information, Communication and Electronic Technology (MIPRO)*. pp. 648–653. IEEE (2022)
17. Sajben, J., Klimová, N., Lovászová, G.: Minecraft: Education edition as a game-based learning in Slovakia. In: *Edulearn20 Proceedings*. pp. 7686–7693. IATED (2020)
18. Nkadiemeng, M., Ankiewicz, P.: The affordances of Minecraft education as a game-based learning tool for atomic structure in junior high school science education. *Journal of Science Education and Technology*. 31, 605–620 (2022)
19. Saricam, U., Yildirim, M.: The Effects of Digital Game-based STEM Activities on Students' Interests in STEM Fields and Scientific Creativity: Minecraft Case. *IJTES*. 5, 166–192 (2021). <https://doi.org/10.46328/ijtes.136>
20. Uusi-Mäkelä, M.: *Learning English in Minecraft: a case study on language competences and class-room practices*, (2015)
21. York, J.: *Minecraft and language learning. Minecraft in the Classroom: Ideas, inspiration, and student projects for teachers*, 179-196 (2014).
22. Andersen, R., Eie, S., Mørch, A.I., et al.: *Rebuilding the industrial revolution: Using Minecraft in teacher education in social studies*, (2021)

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