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Game-Based Learning in Action: How Teachers Use Minecraft Education to Foster Student Engagement

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Game-Based Learning in Action: How Teachers Use Minecraft Education to Foster Student Engagement

Abstract

As the increasing pressure for teachers to develop innovative teaching practices aimed at increasing student engagement, teachers are increasingly encouraged to adopt game-based learning strategies. This study evaluates the utilization of Minecraft Education (ME) into lesson planning in various subject areas, focusing on how teachers incorporate game-based learning into instructional design to elucidate both challenges and successes within the lesson planning experience. This study employed a document study methodology where 15 lesson plans were analyzed to identify trends, challenges, and successes regarding the incorporation of ME into formal educational structures. These findings indicated that teachers experienced some differences in their ability to adopt ME by adapting their practices; however, most managed to develop significant effort and malleability after early challenges. This study exemplified how the inclusion of game-based learning (GBL) methods can change conventional lesson preparation and stimulate students' critical decisions, creativity, and cooperation. Additionally, the results underscore the importance of targeted professional development initiatives for teachers to address the identified gaps in digital pedagogy and enhance their ability to design effective game-based learning experiences. This study contributes to ongoing explorations of curriculum integration in game-based learning, instructional innovation and educational technology more generally.

Keywords: Digital Pedagogy, Educational Technology, Game-Based Learning, Lesson Plan Analysis, Minecraft Education

Introduction

With the rise of the Fourth Industrial Revolution, the incorporation of technology in education has become an urgent imperative to equip students with the essential skills to thrive in a digitally transformed world. That challenge is worldly, especially when considering how to incorporate technology into lessons. And this challenge is exacerbated by another: the increasing demand for the integration of technology into lesson planning to develop collaborative, student-centric contexts that promote critical thinking and problem-solving (Jansen & Lazonder, 2015). The teaching and learning need the cornerstone teacher planning competencies are built from the growing demand for learner-centered practices (Department of Basic Education [DBE], 2011), which requires teachers to have planning skills to ensure effective teaching and learning. Meeting these demands will require teachers to embrace advanced competencies in lesson planning, ensuring that their approaches are robust and appropriately attuned to their learners. Literature supports the necessity of providing teachers with the tools and know-how needed to incorporate technology into the lessons, since it can improve learning and teaching (Voogt et al., 2013).

However, a common challenge remains whereby often teachers do not possess the confidence and knowledge to design lesson plans that successfully integrate digital tools

and resources (Seherrie, 2020). While there is no doubt that ubiquitous tech-driven lesson plans are useful, not all teachers have the confident and capability to implement these tools into their lessons. According to Mishra and Koehler's (2006) TPACK framework, teachers need to be equipped with the skills in integrating technology into their subject-matter instruction. This is consistent with evidence that planning is the core to teaching, which calls for a clear planning of how best to arrange lessons for optimal learning (Voogt et al., 2013). Planning is not just giving a guide to teach but it is an organize process which involves content, learning objectives, prior knowledge of learners and teaching methods (Magano, 2009). Yet, research has shown that teachers struggle to innovate and rework their lesson plans, and there is a need for comprehensive training and support (Adewumi & Titilawo, 2015; Magano, 2011; Prinsloo, 2007). In addition, it should be emphasized that skills such as activities designing, teamwork, decision-making and time management are very important aspects of effective planning of lessons (Matshoba & Rooth, 2014). To address these issues, this study examines teachers' competencies to develop lesson plans implementing ME. The aim of the study is to identify the procedural and factual dimensions of lesson planning that contribute to coherence and efficiency by analyzing written lesson plans and reconstructing the structuring measures used (Doyle, 2006; Lipowsky, 2015). The results will help inform ways to support teachers in using technology to improve student learning outcomes and fill existing gaps in how lessons are planned.

Literature Review

Game-based Learning Trends in Education

The move towards the digital transformation of education is not an isolated one; rather, it is a part of a larger imperative to prepare students for what they are expected to be in the 21st-century world. These include both core academic competencies and essential “soft” skills (Nguyen et al., 2022), such as critical thinking, creativity, communication, collaboration, and digital literacy. Digital tools especially game-based learning (GBL) platforms like ME really show how this vision covers our goals and needs, because GBL offers students immersive, experiential, and engaging environments that nurture the building of such skills.

Though in recent years GBL has emerged quickly, establishing itself as a revolutionary option to introduce in classrooms by ensuring student re-engagement in various subjects. Because of its motivating force, ability to encourage the active participation of learners and to facilitate their cognitive, social, and emotional development, gamification is seen as an essential part of modern education (Wang et al., 2021). Different from passive content delivery methods that traditional instructional models typically use, GBL can offer interactive, goal-oriented experiences. Features like challenges, rewards, and narrative progression drive persistence and foster deeper emotional and cognitive ties to learning tasks (Gee, 2007). GBL has yielded promising results in STEM education, an area notorious for students' difficulty in making connections to abstract or complex content. Game-based methods provide opportunities to apply theoretical knowledge and immerse learners in simulated, experimental, and iterative environments where they can apply new knowledge in real-world constructs that matter. In mathematics and science, for instance, students can engage with models and systems that see abstract ideas spatially, making it more palpable, and inquiry-focused (Lee & Hammer, 2020;

Anderson & Barnett, 2013). It actively leads to problem-solving, experimentations, and reflections which are essential components to constructivist learning theories.

Despite the well-known benefits of GBL, there are still many obstacles to its application, especially in formal classrooms. And one of the largest challenges help teachers align game-based activities with national curriculum standards. This misalignment poses problems in lesson design and assessment practice (Sung et al., 2022). Additionally, the evaluation of learning in GBL environments is still an open debate, especially concerning how to assess higher-order thinking or collaborative performance, which are relevant to the development of 21st-century skills (Kim et al., 2021). Despite growing interest in GBL practices and GBL-related student outcomes, however, one significant gap in the field is around how teachers approach the design, structure, and implementation of GBL-integrated lesson plans, as well as how they assess student understanding after implementation. However, their integration into teacher-generated, curriculum-aligned lesson plans is not well documented, especially for platforms such as ME, which is a popular tool among students. It would be great to have accessible models of instruction and a variety of planning tools that makes it hard for those who want to use Minecraft in school. Bridging this gap is necessary: GBL tools should be engaging as well as pedagogically sound and academically aligned.

Minecraft Education as a Teaching Tool

ME Edition is one of the most widely used digital platforms in GBL due to its open-ended, sandbox structure that promotes creativity, exploration, and student-led learning. The adaptable environment enables teachers to personalize learning experiences to varied subjects, such as mathematics, computer science, history, geography, and environmental science (Miller et al., 2023) Students can model geometric shapes in the game, simulate chemical reactions and design sustainable cities with all within the immersive 3D space of the game Minecraft. This flexibility allows teachers to embrace constructivist learning, where students do not simply memorize facts, but instead, have active roles in how they build knowledge through experimentation and collaboration (Papert, 1980).

Research shows that with ME, students are more engaged, have improved spatial reasoning, creativity, and collaboration, particularly students in primary and middle school (Johnson & Smith 2022). Autonomy, mastery, and relatedness are key components of self-determination theory (Ryan & Deci, 2000), and the platform encourages intrinsic motivation through these pillars. The use of multiplayer modes or multiplayer strategies helps support peer learning and teamwork which is important for building up interpersonal and social-emotional skills as seen in most practices of digital learning environments. However, literature identified a significant gap around understanding how teachers plan, design and incorporate ME into structured lesson designs. Although research indicates that Minecraft can positively influence student outcomes, relatively little research focuses on the processes of instructional design that underpin classroom use of the game, including lesson objectives, standards alignment, scaffolding, and assessment (Hanghøj & Hautopp, 2020). Not having more detailed, teacher-created lessons could slow wider adoption of ME, because teachers don't have ready models or frameworks for implementation. Clearly defining this connection is vital to supporting teachers in designing relevant, standards-aligned learning experiences that maximize the potential of Minecraft as a teaching and learning resource.

Teacher Competencies in Technology Integration

The success of deploying digital tools like ME in teaching and learning is highly dependent on teachers' technological skills and pedagogical preparation. Teachers are now not just teachers but also educational technologists, constantly integrating the vast availability of educational technology currently available with technology in their classrooms, roles, and lives. The key factors related to teachers' readiness were comfort with technology, experience, access to ongoing professional development opportunities, and support systems within the institution itself (Jones et al., 2021).

It suggests that effective GBL does not just depend on good technical skills but relies on the integration of the corresponding technical, pedagogical and content knowledge as is often described (Mishra & Koehler, 2006) by the Technological Pedagogical Content Knowledge (TPACK) framework. Not only must teachers understand content matter, but they must also know to create interactive and differentiated learning tasks to meet curricular objectives and captivate learner attention among learners with different needs and styles of learning (Parker & Thompson, 2023). However, there is little research knowledge to date on teachers' competencies regarding developing lesson plans through the integration of ME. Teachers found it difficult, for example, to decide which topics to focus on, support student missions, and connect game-based activities to assessable and measurable learning goals and national curriculum criteria (Voogt et al., 2015). Furthermore, without well-structured planning frameworks or exemplary lesson plans, teachers might turn to trial-and-error methods, further preventing the effectiveness of integration, particularly for those who might not respectively engage in GBL classrooms. While ME continues to grow in use, high-quality, specific, ready-to-teach lesson plans remain limited. Without practical models or benchmarks to follow, it appears that the availability of resources in education is limited (Karsenti & Bugmann, 2017). Closing this gap would relieve some of the burden off individual teachers but also foster the kind of mirrored work commonly seen among communities of practice around sharing resources, ideas, and innovations.

Minecraft Education Lesson Planning

A lesson plan is the blueprint that teachers create to determine what learners need to accomplish and how, during their time with the teacher, the learners will be organized and learn to meet that goal. Instructional plans are frequently referred to as roadmaps for teaching and learning, outlining the session or unit material, pedagogical approach, materials, and the assessment methods used in the process. A well-crafted lesson plan can facilitate more than just instructional delivery; it paves the way for passive observers, the teacher and the learner, as well as the active agent, the subject matter, to engage each other in a dynamic and real-time manner as teachers leverage on-the-spot decision-making with a consideration of the forward looking outcomes they are aiming for (Lai & Lam, 2011).

But in practice, teachers do not always adhere strictly to predetermined plans. The planning process involves being flexible and responsive (Santagata et al., 2007), which is evident when they borrow from their instructional strategies as they examine formative feedback and learner responses. The teachers are required to be able to state the learning objectives clearly, organize the proper instructional system, and select the right assessment methods to help monitor and evaluate the students' progress towards the

learning objectives (Simwa & Modiba, 2015). Integrating ME into lesson plans takes another level of planning expertise. Not only do teachers have the traditional elements of timing, objectives, and content, but they must position good game-based learning strategies throughout their instruction.

This includes ensuring that in-game activities align to curriculum standards, deciding how to scaffold tasks in and out of the Minecraft environment, and designing assessments that capture creativity, problem solving, and collaboration. Such kinds of instructional plans must be strategic and pleasurable (Woolfolk, 2016), accounting the ongoing nature of learning within immersive digital environments. One of the key challenges for teachers planning with digital tools such as Minecraft is contextualizing the amenable elements of planning to the needs of diverse learners. Scholars such as Enow and Goodwyn (2018) and Stigler and Miller (2018) have shown that teachers who have continued process-driven planning make instructional decisions based on the developmental level, prior knowledge and learning preferences of their students. This is especially significant in the case of GB tools, as they tend to naturally encourage open-ended exploration and often depend on the design phase of the game to make the experience meaningful for a different level of students.

In addition, ME, a flexible sandbox platform invites teachers to step into the role of instructional designers to create meaningful, immersive, and standards-based learning experiences. Such planning naturally necessitates a deep understanding of the confluence of content and pedagogy, how digital technologies can enhance and supplement learning, and how 21st-century classrooms might promote the idea of technology pedagogical content knowledge (TPACK) (Mishra & Koehler, 2006) in 21st-century classrooms. So in short, lesson planning with ME is an intricate but fulfilling endeavor. It requires content fluency, pedagogical intent, and technological nimbleness, all enacted from within a learner-centered perspective. Such to-day-to-day competence enables teachers to create rich, engaging, and effective learning environments that not only achieve curricular learning goals, but also promote important twenty first century skills, including creativity, collaboration, and digital fluency.

Application TPACK Framework in Game-Based Learning and Lesson Planning

In designing the lesson plan, teachers are guided by the TPACK for understanding how teachers integrate technology in the classroom (Mishra & Koehler, 2006) provides a guiding framework. The TPACK framework includes three domains: domain-specific content knowledge, content pedagogy, and digital technology to integrate in a way that allows researchers and teachers alike to better understand the ways in which teachers develop lessons for game-based learning, namely ME (Harris & Hofer, 2019). Teachers need to address the technological content knowledge component, so that in-game-based activities are appropriate with suitable teaching approaches that are beyond engagement (such as inquiry learning, problem-solving, and cooperation, and game mechanics (Voogt et al, 2013).

Similarly, technological content knowledge assesses how well teachers choose and use game-based components to illustrate subject matter ideas. For example, in the field of science, teacher might use Minecraft to model geometric constructions, and in the field of mathematics, teacher might use it to mimic the interactions between the creatures in a specific ecosystem (Chai et al., 2013). Teachers are guaranteed this through the pedagogical content knowledge

component, so they decide to choose an approach that is age-appropriate and fundamentally curriculum-aligned, allowing for meaningful learning experiences. This study examines instructors' lesson plans using the TPACK framework to determine how they incorporate ME into structured lesson planning. To create game-based activities that favorably impact topic mastery rather than being stand-alone interactive tasks, the analysis then attempts to determine if and to what extent teachers balance instructional techniques with digital affordances (Koehler et al., 2014).

Methodology

Research Design

This study applied qualitative document analysis research design and aimed to analyze teachers' capacity and challenges of integrating ME into planning class for various disciplines. Research design using a qualitative document analysis approach, 15 lesson plans were examined, specifically focusing on curriculum alignment, assessment and instruction strategies, and the application of game-based learning principles. This process provided a systematic evaluation of how teachers incorporated Minecraft mechanics into lesson plans as well as highlighting best practices, areas for improvement and more generally, lessons learned from game-based learning.

Participants

This study involved fifteen teachers drawn from different subject fields, including science, biology, chemistry, mathematics, and English. These teachers were selected specifically based on their availability to participate and their openness to incorporating ME into their lesson plans. The participants had varying levels of familiarity with ME as well as teaching experience ranging from three to fifteen years, which provided a diverse perspective on its integration.

Data Collection

15 lesson plans developed by teachers with ME in their teaching methods were analysed. The lesson plans were analyzed to evaluate for pedagogical practices, curricular alignment, topic relevance, integration strategies, and creativity in the implementation of game-based learning. Using a rubric for Minecraft integration that examined criteria such as organization of lessons, engagement strategies, assessment strategies, and twenty-first century learning objectives, the quality of this combination of traditional and digital learning experience was evaluated. An inductive thematic analysis was conducted, with a focus on how teachers utilized Minecraft mechanics to enhance their students' learning, to derive new insights and challenges regarding lesson design. They cover themes like curriculum alignment, assessment design, innovation, and technology integration. It also examined lesson plans' use of game-based learning concepts to stimulate critical thinking, problem-solving and teamwork.

Ethics approval for the study was obtained prior to its initiation. Instructors expressed informed agreement, and strict guidelines of confidentiality and anonymity were implemented to analyze their class plans. Participant names have been replaced with pseudonyms, and all data was securely stored to maintain anonymity. The use of a small sample population and variations in prior experiences of instructors using ME has been cited as two detriments that could

potentially lessen the scope and impact of game-based implementation within student lesson planning. Yet, the findings indicate areas where more professional development and instructional support are needed and provide interesting insights into how teachers create lessons utilizing ME.

Result and Discussion

The 15 lesson plans submitted by teachers were analyzed based on three key dimensions: Instructional Design, Creativity & Innovation, and Curriculum Alignment. Analysis of these results shows differences in teacher proficiency, as well as challenges and successes in integrating ME in the classroom.

Instructional Design

The instructional design aspect is paramount to making sure lessons with Minecraft piece together to support learning. This dimension assesses whether learning objectives can be clearly articulated, step-by-step instructions are available, and whether the assessment methods used in the lesson plans are appropriate. The analysis showed that 6 in 15 of the lesson plans (40%) were highly structured with clear learning objectives, explicit instructional steps and integrated assessment methods. While not directly related to a single lesson plan, it offers an example of a learning plan. For example, Teacher A created a Mathematics (Perimeter & Area) lesson plan that served a step-by-step learning flow in which the students built houses in Minecraft, incorporating the mathematical concepts in a structured manner. This is consistent with studies that have shown that clearly designed lesson plans enhance students' understanding of concepts and engagement in digital learning environments (Parker & Thompson, 2023). The remaining 5 lesson plans (33%) were coded as moderately structured lesson plans, meaning that they included clear objectives and teaching strategies but omitted detailed scaffolding for a variety of student proficiency levels. For example, the lesson plan on English (Crime Investigation) was engaging but did not meanfully focus on differentiation strategies for students with varying language abilities. Previous research indicates that differentiation is essential in game-based learning settings; it enables learners to move at their own pace through the content, while being supported adequately (Nguyen et al., 2022).

Finally, 4 (27%) were loosely structured lesson plans, which means that these teachers did not provide specific instructions and or did not establish a grading system to measure the learning outcomes. As one example, the Periodic Table (Chemistry) lesson, students built a Minecraft version of the Periodic table, but it was unclear how the lesson was delivered or what the evidence of learning assessment strategy would be. Research indicates that lesson plans that lack a clear structure often lead to limited student engagement and challenges in meeting learning goals (Johnson & Smith, 2022). Findings showed them that implementation challenges and effective strategies had an impact on effective implementation of game-based learning when analyzing the lesson plans integrating ME. A significant concern indicated was also considered the unclear instructional sequencing, which challenged teachers to facilitate students in their game-based process in the right way. Lack of explicit guidance, however, may prevent students from understanding the learning path that they are following entailing a risk that the lesson effectiveness is not fully reached (Clark et al., 2020). And assessments were often nebulous, focusing on group participation rather than individual learning. The absence of precise criteria

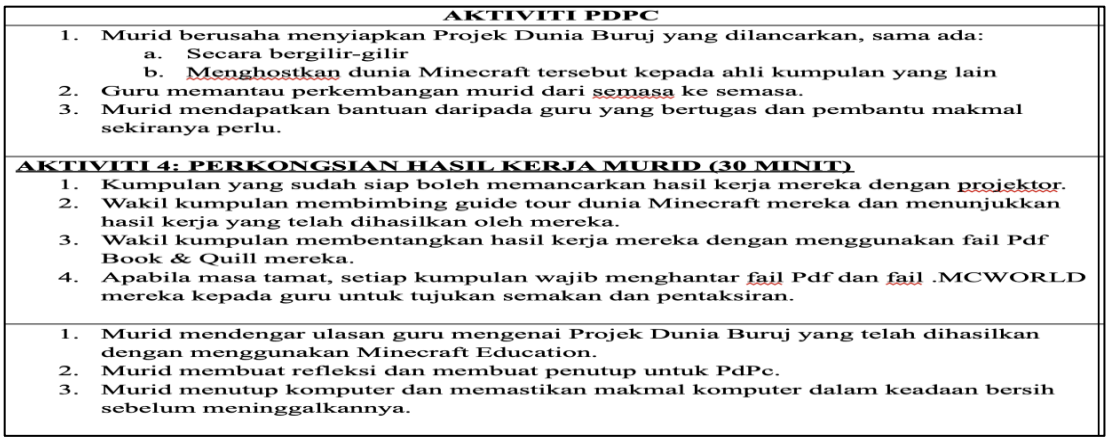
for assessment posed a challenge for teachers attempting to evaluate students' conceptual understanding, creativity, and critical thinking skills within the game-based learning environment (González & Blanco, 2021).

Still, some best practices emerged from the most effective lesson plans. More successful lessons that kept students engaged with material and helped them learn included step-by-step teaching, differentiated activities and clear learning standards. These guided the students through the game-based tasks efficiently, and differentiated activities provided opportunities for multiple skill levels and various learning paces. The structured rubrics allowed teachers to assess students beyond participation to provide a more holistic assessment of their learning progress (Raes et al., 2020). These conclusions demonstrate how well-planned lesson structures and clear assessment strategies are essential corners in creating classroom environments that fosters game-based learning.

Creativity & Innovation

The Creativity & Innovation dimension assesses the integration of ME to show how the platform enhanced student engagement, collaboration and inquiry-based learning. The researchers indicated varying levels of creativity when teachers used ME in their lesson plans, some maximizing features of the game while others utilizing it in a more secondary capacity. Fully 15 lesson plans were prepared and submitted out of which 8 (53%) grouped under high innovation, gained by using ME as a core learning object, taking the students through game-based problem-solving mechanisms, design challenge and real-world approach. One lesson, Pendidikan Islam (Bersuci – Building a Mosque in Minecraft), also formed a creative link between religious studies game-based construction, helping to concretize some otherwise abstract ideas. Likewise, the English (Sustainable Homes) project involved students designing environmentally friendly homes in Minecraft while practicing English vocabulary and grammar rules. This has also been supported from prior research indicating that game-based learning environments are necessary for deeper learning when students participated in active problem-solving and creativity (Miller et al., 2023).

Conversely, 5 (33%) lesson plans were deemed moderately innovative, as they utilized ME but not holistically. These lesson plans often prescribed specific structures and did not allow students to solve open-ended problems. Take for example the Science (Cell Structure) lesson plan which asked the students to develop 3D models of cells in Minecraft but where students renewed little autonomy over the design of the structure. It might be useful for them to have structured tasks, but they should also be given the opportunity to explore and experiment for streams of more critical thinking (Wang et al., 2021) to enhance this collection stage considering them being students. Finally, 2 lesson plans (14%) were classified as low innovation, meaning Minecraft served as an ancillary activity rather than a core teaching tool. The English (Crime Investigation – Creating Mystery Clues) lesson, for instance, used Minecraft for storytelling but did not maximally utilise Minecraft’s interactive learning potential to enhance student engagement. Evidence indicates that the educational value of digital technologies used passively is greatly diminished (Taylor et al., 2023).



AKTIVITI PDPC

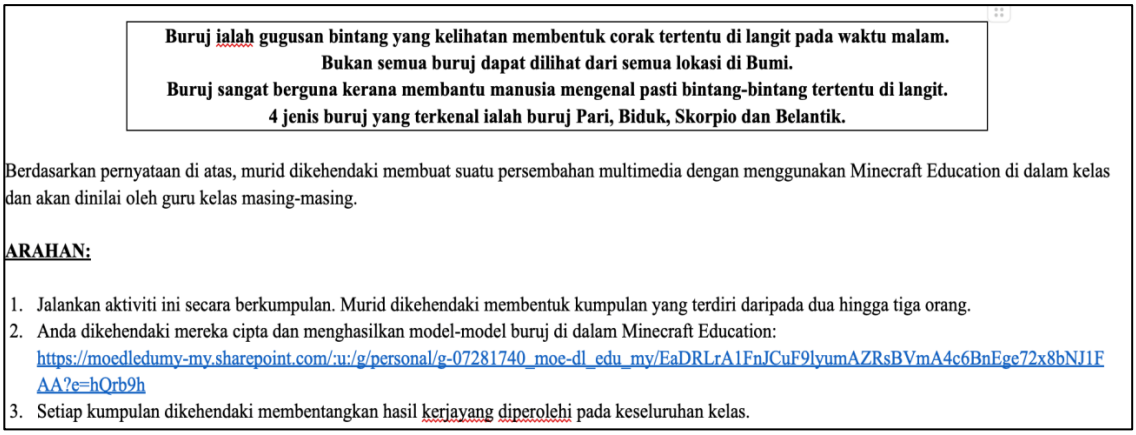
1. Murid berusaha menyiapkan Projek Dunia Buruj yang dilancarkan, sama ada:
   a. Secara bergilir-gilir
   b. Menghostkan dunia Minecraft tersebut kepada ahli kumpulan yang lain
2. Guru memantau perkembangan murid dari semasa ke semasa.
3. Murid mendapatkan bantuan daripada guru yang bertugas dan pembantu makmal sekiranya perlu.

AKTIVITI 4: PERKONGSIAN HASIL KERJA MURID (30 MINIT)

1. Kumpulan yang sudah siap boleh memancarkan hasil kerja mereka dengan projektor.
2. Wakil kumpulan membimbing guide tour dunia Minecraft mereka dan menunjukkan hasil kerja yang telah dihasilkan oleh mereka.
3. Wakil kumpulan membentangkan hasil kerja mereka dengan menggunakan fail Pdf Book & Quill mereka.
4. Apabila masa tamat, setiap kumpulan wajib menghantar fail Pdf dan fail .MCWORLD mereka kepada guru untuk tujukan semakan dan pentaksiran.

1. Murid mendengar ulasan guru mengenai Projek Dunia Buruj yang telah dihasilkan dengan menggunakan Minecraft Education.
2. Murid membuat refleksi dan membuat penutup untuk PdPc.
3. Murid menutup komputer dan memastikan makmal komputer dalam keadaan bersih sebelum meninggalkannya.

Figure 1. Encourages collaborative learning and hands-on activities.



Buruj ialah gugusan bintang yang kelihatan membentuk corak tertentu di langit pada waktu malam.
Bukan semua buruj dapat dilihat dari semua lokasi di Bumi.
Buruj sangat berguna kerana membantu manusia mengenal pasti bintang-bintang tertentu di langit.
4 jenis buruj yang terkenal ialah buruj Pari, Biduk, Skorpio dan Belantik.

Berdasarkan pernyataan di atas, murid dikehendaki membuat suatu persembahan multimedia dengan menggunakan Minecraft Education di dalam kelas dan akan dinilai oleh guru kelas masing-masing.

ARAHAN:

1. Jalankan aktiviti ini secara berkumpulan. Murid dikehendaki membentuk kumpulan yang terdiri daripada dua hingga tiga orang.
2. Anda dikehendaki mereka cipta dan menghasilkan model-model buruj di dalam Minecraft Education: https://moedledumy-my.sharepoint.com/:u:/g/personal/g-07281740_moe-dl_edu_my/EaDRLrA1FnJCuF9lyumAZRsBVmA4c6BnEge72x8bNJ1FAA?e=hQrb9h
3. Setiap kumpulan dikehendaki membentangkan hasil kerjayang diperolehi pada keseluruhan kelas.

Figure 2. Interactive and engaging activities through ME.

Incorporating ME in a lesson plan came across in both the struggles and successes that impacted student engagement and performance. A key problem identified was where many teachers transitioned their teaching methods directly into Minecraft, without utilizing the interactive and immersive mechanics the platform allows to create deeper learning experiences. Rather than leveraging game-based affordances like problem-solving, exploration, and interactive simulations, other teachers were using Minecraft, at best, as another digital form of communicating traditional instruction, which restricted its potential as a transformative learning tool (Squire, 2021). Using this approach, many lessons became less dynamic and student-driven than game-based learning allows. Some lesson plans also came off as overly prescriptive in specifying how students should complete activities, leaving little room for open-ended exploration of the problem at hand or flexible building. Though structure matters for clear instruction, too much limitation on students' creative expression diminishes motivation and limits opportunities for critical thinking and collaboration (Hanghøj & Hautopp, 2020). When variant design approaches limited autonomy, they did not provide opportunities to seize on what is possible with Minecraft for innovation, inquiry-based learning, and flexibility.

However, some best practices were identified from the best lesson plans. The best lessons (by a long shot) included collaboration, applicable scenarios to the real world, and choice over

the project in Minecraft. Programs that enabled students to be true owners of their own learning journeys — designing sustainable cities, modeling experiments in science, or constructing cross-cutting historical reconstructions — more often led to deeper conceptual understanding and 21st century skills such as higher-order thinking (Nebel et al., 2020). Also, when teachers embed real-world problem-solving tasks into Minecraft activity, students can be more engaged and showed better creativity, teamwork, and critical thinking in their learning process. The implications of the findings are that for game-based learning to take place in a meaningful way, formal learning environments need to shift away from traditional teaching models and adopt a student-centered philosophy that embraces the affordances of digital spaces like ME. In doing so, teachers can construct more relevant, pedagogically sound, and engaging learning experiences that meet the 21st-century purposes of education.

Curriculum Alignment

From the standpoint of curriculum alignment, which evaluates how well Minecraft activities match learning objectives, subject-specific competences, and national curriculum requirements, the lesson plans were examined.

8.	**Objektif Pembelajaran**	:	Pada akhir pembelajaran, pelajar dapat: (i) Menghasilkan corak buruj yang lengkap di dalam Minecraft Education. (ii) Mencatat maklumat mengenai ciri-ciri dan kegunaan buruj di dalam Minecraft Education. (iii) Mencari maklumat mengenai buruj lain dan mencatatkan buruj tersebut di dalam Minecraft Education.
9.	**Kriteria Kejayaan**	:	Murid akan berjaya jika: (i) Menghasilkan sekurang-kurangnya 1 buruj dengan menggunakan Glowstone. (ii) Menggabungkan sekurang-kurangnya 1 buruj dengan menggunakan Redstone dust. (iii) Menggambil gambar dengan Camera dan memasukkan sekurang-kurangnya 1 gambar berlabel ke dalam Book & Quill. (iv) Mencari maklumat mengenai ciri-ciri dan kegunaan buruj tersebut dan memasukkan sekurang-kurangnya 1 maklumat mengenai ciri-ciri dan kegunaan Buruj tersebut ke dalam Book & Quill.

Figure 3. Lesson Plan with strong alignment with KSSR 2017 Science Standards.

The lesson plan with objectives fulfills the basic instructional steps, and methods for assessing whether the student has achieved each of those learning objectives. Thus, ME is implemented to enhance the students' knowledge about constellation (Buruj) through hands-on activity. The use of Glowstone, Redstone, and Book & Quill promotes creativity.

It was found that strong curriculum alignment in 7 of the 15 lesson plans (47%): clear learning objectives were provided, and the lesson plans mapped what students would do in Minecraft to the syllabus requirements. An example of this would be the Mathematics (Quadratic Equations – Minecraft Stages) lesson plan, which included core learning, problem-solving activities, and skill-based learning objectives all within a curriculum framework. Likewise, the Science (Ecosystem and Biodiversity) lesson interwove Minecraft-tied conservation projects with scientific inquiry skills to strengthen real-world ecological awareness. Previous research has shown that game-based learning works better when it is explicitly connected to learning goals (Cohen et al. 2021). Three lesson plans (20%), demonstrated the most moderate level of curriculum alignment, meaning that Minecraft was a tool being utilized effectively behind the

scenes, but there were weaker explicit connections to national standards. For instance, this was the English (Product Creation & Advertisement in Minecraft) lesson which was engaging for the students but lacked grammatical/linguistic development targets within the assessment. And finally, 3 plans (20%) exhibited weak curriculum alignment, prioritizing gameplay over structured learning goals. In subjects like Music this was especially apparent, where students constructed musical notes out of blocks in Minecraft, but a theoretical understanding of concepts was not well applied throughout the lesson.

TP5	• Lengkap kesemua tugasan yang diberikan: ✔ Menghasilkan 4 buruj dengan menggunakan Glowstone. ✔ Menggabungkan 4 buruj dengan menggunakan Redstone dust. ✔ Menggambil gambar dengan Camera dan memasukkan 4 gambar buruj berlabel ke dalam Book & Quill. ✔ Mencari maklumat mengenai ciri-ciri dan kegunaan buruj tersebut dan memasukkan maklumat mengenai ciri-ciri dan kegunaan 4 Buruj tersebut ke dalam Book & Quill. • Mengeksport Book & Quill dalam bentuk Pdf. • Menghantar file .MCWORLD dan fail Pdf kepada guru untuk semakan.

Figure 4. Lesson Plan with Rubric-based assessment for Minecraft tasks

However, including a more reflective element in the assessment would provide a more holistic assessment of student engagement. The citing examples of existing research that have assessed multiple lesson plans using ME integration for which some lessons failed to make explicit connections between their game-based activities and potential learning outcomes. Though it contained engaging and interactive components, the lack of clearly established goals and assessment criteria made it challenging to assess students' progress in a meaningful way. It has been observed that there is a risk of game-based learning becoming a fun but unstructured exercise when there aren't defined learning objectives (Mayer, 2021) which further makes it challenging to assess conceptual and skill development. Finally, lesson plans in subjects like English and Music highlighted another major issue of curriculum alignment, where discussion surrounding whether the Minecraft activities could be considered learning for the subject at hand, and if not, what results could be achieved via Minecraft, and whether those results were worthy of the subject matter. For example, although students were having fun building different types of structures or creating musical compositions in the game, these activities were not often overtly connected to skills behind language acquisition or principles of music theory." Previous research suggests that for game-based learning to have a pedagogically strong impact, it must bind itself with disciplinary knowledge and learning frameworks; students are not only engaged in creative activities, but they also build vital academic skills (Vos et al., 2020).

On the contrary, several lesson plans showed the best practices by specifically aligning Minecraft activities to curriculum standards and assessment frameworks. The best lesson designs offered structured information that allowed students to find correlations between what they were doing while playing and the skills they were targeting to learn. Teachers working in areas like Science and Mathematics that matched national education standards with problem solving tasks using Minecraft as a tool helped to create deeper learning experiences enabling students to make links between their theory and the real world (Nebel et al., 2020). These findings reinforce the need to plan lessons with purpose when utilizing game-based learning tools like ME. By keeping the lessons and the games clearly aligned with the goals of curriculum implementation and real assessment, the impact of digital game-based learning can be amplified so that engagement enhances academic progress.

Discussion

Analysis of 15 lesson plans in which Minecraft was integrated revealed differences in teachers' capabilities to apply the principles of game-based learning methodologies. There were elements of effective lesson planning such as use of concrete learning objectives, scaffolding, curriculum use, and involving students; however, there were also more serious issues related to scaffolding, assessment, and curriculum connections. These findings corroborate previous studies showing that the competences of instructors regarding their skills or experience to use instructional technology often differ according to their history, education and the extent to which they are familiar with digital technologies (Voogt et al., 2022). Most teachers showed interest in and willingness to adopt game-based learning as a teaching approach despite these differences (Wang et al., 2021).

The 15 lesson plans that were submitted for review cover a wide variety of subjects, including mathematics, science, English, chemistry, Islamic studies, music, and technology education. All lesson plans leverage ME as an instrument to facilitate student engagement, and encourage group projects, and cultivate 21st-century skills: creativity, problem-solving, and digital literacy. Such lesson plans reflect the growing emphasis on creative teaching techniques in the digital age and demonstrate teachers' efforts to integrate game-based learning into their pedagogical approach.

Several lesson plans focused on STEM concepts utilized Minecraft to help students develop an understanding of concepts through interactive online activities. In the perimeter & area math lesson, students had to create structures in Minecraft using geometric concepts in an interactive, visually appealing format as an example. Similarly, during the cell structures science lesson, students built 3-D models of cells to reinforce their comprehension of biological processes and cellular parts. In the periodic table chemistry lesson, students had to virtually rearrange the elements as per the atomic structures and gained hands-on in-depth knowledge about the principles of chemistry. Beyond STEM education, teachers have been using Minecraft in language and humanities classes to enhance students' historical understanding and communication skills. The Crime Investigation English course, for example, developed critical thinking and narration skills as students created and solved mysteries in Minecraft. Students in Islamic studies explored historical and religious concepts by re-creating the city of Madinah, lending some abstract topics a tangible and engaging experience.

Elsewhere, the Pendidikan Muzik (Music Education) course promoted an engagement with music theory and composition through participatory means, with students tasked with building musical notes in Minecraft. Some even tackled sustainability issues and real-world applications. The English sustainable homes initiative incorporated language instruction with sustainability instruction by having students design eco-friendly homes. In Reka Bentuk dan Teknologi (Design and Technology) subject, students learnt about workshop safety measures. Students used interactive features with NPCs in Minecraft to create a virtual workshop and administer safety instructions. These lesson plans demonstrate the use of ME to teach both technical and conceptual material across several subject areas. Overall, there is a range of effectiveness in instructional implementation of game-based learning, from relatively structured, formal curricula designs that work to meet targets to less structured approaches that prioritize engagement over assessment. It was found out that while some teachers used

Minecraft as an additional tool instead of a pedagogical method, others managed to take advantage of the game elements to enhance the learning process. These variances provide insights, indicating the challenges and successes of integrating ME into different topic domains.

In answering the research question, the proficiency of teachers in integrating the ME into the lesson plans were classified into three levels of proficiency, namely high proficiency, moderate proficiency, and emerging competency. The lesson organization, curricular alignment, instructional clarity, and assessment techniques were referred in the level classification. Integrated assessment, planned lesson plans, and published learning objectives were strong instructional design components demonstrated by highly rated teachers, of which 6 of 15 (40%) teachers had on example of this trait. Building dwellings in Minecraft, for example, was part of the mathematics (Perimeter & Area) lesson plan that had a structured teaching flow in which students systematically applied math concepts. This parallel with previous research showing that higher-quality game-based learning tasks post the higher potential in learning and student engagement (Sung et al., 2022). The impressive example was shown in the curriculum integration and creativity evident in the lesson designs of Pendidikan Islam-Bersuci and Sains-Buruj by a teacher sample. The well-structured lesson plans clearly demonstrate a strong pedagogical understanding of game-based learning, effectively leveraging the interactive features of Minecraft (Shute & Ke, 2022).

Moderately advanced teachers (5 out of 15; 33%): Lesson plans presented stimulating teaching strategies, as well as precise learning objectives, but lacked comprehensive scaffolding for students with different skill levels. For example, while the English (Crime Investigation) session was designed to foster collaborative problem-solving, it needed more overt differentiation strategies; it also needed to cater to learners at different ability levels. Referring to Asas Sains Komputer-Perwakilan Data and Pendidikan Muzik-Notasi Muzik, while the lesson plans involved creativity, they fail to substantiate the correlation of learning objectives and in-game activity. LEAP looked at how various subjects could be explored in Minecraft, for example students created musical notations in Minecraft in Pendidikan Muzik - Notasi Muzik; though unfortunately the connection to ideas in music theory wasn't very explicitly explained. Moreover, while some assessment methods were deployed, they were not adequate to measure students' level of application of skills and understanding of concepts. These findings question the extent to which ME has been capable of supporting meaningful learning, corroborating the need for organized lesson design and thorough assessment procedures (Hamari et al., 2020).

Although teachers in developing proficiency (4 / 15, 27%) showed creativity in lesson design, they still needed to align more to curriculum and provide clearer instruction. The lesson plan in periodic table (Chemistry) had activities for Minecraft related course but did not provide clear assessment techniques, so it was difficult to distinguish if students learnt from the lesson. This is consistent with earlier studies which have established that poorly thought-out game-based lesson plans beget low student engagement and inefficient teaching (Parker & Thompson, 2023). Likewise, the English-Product Creation & radio advert lesson plan emphasized communication and collaboration as students created advertisements, as well as designs for their products, with Minecraft. The lesson did not explain how the Minecraft activities lined up with the English language learning objectives, making it challenging to analyze and adapt/crosswalk between the two curricular inputs.

In the case of the variation of teachers' skill level, the potential and challenges of using ME into the lessons were studied. Some teachers made successful use of game-based learning,

but others struggled with instruction design, curriculum and evaluation. These findings can be supported by previous work that emphasizes the need to offer targeted training in digital pedagogy for teachers, such that there is reduced disparity between traditional teaching methods and novel pedagogical technologies (Hirsh-Pasek et al., 2022). If institutions are to optimize the pedagogical possibilities of ME, professional learning initiatives should focus on curriculum mapping to ensure alignment with discipline-specific learning outcomes, strategies for assessment design to measure creativity, teamwork and conceptual understanding as well as scaffolding practices to enable fewer adopt learners in game-based contexts. Destines Teachers to a curriculum aligned and pedagogically competent teaching tool (Herodotou et al, 2021).

Some teachers showed great creativity and innovation in using ME. Most (8 of 15, 53%) of these highly innovative lesson plans leveraged the high interactive potential of Minecraft to promote engagement, collaboration, and inquiry during learning. An example of this is the Pendidikan Islam (Bersuci – Kena GAWAT di Dalam KOT) lesson that dovetail religious studies and constructing via game where students were able to explore historical and also cultural aspects while in a virtual setup. The English (Sustainable Homes) project involved students working on building eco-friendly homes, linking language and the idea of sustainability. This is in line with previous literature indicating that game-based learning adopters tend to highlight issues based on real-world problem-solving and the creation of immersive experiences for learners (Miller et al., 2023).

Besides showing varying degrees of expertise, most of teachers showed incredible high adaptability and a strong desire to integrate ME into the lesson plans. Their willingness to participate in game-based learning indicates that teachers are becoming more aware of how it could increase student engagement and promote deeper conceptual understanding (Herodotou et al., 2021). This adaptability was especially noticeable via the teachers created creative lesson plans that used Minecraft's interactive features to present learning activities centered around particular subjects. For example, the science teacher sample demonstrated the method to create constellations using Glowstone blocks, and some math teachers utilized pixel art to illustrate binary numbers in this study. This creative method turned abstract ideas into interactive, hands-on learning opportunities that reinforce studies showing how effective digital games are at encouraging active learning and in-depth conceptual understanding (Rahimi & Shute, 2021). Teachers were also flexible in addressing the pedagogical and technical challenges of integrating ME into their teaching.

The major issues noted in this study was curriculum alignment, whereby some lesson plans did not specifically align Minecraft activities with national learning standards. Lesson plans which were strongly aligned (7 out of 15, 47%) had clear curriculum goals and Minecraft activities were mapped to subject-specific competencies. For instance, the Mathematics (Quadratic Equations – Minecraft Stages) lesson incorporated problem-solving challenges into a structured curriculum framework. Also, the Science (Ecosystem and Biodiversity) lesson made natural connections between Minecraft-partnered conservation projects and the investigative nature of the scientific process. These results are consistent with earlier studies stressing the importance of game-based lesson plans to fit into the context of formal education (Cohen et al., 2021). However, moderate curriculum alignment was found in five of the 15 lesson plans (33%) where Minecraft was effectively incorporated but it did not have overt alignment to national standards. Such as the English (Product Creation & Advertisement) lesson, where students developed business models using Minecraft, the assessment criteria did

not directly assess a proficiency in language. Finally, 3 lesson plans (20%) also demonstrated weak curriculum alignment, as gameplay was favored over structured learning objectives. This was especially apparent in subjects like Music, where pupils created musical notes in Minecraft, which were yet not necessarily linked to any key concepts found in music theory. This is consistent with research that indicates that game-based learning is most effective when its objectives are crystallized and measurable (Taylor et al., 2023). Assessment challenges surfaced across several lesson plans as well. Many depended on group tasks, which are hard to evaluate by the individual. Some lesson plans incorporated self-assessment tools and peer feedback mechanisms, whereas others omitted rubric-based evaluations for monitoring students' progress and learning. Prior studies highlighted the need for formative assessments, performance-based assessments, and structured rubrics for effective assessment in GBL (Jones et al., 2021).

Recommendations

Professional development for teachers is necessary to enhance teachers' capability in game-based instructional design. Nguyen et al. (2022) also recognized that requirement in structured training and ongoing professional development on curriculum alignment, differentiation strategies, and evaluation methodologies to optimize GBL and provide students with current lessons. Furthermore, teachers can use rubric-based assessments to gauge their students' creativity, problem-solving skills, and engagement level when instructing Minecraft-based classes via ME. By integrating peer and self-evaluation in ME, assessment validity may be further enhanced (Sung et al., 2022). Finally, compared to teacher-centered instruction, lesson plans that integrating ME provides students more autonomy to experiment and learn through unstructured problem-solving activities in the safe platform.

Conclusion

The study has provided strong evidence of competency, enthusiasm, and adaptability among the teachers in integrating ME with different levels of proficiency found in instructional design, innovation, and curriculum alignment. The ability of teachers to incorporate ME into their lesson plans has demonstrated their potential in implementing game-based learning. The strongest lesson plans successfully linked Minecraft-based activities to subject-specific learning outcomes, while others necessitated clearer assessment forms and differentiation strategies. Hence, it was strongly believed that through professional training, enhanced assessment methods, and curriculum alignment strategies, ME can be further optimized as a powerful tool for game-based learning.

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