Methods for Delivering PBL through Minecraft Environments

O1/A1

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Revision History

Version	Date	Author	Description	Action	Pages
[..]	DD/MM/YYYY	PARTNER ORGANIZATION	[Creation/Insert/ Delete/Update of the document]	[C/I/D/U]	[No. of pages]

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Referenced Documents

ID	Reference		Title
1	2020-1-UK01-KA226-HE-094536		EPITOME Proposal
2			

Applicable Documents

ID	Reference	Title
1	[PARTNER ORGANIZATION]	[TITLE OF THE REFERENCED DOCUMENT]

Contents

1 Introduction

1.1 The scope of the project

The project aims at supporting the use of digital learning spaces by European educators as a means to help them continue to deliver through virtual classrooms Problem Based Learning activities that were until now offered only through physical collaboration in classrooms. By helping HE institutions with pedagogical departments to extend their academic curricula with practical approaches towards remote PBL in combination with Game Based Learning, EPITOME aims to improve the current situation with respect to the teacher's ability to deliver remotely, through virtual classrooms, the same quality of education they delivered in physical classrooms until now.

1.2 Target groups

The target groups are academic staff of HE establishments which have pedagogical departments, and which can use the outcomes to extend their teaching so as to equip the educators of tomorrow with the knowledge and skills to deliver remotely PBL experiences to their students through their virtual classrooms. Target group is also the school community which is in desperate need of all-inclusive resources which can be immediately put to use by the teachers in order to facilitate remotely collaborative problem solving. Additional target group are the STEAM centres which also need to be in position to operate remotely and from a wider perspective, any teaching/training organisation that can benefit from the use of digital learning environments independently of the age groups it addresses as game-based learning has been proven to be efficient for all age groups.

1.3 The scope of this output

The scope of this outcome is to describe methods for delivering remote PBL experiences in Minecraft, specifications for creating PBL experiences in Minecraft and describe examples of PBL challenges, that will lead to the creation of the EPITOME Minecraft world. It concerns the design and implementation of the Minecraft resources that will materialise the PBL challenges. Educators can use Minecraft to engage students across subjects and bring abstract concepts to life. It is an excellent tool to engage students in learning, collaboration and critical thinking and there are numerous resources of high quality available for educators to understand and use Minecraft. This output aims to fill in an existing gap by providing concrete Minecraft-aware methods for delivering PBL experiences.

2 Problem Based Learning

2.1 A definition

Problem Based Learning (PBL) was first introduced at the school of medicine, McMaster University in 1968. It was originally formulated to address the issue of students' inability to apply knowledge and solve problems in real world situations. It has been utilized in numerous forms and in a number of settings since its conception at McMaster University, resulting in inconsistencies in its definition and purpose. While there really are many definitions due to its use across so many disciplines and institutions, this is our preferred definition within the context of Minecraft purpose and practice.

*"**Problem-based learning** is a constructivist pedagogical approach that organizes curriculum and instruction around carefully crafted "ill-structured" problems as the focus for learner engagement. Guided by teachers acting as cognitive coaches, students work collaboratively to develop critical thinking, problem solving, and critical skills as they identify problems, formulate hypotheses, conduct research, perform experiments and formulate solutions. Problem-based learning enables students to embrace complexity, find relevance and joy in their learning, and enhance their capacity to make creative contributions to real-world problems."* [1]

[1] *Problem-Based Learning Background Reading and Guidance Document, Innovative Educator, Microsoft* https://onedrive.live.com/redir?resid=91F4E618548FC604%212182&page=View&wd=target%28Preface.one%7C4a72b36d-27fd-4a8b-b586-2ca790a89a39%2FPreface%7C2c56573a-f8e1-db43-87b0-8544771e4427%2F%29

3 Characteristics

Despite its diverse use across institutional settings such as universities, high schools and elementary schools, and its vast number of definitions, much of the literature agrees that the successful instruction of PBL requires particular elements to be implemented at the planning and delivery stages. These are:

- Authentic Context
- Collaboration
- Ill-defined problem
- Self Determination
- Reflection.

Figure 1: The five elements of PBL (Source: Microsoft PBL essentials)

3.1 Authentic Context

To ensure that students are motivated by tasks and school assignments, “problems” must be based on real-life scenarios. This allows students to take ownership of and solve problems that are relevant to them. One of the most significant advantages of “problem-based learning”

over standard classroom teaching approaches is that it can naturally express the importance of learning to students.

The goal of authentic teaching is to relate the learner's learning, issue, or challenge to something meaningful and relevant to them. Since students may perceive real-world applications and relevance in their learning, this type of learning is particularly well suited to 'real-world' difficulties. Regarding Problem Based Learning, research reveals that the 'problem' must be based on an issue that is meaningful to the learners; a real-world issue that they can own and solve. Evidence demonstrates that an authentic learning environment aids motivation, comprehension, and knowledge retention.

Using "real-world" challenges as a backdrop not only gives students a sense of relevance, but it also allows them to solve problems across various disciplines. Those who want to advance the science, technology, math, and engineering (STEM) agenda in their schools, will be especially interested in this since it allows them to foster knowledge and skill development across the curriculum.

3.2 Collaboration

In problem-based learning, students are usually divided into small groups (4-8 students) to create a collaborative social environment in which learners can gather and share knowledge, questioning about unknown matters and develop strategies to fill knowledge gaps. According to Hmelo-Silver[2] , through group cooperation, students can '*distribute the cognitive load*' and '*negotiate a shared understanding'* in the process of problem-solving.

By taking advantage of the different strengths of group members, learners begin to understand their own strengths and weaknesses, and have the opportunity to learn from more proficient people how to improve their skills. Continuous reinforcement of current knowledge, as well as assistance in integrating and synthesizing new information, is a key developmental stage in higher cognition.

3.3 Ill-defined problem

This element is the cornerstone of the Problem Based Learning methodology. This is due to the fact that with PBL, all of the learning takes place within the problem. To reflect the idea that the assignment should not be a linear problem-solving procedure with a single, "right" answer, the problem set should always be "poor defined" or "unstructured Because real-world issues are messy and complex by definition, the problem setting should reflect this. Open-ended problems with various solutions should be used. These problems require students to evaluate many different practices, methods and results before choosing a solution.

Based on research literature on Problem Based Learning, Stanford University has established a framework to help in the preparation of 'ill-defined questions,' which should contain the following characteristics: [3]

[2] Hmelo-Silver, C. (2003) "The Constructivist teacher: Facilitating problem-based learning." American Educational Research Association annual meeting, Chicago, IL.
[3] Adapted from Allen, Duch & Groh, 1996; Gallagher, 1997

- Require more information for understanding the problem than is initially available.
- Contain multiple solution paths.
- Change as new information is obtained.
- Prevent students from knowing that they have made the “right” decision.
- Generate interest and controversy and cause the learner to ask questions.
- Are open-ended and complex enough to require collaboration and thinking beyond recall.
- Contain content that is authentic to the discipline.

3.4 Active and Self-Directed Learning

This element requires students to actively participate in the learning process, rather than passively “receiving” information. In active learning students take responsibility for their own learning by engaging in learning process through various means (such as research, discussion, reflection, processing, analysis, experimentation and so on) and actively create their own knowledge. In PBL, this is another step forward and invites students to organize and manage their own learning. They do so by identifying their own learning objectives, scheduling and assigning tasks to each participant, evaluating the worth of contributions, deciding which solution will best achieve their goals, and evaluating their own and their peers’ performance.

This approach requires the teacher to be flexible about their function within the classroom, adopting a role as a facilitator or cognitive coach. Hmelo-Silver (2004)[4] suggests that the role of the facilitator should be in guiding students on the learning process, challenging them to think deeply, and modelling the kinds of questions they need to be asking themselves. Facilitators push learners to think deeply by providing scaffolding through questioning that highlights key behaviours, practices or decisions that lead to successful outcomes, promoting cognitive apprentice.

This results to the empowerment of students’ own awareness of best practice in problem solving, illustrating the kinds of questions they need to be asking of themselves and enabling them to transfer their learning to other problems[5]. Knowing how and when to remove scaffolding to help students to become more independent is one of the most difficult problems for a teacher transitioning from traditional instruction to facilitation.

Barrows (1992)[6] suggests that the ability of a teacher to take on the role of facilitator is one of the key influences on the success of methods that attempt to develop the cognitive skills (such as PBL) and in enabling and empowering them to become self-directed learners.

[4] Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? Educational Psychology Review, 16, 235–266.
[5] Hmelo-Silver, C. E., & Barrows, H. S. (2006). Goals and strategies of a problem-based learning facilitator. Interdisciplinary Journal of Problem- based Learning, 1, 21–39.
[6] Barrows, H.S., (1992) The Tutorial Process. Springfield, IL: Soutehrn Illinois University School of Medicine

3.5 Reflection and Metacognition

Students in PBL are encouraged to acquire a habit of metacognitive reflection. These are significant in and of themselves, but they are also an important element of the process in self-directed learners who have advanced. Metacognition is a set of skills that include being aware of one's own thought processes as well as being able to monitor, analyze, and moderate one's own thinking and decision-making[7].

Learners must first be aware of what they do and do not know in order to develop purposeful learning objectives in the problem-based learning classroom, so metacognition is important. They must also plan how they will reach these goals and assess how effective their strategies have been in tackling the challenge. Self-reflection, meanwhile, can assist learners in becoming accustomed to thinking about their thinking and analyzing their choices and actions. In the end, the goal of reflection is to help students realize the connection between their learning and the decisions and choices they make while solving problems. According to Hmelo-Silver (2004)[8], this reflection should achieve three objectives:

1. Relate new knowledge to prior knowledge
2. Purposefully abstract knowledge
3. Understand how their learning can be transferred to other situations and problems.

Reflection is the last step of learning process in many PBL models. This is not to say that reflection should not occur at other points in the programme, but that it is particularly important at the end of the course. Undertaking reflection and metacognition is just as important as participating in the higher order thinking activities posed by problem-based learning. The main role for the facilitator is to provide scaffolding to illustrate how to think reflectively, by modelling reflection on the strategies used for problem solving, as well as on the outcomes[9].

[7] Savery, John R., and Thomas M. Duffy (1995) "Problem based learning: An instructional model and its constructivist framework." Educational technology 35.5 31-38.
[8] Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? Educational Psychology Review, 16, 235–266.
[9] Savery, John R., and Thomas M. Duffy (1995) "Problem based learning: An instructional model and its constructivist framework." Educational technology 35.5 31-38.

4 Instructional principals of PBL cycle

Depending on the setting, discipline, and purpose, the instructional approach for delivering PBL varies. However, the PBL Cycle's basic concepts remain the same. This is due to the important pedagogical concepts that distinguish this technique from other constructivist educational approaches. Below are presented generally the principles in the PBLCycle (Figure 2).[10]

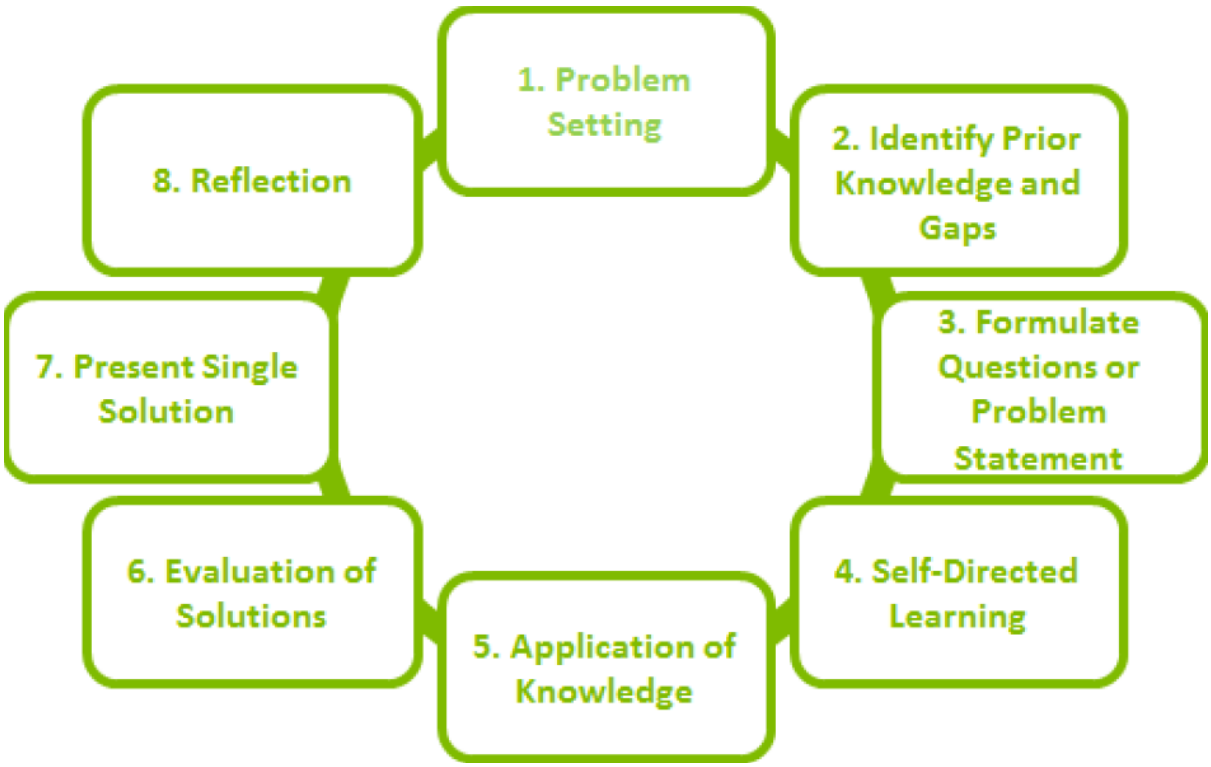


Figure 2: Instructional principles of PBL Cycle

1. **Problem setting:** The problem directs the lesson and acts as a focus point for information acquisition. It has to be presented and introduced in a variety of methods that could engage students, such as: written on the board, as a letter delivered to the class, revealed through an artefact/object, from a newspaper clipping.
2. **Identify prior knowledge and gaps:** An important step for educators is to provide background, clarify terminology and answer basic questions relating to understanding the problem. If this is the first time the learners have undertaken PBL, a discussion on

[10] Retrieved by "Microsoft PBL Delivery Instructional Principles", available at: https://education.microsoft.com/en-us/learningPath/f0033db8/course/903e75a1/5

parameters related to PBL, expectations and group working etc is deemed also essential.

3. **Formulate Questions or Problem Statement:** It is important that the students have limited background to the problem. This means that the students hold enough prior knowledge to understand the problem, but solving the problem requires them to actively participate in the learning process and conduct more in-depth research to formulate questions and set the problem.
4. **Self-Directed Learning:** Students should be encouraged to go off in small groups or individually, using the questions they developed for themselves to guide their data collection. Students will then have to read, comprehend and begin to analyse the materials they have gathered to determine in what way the data and information they have found might be useful in solving the problem. This will involve analysis, evaluation and for some learners, a degree of scrutiny and criticality (critical thinking).
5. **Application of Knowledge:** Individuals or cooperative pairs bring their findings back to the main team. The team begin to work their way through the findings to try to gather the evidence to answer their questions. Supporting students in finding strategies for communicating and sharing ideas and in practicing using dialogue and questioning that helps them clarify and refine their collective thinking will be useful, particularly to groups undertaking PBL for the first time.
6. **Evaluation of Solutions:** Once all of the ideas and possible solutions are on the table students will have to employ convergent thinking strategies to decide which one to propose as the solution and justify why they are discarding the others. Students must weigh up evidence, negotiate and debate with each other and find a way to come to a consensus about most appropriate solution for the problem.
7. **Present Single Solution:** Students present their solution, supported by well sourced evidence and justifications. The format of this presentation can be pre-determined by the teacher (report, group poster, Powerpoint presentation, video news report, podcast, animation, Minecraft world, model etc) or can be selected by individual teams based on a list that is provided.
8. **Reflection:** A crucial element of the process is to allow time at the end of the programme for students to reflect upon their learning. Educators could provide a template that asks reflective questions or invite them to journal throughout the process.

Reflection is important because only by understanding choices, methods, decisions and the ways in which they reached conclusions, will students be more likely to transfer their learning to other problems in future.

5 EPITOME: Methods for delivering PBL

The current output concerns the delivery of remote Problem Based Learning based on instructional methods for delivering PBL through Minecraft environments.

As Minecraft is a digital learning space, the methods may be also applicable to other digital learning spaces, but the present work will not limit its scope to generic methods but conclude to specific methods that are applicable to Minecraft environment while supporting PBL learning, so that the academic staff can immediately put them to use to strengthen their teaching and the school community can use them to deliver engaging PBL experiences.

The methods will provide the initial input of requirements to be transcribed to specifications (O1/A2) for a Minecraft world. PBL experiences which will be materialized through the elaborated methods will be accompanied by specifications for a Minecraft world so that it is immediately apparent how the environment can be used to deliver that kind of experience.

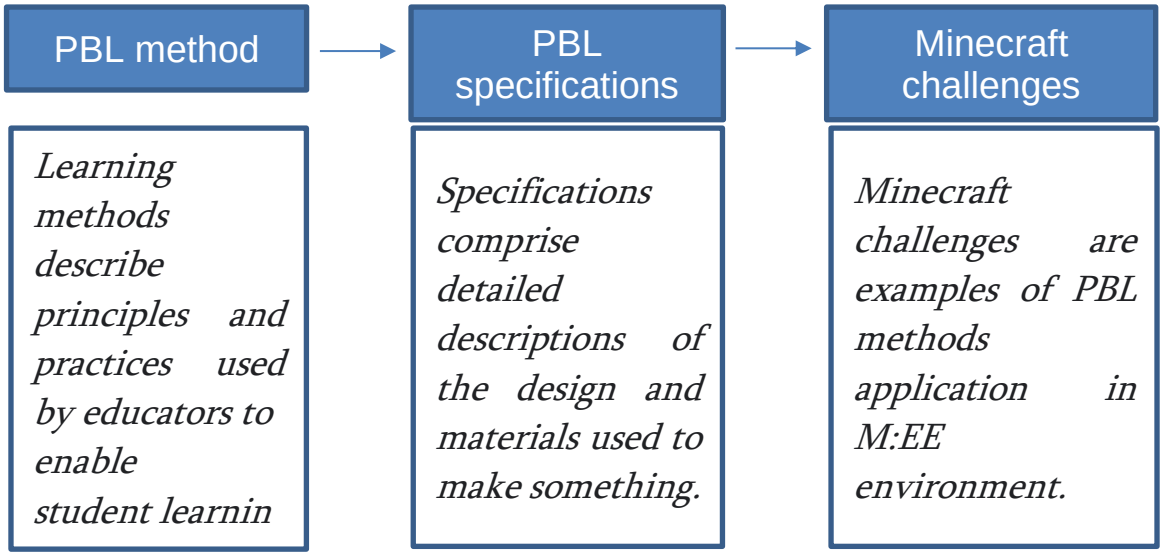


Figure 3: The method towards elaboration of Minecraft challenges

Those methods are not sequential steps to create a PBL learning experience, but irrespective of one another. At the table below (*table 1*), the suggested methods are matched to the PBL cycle instructional principals (*figure 2*) to provide a better picture of where these methods can be applied in the process of PBL learning. Different combinations can be applied due to the subject, students' level of experience and abilities and learning objectives.

The learning methods described and analysed below are the followings:

(1) **learning journal**

(2) **scaffolding**

(3) **flexibility dynamic**

(4) **Self-peer evaluation**

(5) **Reinforcing Effort/Providing Recognition**

(6) **Game-based learning**

(7) **Role-playing**

(8) **Scenario-based learning**

(9) **Learning stations**

(10) **Differentiated instruction**

	PBL cycle steps								
		Problem setting	Identify prior knowledge and gaps	Formulate Questions or Problem Statement	Self-Directed Learning	Application of Knowledge	Evaluation of Solutions	Present Single Solution	Reflection
methods	learning journal		**X**		**X**	**X**		**X**	**X**
	scaffolding		**X**	**X**					
	flexibility dynamic		**X**	**X**	**X**	**X**	**X**		
	Self-peer evaluation					**X**	**X**		**X**
	Reinforcing Effort	X	X	X	X	X	X	X	X
	Game-based learning	**X**		**X**	**X**	**X**		**X**	
	Role-playing	**X**		**X**	**X**	**X**	**X**	**X**	**X**
	Scenario-based learning	**X**				**X**		**X**	
	Differentiated instruction	X	X	X	X	X	X	X	X

Table 1: Methods apply to PBL cycle

5.1 Learning journal

Learning journal is also called a log, a learning log or a diary. It consists of recorded notes, observations, thoughts, feelings, understandings or/and plans and analysis, regarding a learning experience.

It serves as a reflection exercise for personal use or in context of a learning assignment, as a deliverable.

Recording a learning experience is irrelevant to the subject of the learning content, so it is widely applicable. However, different subject areas may require focussing on different aspects of the experience or/and a different format. Regardless the aspects, the format or the means, reflective learning works best when you think about what you are doing before, during and after the learning experience.

Why use a learning journal:

- A learning journal helps students to be **reflective about their learning**. Encouraging students to record their thoughts and observations, during a problem-based learning experience, will provide them with something tangible to go back to as they plan new goals and evaluate their own work.
- Writing a learning journal makes students more aware not only of *what* they learn, but also *how* they learn (Voss, 1988)[11]. (ownership)
- It helps students identify their strengths, weaknesses, and preferences in learning, building the foundations towards self-directed learning.
- It is an opportunity for students to communicate their thinking process: how and why they did what they did, and what they now think about what they did.

What kind of learning journal?

In order to apply this method 4-factors must be defined: tools & format, use, subject and purpose.

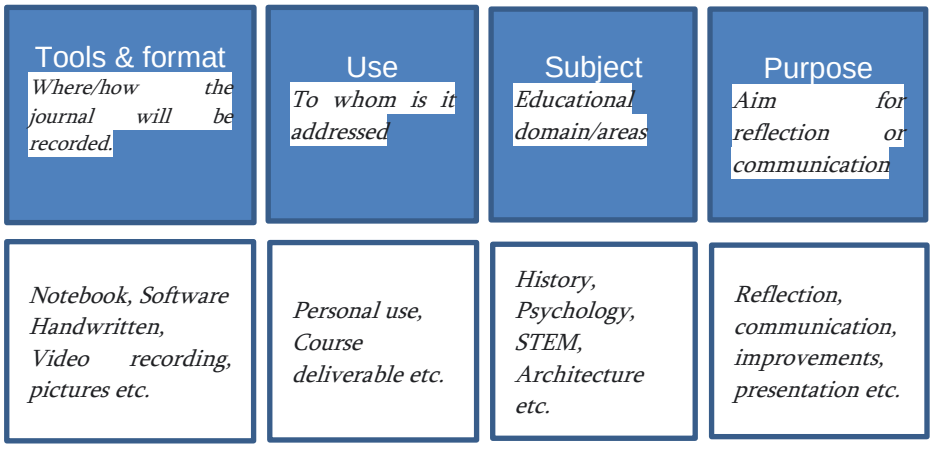


Figure 4: Factors to be defined for Learning Journal.

[11] VOSS, M.M. (1988) The light at the end of the journal: a teacher learns about learning, Language Arts, 65(7), pp. 669–674.

For example, in case someone wants to learn how to reduce their personal carbon footprint in the context of environmental awareness, during the process of solving that problem they could use a learning journal. They need to observe their habits, research ways to attain their goal, manage the whole process to set new goals and tasks and observe the results. The 4-factors that describe the type of the journal they are going to keep may be the followings, *tools & format*: notebook/handwritten, *use:* personal, *subject:* environmental awareness / how to reduce personal footprint and *purpose:* reflect and improve.

Similarly, to create an assignment for students, the educator have to define those 4-factors. For example, ***tools & format*: Microsoft word – text format, *use:* deliverable for course, *subject:* environmental awareness / how to reduce personal footprint and *purpose:* present process and findings.**

In M:EE there are tools that can serve this purpose and support the recording of the learning experience and/or capture students' creations like the camera, the portfolio, the book & quill, different signs and boards.

5.2 Scaffolding

Scaffolding is defined as a pedagogical support that is provided by others who are more capable, such as teachers or peers, to help students attain educational goals they cannot reach alone (Wood et al. 1976)[12]. The same way, in construction context, builders use scaffolding in order to reach higher levels, instructional scaffolding helps students to complete activities and learning tasks they otherwise might not have been able to.

The concept of scaffolding was extended to include technology-enhanced collaborative learning environments that assisted students in a similar manner to an educator or a peer. The different types of scaffolds should be seen as part of an interconnected system.

As **PBL is a student – centric and active learning approach**, by using scaffolding educators could take on a more flexible role within the classroom, as a facilitator or a cognitive coach, to support and guide the students through their zone of proximal development. The educators could assist the first steps of the process, like filling in the existing knowledge gaps, and then guide the students towards a more self-directed learning approach.

Types of scaffolding in technology enhanced classroom environments:

(1) demonstration,

(2) Instruction: functional and process-related instructions and directions,

(3) procedural assistance: students' questions asking for process-related help, directions, orientations, suggestions, and proposed courses of action,

(4) validation: students' task-related confirmations, and

(5) exchange of multiple perspectives.

Why use scaffolding:

- Encourage students to improve their learning (learn how to learn).

[12] Wood, D., Bruner, J. S., & Ross, G. (1976). The role of tutoring in problem-solving. Journal of Child Psychology and Psychiatry, 17, 89–100.

- Provides individualized instruction (especially in smaller classrooms)
- Motivate students to build up individual learning goals.
- Students gain self-efficacy through taking control of their learning experiences (learning ownership), advocating for themselves, and initiating peer collaborations.

5.3 Multiple paths to success or flexibility dynamic

Flexibility dynamic, in other words multiple paths to success, is one of the main principles of game-based learning, but it can also be applied and support project-based learning especially in game-like environments, like Minecraft. It creates the opportunity for the students to complete the project in their own unique way by taking a personalized path to the end. Instead of linear activities with predefined start and end point, provides an environment that enhance exploration, self-directed learning and even innovation.

Why use multiple paths to success:

- It enhances the **engagement** as each student or team creates their own path towards the learning process and there is not a pre-defined end to the activity. It provides an element of surprise, as none of their classmates would have taken the exact same path.
- It supports **exploration learning**. With instructional and peer-based support, students learn by exploring settings, reality, and lived and virtual experiences. This way of thinking about learning is founded on the assumption that through meta-reflection, learning patterns can be usefully transferred to different settings.
- It, also, promotes **self-directed learning and ownership of learning,** as the students become the creators of the learning experience.

5.4 Self-peer evaluation

Reflection and evaluation are an important part of PBL and Minecraft world can be a great tool for doing and sharing self and peer evaluation of the project, i.e., questionaries, presentation or chat discussion etc.

The purpose of the self/peer evaluation is to urge each student to consider and comprehend how effectively he or she and their partner conducted the team activity, as well as to improve their collaboration abilities. Each couple or team may contribute one **peer-reflective** and one personal (**self-reflective**) remark on their work for each assignment, as well as a copy of their notes on the resources they produced or found.

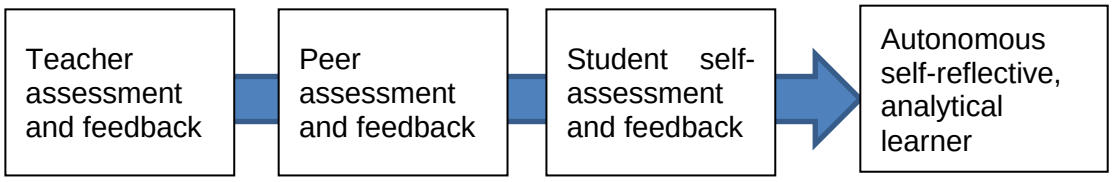
Peer evaluation include students analysing their peers' work and comparing it to success criteria connected to a learning goal, as well as offering constructive criticism.

Students use success criteria linked to a learning objective, reflect on their efforts, identify improvements, and alter the ‘quality' of their work through self-assessment.

For example, the following headings could be included in the self/peer reflection questions: (1) Individual duties and responsibilities (2) Generating and developing ideas/strategies; (3) Research; (4) Collegiality; (5) Final outcome/product; (6) Organizational skills.

Why use self-peer evaluation:

- Errors are viewed as chances to learn.
- Students take an active role in their own learning and evaluation;
- they see peer and self-assessment as an important component of the learning process;
- they are driven to improve their own and others' work.
- Self-assessment can assist discover gaps in students' knowledge and offer insight into their true understanding.
- Assist to assess their strengths and also areas they need to improve.
- Encourage students to become more autonomous learners by providing a better picture and understanding of the learning objectives and whether they are met.



How to introduce it?

- Students should be involved in defining/clarifying success criteria, which are explanations of what it means to achieve the learning intention/s.
- Work with examples – examples help students see the criteria.
- Explicit education and modelling help students grasp what makes "excellent."
- As students apply criteria, provide advice - applying criteria to anonymous samples allows students to have a better grasp of the criterion.
- Encourage students to participate in peer evaluation and feedback by providing prompts such as sentence starters and feedback forms.

5.5 Reinforcing Effort/Providing Recognition

A large part of what teaching is ensuring that students understand what is expected of them and promoting positive behaviours that will aid every student in learning. This is accomplished through reinforcement, with the goal to increase the likelihood of a desired action occurring again.

Teachers utilize reinforcement in a number of ways in the classroom. You could wish to encourage good actions and rule-following, for example, so that students routinely fulfill behavior standards. Furthermore, reinforcement may be utilized to motivate students to work hard.

By addressing students' attitudes and ideas about learning, it improves their grasp of the link between effort and accomplishment.

Why use Reinforcing Effort/Providing Recognition:

- Not all students realize the impact of effort.
- Students can change their beliefs on the importance of effort.
- Showing students how their efforts tie to results through recognition could reinforce beliefs that tie effort to success.
- Increase the instinctive motivation of students, as the feel acknowledged for their effort, not only the result.

Technology, like M:EE environment assists with reinforcing effort by providing a means to track and provide immediate feedback to students. Also, as a game environment provides multiple ways and means that fit different tasks or activities for various learners.

5.6 Game-based learning

The most effective approach to replicate and analyse difficulties in the educational process is to offer them in the form of a game that includes group decision-making training in realistic situations. The game environment of Minecraft is ideal for gamify PBL, but the environment alone is not enough. Game elements and mechanics are required to provide a complete game-based learning experience (i.e., score, rules, challenges, feedback etc.).

Game-based learning meets students where they are and where they want to be. For example, educators can provide learners the opportunity to engage in play that challenges them, giving the students room to be creative and “fail forward,” as well as letting the learners take risks that iterate along the way.

Game-based learning is a teaching method that balances educational materials with the strategies, rules, and social aspects of playing a game. Many educational games expose learners to targeted content through real-world situations and help learners develop essential life skills.

Why use game-based learning?

- Low-risk competition
- Social-emotional growth through development of "soft" skills
- Student-centered learning
- Increase a child's memory capacity
- Computer and simulation fluency
- Strategic thinking and problem-solving

- Games are designed to be intrinsically rewarding.

The course information is integrated into the game to offer a scenario learning environment, and repeated self-learning, as well as continuing engagement and feedback, can improve learning interest and motivation. As a result, game-based learning may be able to achieve the objective of effective learning.

What makes a game?[13]

1. **A Game is Structured with a formalized set of rules.** These structures are sometimes referred to as mechanics; they are game components that define what can and cannot be done in order to accomplish the victory goal. As the lesson's designer, your job is to make sure that the rules correspond to what you intend to teach.
2. **Risk vs. Reward is present in a game, which gives rapid feedback.** Games that are either too simple or too difficult are not enjoyable. In reality, research suggests that games that are unbalanced nearly never succeed. We need to include some aspect of difficulty, danger, and reward in order to develop an engaging game. The reward is an extrinsic motivator, whereas the danger and difficulty are intrinsic motivators. We may add points for each right task performed, and we can also add additional tough hurdles to make it more entertaining.
3. **Story, Adventure and Goals are powerful engagement tools.** Every game requires a finite goal. Goals, plot, and adventure may all be highly fluid or more specified and stricter. In an educational game, however, being too open-ended limits our ability to create quick, efficient, and effective games that teach a certain subject.

5.7 Role-playing

Any action in which you either put yourself in someone else's shoes or stay in your own shoes but put yourself in an imaginative circumstance is known as role-playing.

In role-play activities, participants are involved in “as-if” or simulated actions to approximate aspects of a real-life situation that is problematic, impractical, impossible, expensive, or risky to carry out in the real world (Yardley-Matwiejczuk, 1997)[14],

Why use role-playing:

- It's fun and motivating
- Quieter students get the chance to express themselves in a more forthright way

[13] https://education.minecraft.net/en-us/blog/making-learning-more-game-based-with-minecraft-education-edition

[14] Yardley-Matwiejczuk, K.M. (1997). Role play: Theory and practice. London, UK: Sage Publications.

- The world of the classroom is broadened to include the outside world - thus offering a much wider range of opportunities

Role-playing has been demonstrated to be helpful in achieving learning objectives across three primary learning domains: **emotional, cognitive, and behavioral**. Students learn empathy and perspective taking by putting themselves in the shoes of another person. This might lead to increased self-awareness and introspection on the side of the learner. When students put what they've learned in theory into practice, they form a stronger cognitive link with the information, making it simpler for them to learn. Finally, employing role-playing as a training method aids students in achieving their goals.[15]

5.8 Scenario-based learning

Scenario-based learning (SBL) is a type of active learning strategy that employs interactive situations to assist active learning techniques like problem-based or case-based learning. It generally entails pupils working their way through a plot, which is frequently centred on a ill-structured or complicated problem that they must solve. Students must use their topic knowledge, critical thinking, and problem-solving abilities in a safe, real-world setting during this process. SBL is frequently non-linear, and students might get a variety of feedback based on their selections at each stage of the process.

Scenario-based learning can be self-contained, in which case completing the scenario is the only job, or it can be part of a larger project requiring the student to complete the scenario, and then provide a written or oral reflection and self-assessment on the process.

Why use scenario – based learning:

- **Increases learner engagement**. Scenario-based learning has the potential to interest learners by increasing their brain activity, which is one of its most significant features. It teaches students to think critically, helping them to solve issues and make decisions based on their knowledge. Storytelling simulations are a wonderful method to increase engagement since they trigger the emotions of the learners.
- **Increases knowledge retention.** The use of narrative makes it simpler to absorb and retain the information. The combination of narrative and practice increases knowledge retention because people learn the most through their experiences.
- **Speeds up time to competency.** Another benefit of scenario-based learning is that students may pick up new skills much more quickly. Simulations are self-contained and may be completed in a matter of minutes. Simulations reduce the time it takes for students to learn and become competent by allowing them to practice their abilities quickly and efficiently.
- **Enhances the application of knowledge.** It is more likely for students to apply what they've learned in different situation in the real world. It helps them to practice a new

[15] https://ablconnect.harvard.edu/role-play-research

skill in a safe setting before, allowing them to gain confidence. It gives the students real-world examples of how the material they're learning is relevant and can be used in their lives.

When would I use SBL?

SBL can be used in a wide range of contexts, but it works especially effectively when used to simulate real-world practice, providing opportunities which may be difficult for students to experience within the confines of a course. Successful scenarios have been developed around topics as wide-ranging as structural failure in bridges, pesticide applications for apple orchards, and the nursing management of myocardial infarction. SBL can be used as part of either formative or summative assessment. SBL usually works best when applied to tasks requiring decision-making and critical thinking in complex situations. Tasks that are routine to the students will require little critical thinking or decision-making may be better assessed using other methods.

How can I start creating SBL?

1. **Identify the learning outcomes:** It's crucial to figure out what you want students to learn when they finish the scenario, and then work backwards from there to construct the situation that will lead to that learning.
2. **Decide on your format:** Is your scenario going to be delivered in the face-to-face or online environments? What media (photographs, audio, video) and other resources will you need? If you are using an online scenario, will you provide other supporting activities, such as wikis, discussion forums, etc.?
3. **Choosing a topic:** Remember that non-routine tasks lend themselves to scenario-based learning. Consider using critical incidents and challenging situations that have occurred in your subject area.
4. **Identify the trigger event or situation:** This will be the starting point of your scenario. As you create the scenario, identify decision points and key areas for feedback and student reflection.
5. **Creating a storyboard is an effective way to do this**.

5.9 Differentiated instruction

Differentiating instruction might entail teaching the same subject to all students using a range of instructional techniques, or it can mean the educator delivering lessons at different levels of difficulty depending on each student's competence. Students could have more options to choice from, like: easy/medium/hard mode or tablet/laptop or teams/individual work, in order to enhance ownership of learning and target all students with either higher or lower abilities.

Differentiated techniques may be narrowly focus on specific students' attributes, including what subjects inspired students to learn, readiness of what students have learned and still need to learn or the learning style through which students learn best. Differentiation could apply to **content** (what students learn or how they get access to information)**, process** (how

students make sense of and come to understand content), **product** (how students show what they've learned).

For example, learning can be differentiated through:

- Teams.
- Reflection and goal setting.
- Mini-lessons, centers, and resources.
- Voice and choice in products.
- Differentiate through formative assessments.
- Balance teamwork and individual work.
- Choice of device.

Why use differentiated instruction:

- **Different learning styles**. Through differentiated instruction the learning process can target students with different learning styles, visual, kinaesthetic, audio or words. Students could choose their preferred way of learning.
- **Students differ in readiness and performance levels.** It benefits both learners who require additional support and those who need additional challenge.
- **Engagement varies.** Different ways of display and/or instructions provide more effective engaging features for a wider range of students.
- It supports students with **disabilities or learning difficulties**, i.e. attention deficit hyperactivity disorder (ADHD) or dyslexia etc.

Minecraft is a natural vehicle for differentiation. Differentiation can be achieved through the usage of Minecraft in a variety of methods. Students may learn more than just words on a page by creating immersive worlds as a visual, interactive, and informative field trip. Students can use worlds to demonstrate their understanding on topics that they may not have been able to do so on paper or otherwise.

THE END