ALAM JOURNAL OF MARITIME STUDIES (AJMS)

CONSTRUCTIVISM LEARNING THEORY APPLICATIONS IN MARITIME ENGINE-ROOM SIMULATOR (ERS) AND 21ST CENTURY CLASSROOM

Zaful Rullah Hakiem Bin Zaini
zaful.rullah@alam.edu.my

Centre for Professional Training (Simulator), Akademi Laut Malaysia, BT 30 Kg Tg Dahan, 78200 Kuala Sungai Baru Melaka, Malaysia

ABSTRACT

This study explores the benefits of good knowledge of learning theories for educators to understand the learning process and ensure effective and efficient learning. Specifically, it focuses on the constructivist learning theory, which emphasises that knowledge cannot be transferred but should be built by learners. Using extensive literature reviews, the study formulates applications of Constructivism in maritime Engine-Room simulator learning activity, allowing learners to be more engaged and actively involved in the learning process. Overall, the study emphasises the importance of constructivist learning theory and its various applications in the 21st-century classroom to ensure effective and efficient learning.

ARTICLE INFO

Keywords: Learning theories, Constructivism, 21st-century classroom, Maritime education and training, Engine room simulator

1.0 INTRODUCTION

"Educational psychology, as a field of study, is devoted to the application of a wide variety of theories to understand the way humans learn so that the most effective practices of instruction can be implemented." (Click et al., 2022)

Learning theory is one of the aspects of educational psychology. Four dominant learning theories are famous among scholars: behaviourism, cognitivism, Constructivism and connectivism. This study will discuss the definition and overview and include an example of applying Constructivism learning theory using an Engine-Room simulator (ERS).

2.0 LITERATURE REVIEW

Constructivism can be divided into two dominant theories: Cognitive Constructivism by Jean Piaget and Social Constructivism by Lev Vygotsky (Figure 1). In Cognitive Constructivism, Piaget believes that the learner constructs knowledge based on prior knowledge and experience (Piaget, 1958). Although Vygotsky acknowledges that cognition results from mental construction, as stated by Piaget, Vygotsky says that other external factors may influence the construction of knowledge. In social cognitivism, Vygotsky believes knowledge is constructed in a social context through active process and collaboration (Vygotsky et al., 1978).

The teacher is the one who sets what is to be taught. Hence, behaviourism and cognitivism learning theories have systematic approaches and are typically more teacher-centred. The strategy is different under Constructivism learning theory, which emphasises student-centred learning more. The teacher plays a more passive role and merely acts as a facilitator to speed up learning if necessary. As shown in Figure 1, some examples of applications for Constructivism learning theory are flipped classrooms, role-play, and simulation. Improving the learning process also depends on outside variables and socialisation with other students. This process of autonomous or collaborative learning is also known as situated learning.

The Zone of Proximal Development (ZPD) (Figure 2), frequently employed in social Constructivism theory, states that the trainer must understand when it is appropriate to remove assistance from the learners to maximise learning outside their comfort zones. Incremental learning is the best kind of learning. The instructor must watch out that the students don't lose interest in the content or think it's too difficult because of the lack of assistance.

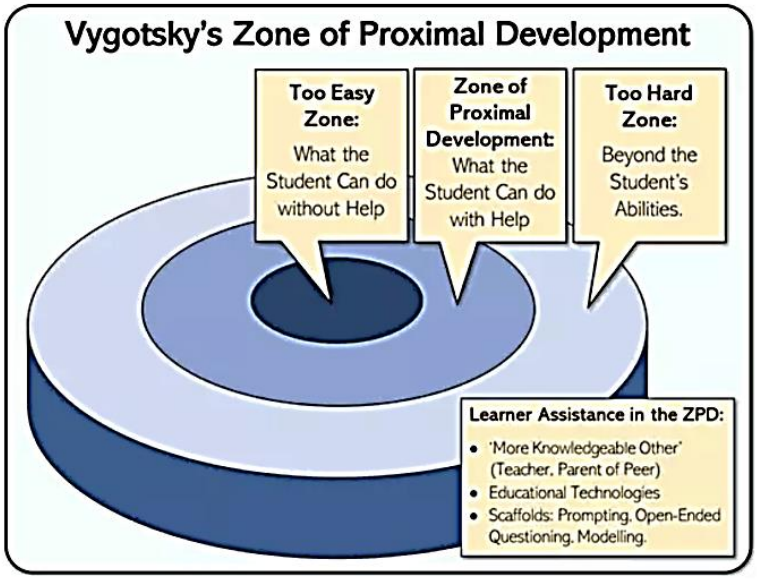

Figure 2: Zone of Proximal Development.

Note: Reproduced from Sociocultural theory of learning in the classroom by HelpfulProfessor, n.d. Retrieved from https://helpfulprofessor.com/sociocultural-theory-education/

The Constructivism technique takes longer than behaviourism and cognitivism since it requires students to engage in self-regulated learning (SRL) and generate knowledge. It also requires more tedious preparation and good learning facilities, which subsequently would increase the cost of education. The earlier approaches are more rule-based and objectivist, and the teachers have complete control over their lessons. However, scholars claim that Constructivism is the ideal strategy for maximising student potential, encouraging critical thinking, and being a dynamic learning process (Padirayon et al., 2019).

2.1 Overview of Constructivism

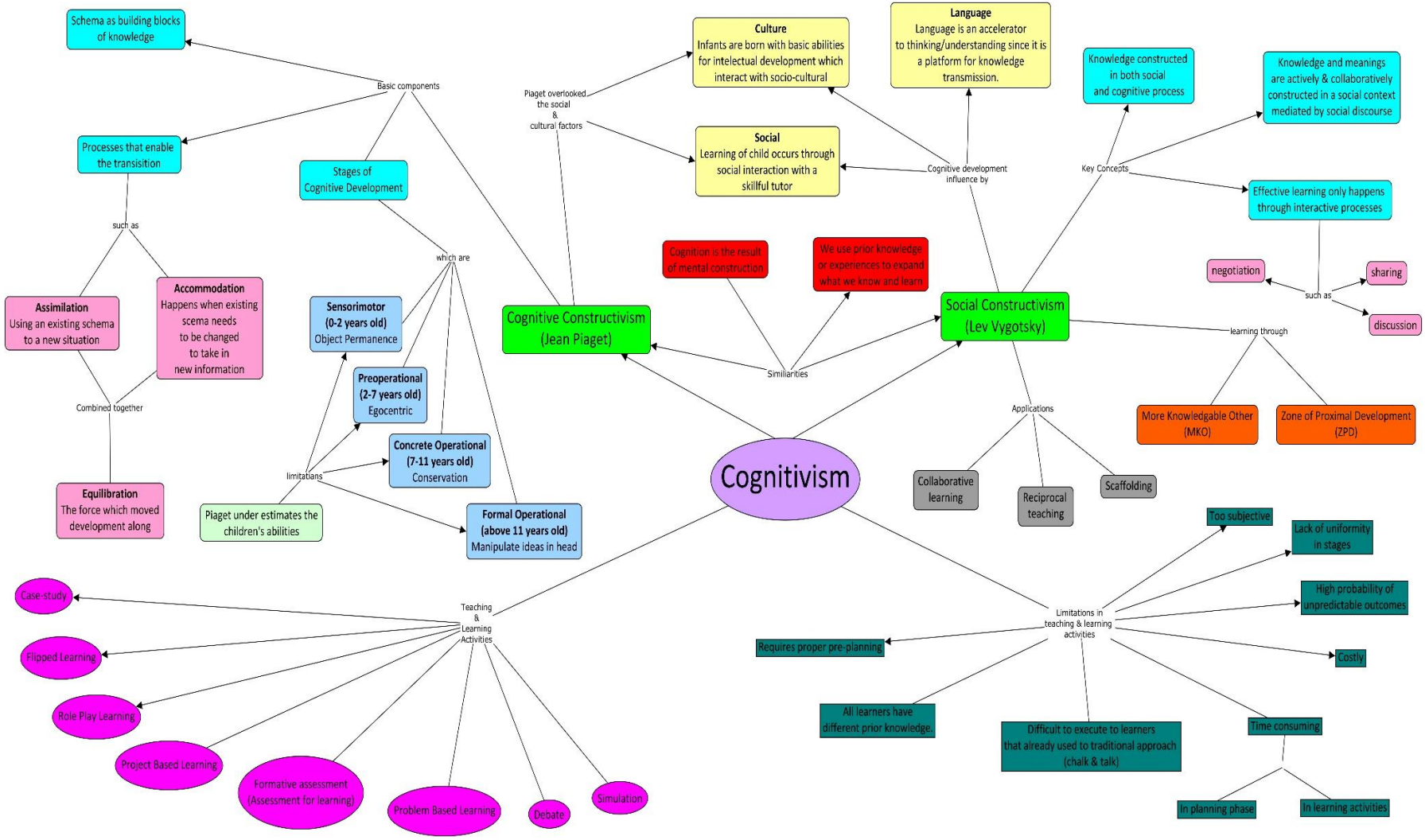

Figure 1: General overview of Constructivism Learning Theory
Note: Self-produced from variable sources

2.2 Constructivism in the 21st-Century Classroom

People with 21st-century skills may evolve with the times. Hence, educators must ensure the learners are equipped to acquire this skill set. To use the Constructivism approach in the 21st-century classroom, teachers should consider several factors to provide an effective learning process. Competencies like critical thinking and the capacity to communicate with people from various languages and cultural backgrounds are needed in today's labour market and benefit learners (Chiruguru, 2020).

In traditional teaching, learning occurs when a teacher transfers their knowledge to the learners. Since the constructivist approach differs, a teacher should be prepared to embark on this journey. The teacher is a facilitator during students' independent work by offering guidance, tailoring the assignments to each student's unique skills, fostering a welcoming environment in the classroom that encourages participation, and stimulating each student's curiosity. As each learner may have different prior knowledge, the teacher must be able to closely monitor learners' performance through their verbal feedback, body language and behaviour. The student-centred approach is aligned with Constructivism and the 21st-century classroom setting. However, based on a study in Ukraine reveals that most academic staff members in Ukraine had a difficult time distinguishing between the traditional teacher's function and that of a facilitator, moderator, or tutor in student-centred learning (Bulvinska & Chervona, 2019). In contrast, one study in Malaysia highlights a positive relationship between teachers' motivation and adopting 21st-century skills in the classroom (Hoon et al., 2022). Another study worth discussing is the teacher's perception of teaching in the 21st-century classroom.

"…. *when teachers possess positive perceptions about their proficiencies in 21st-century skills, they may provide a constructivist learning environment by helping their students arrange their learning, discuss their personal opinions and criticise the teaching styles or strategies used by their teachers."* (Anagün, 2018).

These studies show that Constructivism is only suitable for some situations. One of the essential factors is the teacher itself, which is influenced by their readiness, motivation and perception. In ensuring the Constructivism approach is effective, a teacher requires good communication skills and creativity to develop the learning activities and should be adaptive and dynamic to any changes in the learning process.

Organisation and management for the 21st-century classroom is another crucial factor in ensuring learning takes place effectively through Constructivism, for instance, by having a democratic classroom environment. A constructivist teacher sets up the classroom so the instructor and students can shape the environment rather than blatantly controlling the learners. All decisions made in the classroom impact them as individuals and as learners. A teacher plays a significant role in ensuring this thing happens. As a result, the learners become more expressive, which may help them to verbalise their thought in diplomacy, improve their communication skills, collaborate well with colleagues, and gain confidence in decision-making. All these aspects are essential to acquire 21st-century skills and ensuring the Constructivism approach is effective.

Digital literacy is another critical component in 21st-century classrooms (Figure 3). Therefore, the teacher should maximise the utilisation of technology in classroom management (Bates, 2015). This approach might be costly and impractical when the learning institution operates on a very tight budget. However, many service providers offer free educational software with decent functions and features, such as Google Classroom, Moodle, Kaltura Video Cloud and OpenEduCat (G2, 2022). Since the options are abundant, the teacher should be selective and has a good technology adaptation. The study in Indonesia shows that technology adaptation is

a mediating factor for psychological capital, which subsequently affects classroom performance (Wisetsri et al., 2022). The teacher should be creative in utilising the technology as well. For instance, the teacher may ask the students to collaborate to develop the learning activity using open-source software. This will reduce a teacher's burden and simultaneously give the students a learning experience. In addition, this practice will help both teachers and learners with the new technology, which is increasing. However, the teacher should give adequate support to ensure the task is doable and motivate the learners to complete the task.

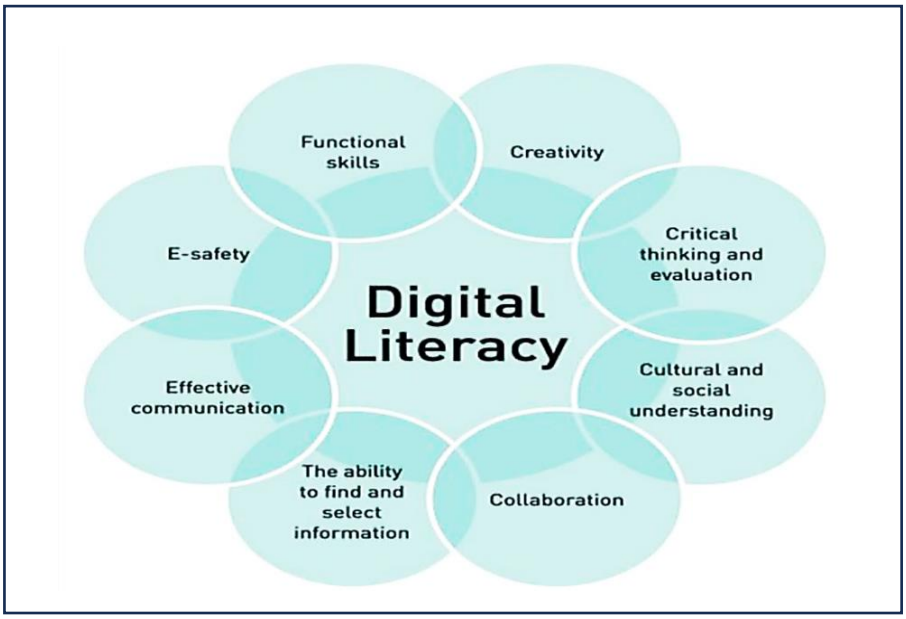

Figure 3: Scope of digital literacy.

Note: Reproduced from Digital Skills and Competencies in Schools by S.Cranmer, 2014.

3.0 METHODOLOGY

The purpose of this study is to investigate the application of Constructivism learning theory in the context of maritime Engine-Room simulator training and its incorporation into the classroom of the twenty-first century. Based on the findings, the researcher formulates an example of the application through ERS learning activities. This study relied primarily on literature reviews for data acquisition and analysis.

3.1 Research Method

This study's research design is a literature review, which entails a systematic and exhaustive analysis of existing literature on applying Constructivism learning theory in maritime Engine-Room simulator training and the twenty-first-century classroom. The design of a literature review permits the accumulation, analysis, and synthesis of data from diverse sources of published literature.

3.2 Data Gathering

This study's primary data acquisition method is a systematic review of the existing literature. The literature sources were identified through an exhaustive search of online databases. Search

terms included “Constructivism learning theory”, “Engine-Room simulator”, “21st-century classroom”, “maritime education”, “competency-based training”, “simulation-based learning”, “learner-centred approach”, and “active learning”. The inclusion and exclusion criteria were established to ensure that the study included only relevant literature.

3.3 Data Analysis:

The compiled literature was analysed using thematic analysis, identifying the data’s themes, patterns, and trends. The thematic analysis consisted of reading and rereading the literature to identify key concepts, categories, and subcategories related to applying Constructivism learning theory in maritime Engine-Room simulator training and the 21st-century classroom. The identified themes were then synthesised to provide an overview of the Constructivism learning theory's application within the context of this study.

3.4 Ethical Implications:

Since this study relied solely on literature reviews, there was no need for ethical considerations. The researcher ensured that all literature sources were appropriately cited and acknowledged to avoid plagiarism.

4.0 FINDINGS AND DISCUSSION

Based on the findings from various literature and including the literature reviews from the previous chapter, the researcher has formulated the application of Constructivism in ERS classrooms. Figure 4 shows an example of a learning activity using a computer-based Engine-Room Simulator (ERS). The name of the training is Operation of Fresh Water Generator (FWG). In this practical training, the learners will use their prior knowledge to perform a starting operation of an FWG. This training is designed for marine engineering students who have never been on a ship.

Since the students don't have any field experience, the trainer needs to establish the knowledge to the students beforehand. This can be done by having extensive discussions about the equipment immediately before the exercise begins. Or else, it also could be covered in other theoretical classroom sessions.

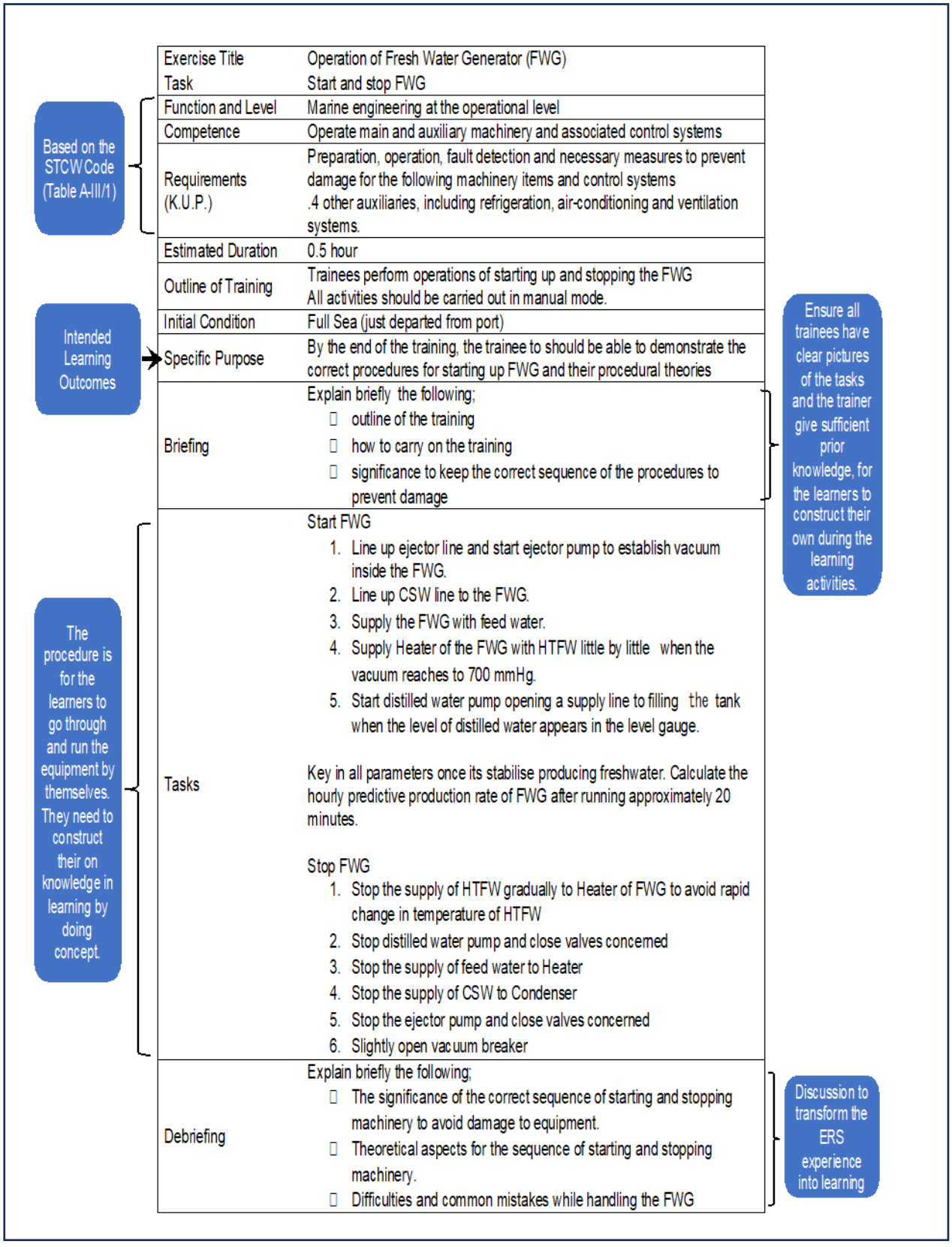

Figure 4: Lesson plan using Constructivism approach in Engine Room Simulator training

Note: Adapted from Model course 2.07. Engine-Room simulator by International Maritime Organization, 2017, IMO Publication. Copyright 2017 by IMO Publication.

Nevertheless, the trainer should conduct a comprehensive briefing and introduction before the exercise can begin. The learners should clearly understand the specific learning objective and how to use the ERS. The trainer may use animation or real video from the ship to demonstrate the procedure from a different environment. This will help the learners to adapt the same concept in the ERS environment.

Each learner will be stationed in their respective workstation for the exercise. During the training, they should follow the procedures written in the exercise sheet. By doing it this way, the learners need to actively engage with the task so that they may complete the task. This is also known as the learning-by-doing method.

As the learners will learn by themselves, the trainer is known as a More Knowledgeable Other (MKO) in Constructivism. While the exercise runs, the trainer may visit each workstation to provide support or scaffolding. However, the intervention should be based on the ZPD. For instance, if a learner is stuck in the middle of an exercise, the trainer may ask some relevant questions to trigger the learner to reconsider their steps.

As the progression of all learners could not be the same, the trainer may assign the high-achiever learners to collaborate with the low-achiever learners to encourage collaborative learning.

Finally, is the debriefing session. Debriefing, self-reflection on the task and helping dispel all doubts should be the most crucial component of this activity. This procedure is dynamic because various classes could have different problems. The trainer may ask questions that help the learners to rationalise the experience into new knowledge. Peer assessment is another tool to verify the students' tasks and give learning experience for the students while assessing their colleagues. In addition, the trainer may conduct a fun formative assessment, such as Kahoot, to validate the learning activity's effectiveness and as a part assessment for learners' learning (Tan et al., 2018).

To summarise, this activity embeds Constructivism theory as the learners actively construct their knowledge through a learning-by-doing approach. The learning process only would be effective if the learners have pre-existing knowledge about the task, which could be done through lectures or demonstrations. Minimum intervention by the trainer also helps the learners to build their confidence and maximise the learning process. Although it is an active learning process, the trainer should monitor the progression and give necessary support or stimulus to help the learner in the learning process.

5.0 CONCLUSIONS

Good knowledge of learning theories helps educators to understand the learning process to ensure learning takes place effectively and efficiently. In constructivist learning theory, knowledge cannot be transferred but should be built by the learners. Although this approach is costly, time-consuming and requires tedious planning, it is a potent tool in knowledge retention to develop critical thinking, collaboration and communication skills among the learners, which are essential 21st-century skills. The role of a teacher shifts from solely an instructor to a facilitator. To ensure the teacher does not burden the learners in constructing their knowledge, this has to be done based on ZPD in the concept of scaffolding. The applications of Constructivism allow the learners to be more engaged with the content and actively learn. Examples of non-exhaustive applications are flipped classrooms, debate, role-play, simulation and interactive classrooms. The teacher's readiness in terms of proficiency using this approach, classroom management and attitude towards the approach is crucial for 21st-century teachers. The teachers should maximise technology usage throughout the process to speed up the

technology adaptation for teachers and learners, which benefits the learning process and prepares the learners in their working field.

It is essential to recognise the study's limitations and the need for additional research to verify and validate the theoretical framework and findings presented in this study. This study is just a starting point for further research, which could involve conducting empirical research, such as experiments or surveys, to acquire data and test the theoretical hypotheses made in the study.

REFERENCES

Anagün, Ş S. (2018). Teachers' Perceptions about the Relationship between 21st Century Skills and Managing Constructivist Learning Environments. International Journal of Instruction, 11(4), 825-840. 10.12973/iji.2018.11452a

Bates, A. W. (2015). Teaching in a Digital Age. Tony Bates Associates Ltd.

Bulvinska, O., & Chervona, L. (2019). Transformation of the roles of Ukrainian Universities teachers in student-centred learning and teaching.3, 38-44. 10.28925/1609-8595.2019.3.3844

Chiruguru, S. (2020). The Essential Skills of 21st Century Classroom (4Cs)10.13140/RG.2.2.36190.59201

Click, K., Schwartz, N., & Bartel, A. (2022). Educational Psychology: Learning and Instruction. (pp. 1-35)10.1007/978-3-030-26248-8_67-1

G2. (2022). Top Free Classroom Management Software. https://www.g2.com/categories/classroom-management/free

Hoon, T., Muthukrishnan, P., Koo, A. C., Kam, N., & Singh, P. (2022). Preservice Teachers' Motivation and Adoption of 21st-Century Skills., 205-218.

Padirayon, L., Pagudpud, M., & Cruz, J. (2019). Exploring Constructivism learning theory using mobile game. IOP Conference Series: Materials Science and Engineering, 482, 012004. 10.1088/1757-899X/482/1/012004

Piaget, J. &. I., Brbel. (1958). The Growth Of Logical Thinking From Childhood To Adolescence. Routledge. 10.4324/9781315009674

Tan, D., Ganapathy, M., & Mehar Singh, M. K. (2018). Kahoot! It: Gamification in Higher Education. Pertanika Journal of Social Science and Humanities, 26, 565-582.

Vygotsky, L. S., Cole, M., John-Steiner, V., Scribner, S., & Souberman, E. (1978). Mind in Society. Harvard University Press.

Wisetsri, W., Chuaytukpuan, T., Prompanyo, M., Raza, M., Cavaliere, L. P. L., & Akhtar, S. (2022). Impact of Psychological Capital and Technology Adaptation on Performance of Teachers.6, 8784-8793.