Developing Higher Order Thinking Skill with the 120-Minute Instructional Station Rotation (MRSP120) Approach: Students' Perceptions

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***Abstract*—Research on blended learning pedagogy has been intensively focused on developing Higher Order Thinking Skills (HOTS) among students. Nevertheless, predicting the effectiveness of students associated with learning through planned blended activities quantitatively would be insufficient without further researches. Therefore, this study included respondents' experiences and opinion in evaluating the effectiveness of the proposed blended learning intervention called 120-Minute Instructional Station Rotation Model (MRSP120). This innovation of Station Rotation instructional model combined three main approaches, which were Team-Based Learning, Online Collaborative Learning and Traditional Method. Also, this pedagogy integrated principles of Meaningful Learning. Semi-structured interview using phenomenology approach was carried out to explore students' state of perception. Reviews on the impact of MRSP120 were collected and analysed. The results depict that the components within MRSP120, play important roles to develop HOTS. Discussion on the MRSP120 implementation could provide some insights on the potential to develop HOTS through discourse activities and argumentation.**

Keywords—higher order thinking skill, blended learning, station rotation model, online learning, instructional design, pedagogy

I. INTRODUCTION

Blended learning is a formal instructional design which combines face to face (f2f) interaction (Traditional Method or Brick and Mortar) and Online Learning environment into the class [1]. This mix-mode or hybrid approach could enhance the explanation theory and science process through hands-on practice and technology [2]. There are four types of Blended Learning Model; namely Rotation, Flex, Self-Blend and Enriched-Virtual Model [3]. However, instructor preferred Rotation Model to integrate multi-dimensional learning approach whether in a form of lab rotation, station rotation, flipped classroom or individual rotation [4][5]. Rotation Model has the potential to cater to students' needs and to engage them into learning process voluntarily [7].

As for that reason, Station Rotation Model which has been well recognized in the US has been chosen to engage and enhance students' Higher Order Thinking Skill (HOTS) in school [6]. Nevertheless, this study has identified disadvantages of the existing Station Rotation Model in suiting the education system environment in Malaysia. Hence, 120-Minute Instructional Station Rotation Model or Model Rotasi Stesen Pengajaran 120 Minit (MRSP120) was introduced. MRSP120 combines the rotation model with the principle of Meaningful Learning Theory [8]. The proper adjustment was made to suit Malaysian Education School System [9] and Malaysian HOTS definition [8]. This innovative improvised style of blended learning is then assimilated into Malaysian curricular system to bond Lower Order Thinking Skill (LOTS – Remembering, Understanding) and Higher Order Thinking Skill (HOTS – Applying, Evaluating, Creating) elements which fit the Bloom Taxonomy level of cognitive [10][11]. Instead of referring to the Bloom Taxonomy level by Bloom [12], Churches [14] Digital Bloom Taxonomy was referred to. Meaningful Learning Theory, revised by Howland [15] was also selected as the foundation of MRSP120 with intention of long-term preservation of knowledge [16][17]. As depicts in Fig. 1, instructional structure, elements of LOTS are mostly covered in the whole class teacher instruction or traditional method while HOTS is generated in Online Collaborative Learning (OCL) with the help of social network application and Team-Based Learning (TBL) collaboration activities.

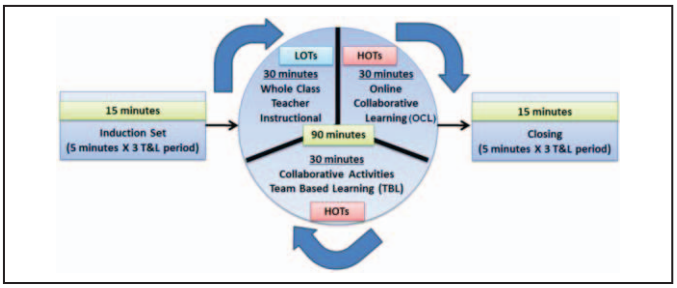

Fig. 1. 120-Minute Instructional Station Rotation Model (MRSP120) [8]

The continuously alternated implementation of different kind of Teaching and Learning (T&L) approach is called Station Rotation Model [18]. To encourage students to argue and becoming more competitive, OCL and TBL were integrated. This has helped in developing HOTS [19][20]. For experimentation, trigonometry had been selected to be bonded with this model in boosting the upper secondary students' HOTS ability in Mathematics. Previously, students were not connected to real-world issues when learning Mathematics [21][22]. Through implementation of two group experimental designs, the statistical result shows that there are significant

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differences in their achievement test in MRSP120 intervention group as compared with the control group [8]. Distinctively, their ability is stronger than the preliminary results. However, the data require further verification to prove the effectiveness of the study particularly in relation with HOTS. Thus, this paper presented the qualitative approach using interview data to further explore students' feedback on MRSP120 in developing HOTS.

II. Methodology

A simple survey which was conducted in the first two weeks revealed the weaknesses and low ability of HOTS among the focus students. The intervention of MRSP120 was then conducted by delivering the content knowledge throughout three different stations of teaching method: Traditional, OCL and TBL. The students which were divided into a few small groups with a maximum of 12 members who were alternately rotated in 30 minutes time to fetch contents at every station. The introduction and wrapping up lesson sessions were delivered in 15 minutes before and after Rotation Station procedure. The rotations were continually executed in everyday T&L session until it fulfilled the syllabus requirement for the topic. The station was designated diversely depending on the instructor's creativity and suitability of subtopics in creating blended experienced among students. Observation on students shows a positive and encouraging behaviour towards the pedagogy environment. After six weeks of treatment, HOTS ability among the students finally showed a significant increment statistically; after analysing the achievement test, distributed in 19th week.

To reinforce the effectiveness of the whole process, an interview session was planned in the last week of the research. Phenomenology approach was employed to review all feedbacks from semi-structured interview. Phenomenology is a qualitative research approach which aims to understand students' experience undergoing intervention of new teaching and learning approach [23]-[26]. Refer to Table I for the research design. In short, the research acquired ten weeks of implementation - two weeks for preliminary survey with structure questionnaires, six weeks for the MRSP120 intervention, and two weeks for quantitative and qualitative data collection using achievement test and Semi Structured Interview Protocol. In this paper, researchers only discussed the interview part which occurred in the 10th week of the research implementation (as highlighted in the Table I). The qualitative semi-structured interview was comprised of three parts. The first part was to identify a preferred approach in MRSP120 by students. This was collected based on their votes and argument.

The second part contained students' explanation regarding their digital learning experience and the way the applications have helped them in terms of their HOTS development process. The third and last part of the interview included students' reviews on MRSP120 and their suggestions for future improvement that would enhance their HOTS. All feedbacks from thirty-five students who had undergone the intervention were analysed successfully using Braun & Clarke [27] thematic analysis procedures. Students aged sixteen on average were interviewed for this purpose. The findings were exploited to be triangulated with quantitative data (statistic) that showed significant differences in students' scores between the intervention and control group. To minimise the bias, two groups with similar academic ability were chosen from distinct schools randomly with a privilege consent for the interview session.

TABLE I. Implementation of MRSP120 Research

Week	MRSP120 Research		
	Procedures	***Data Collection***	***Data Analysis***
1-2 (2 weeks)	Preliminary Survey	Structured Questionnaires	Statistical Test
3-8 (6 weeks)	Implementation of MRSP120 per week on trigonometry	Participant Observation	Phenomenology
9 (1 week)	Test	Achievement Test	Statistical Test
10 (1 week)	Interview	Semi Structured Interview Protocol	Phenomenology

III. Result

Table II depicts that OCL, Traditional (Teacher Instruction) and TBL within MRSP120 are voted as the most favourable approaches in developing HOTS among students. Students' explanations to their selection are provided in Table III. Their explanations were transformed into themes. Next was the discussion related to students' detailed views about the integration of MRSP120 in developing HOTS. The findings are divided into two parts – (1) the first part discusses the argumentation of students' votes regarding the most favourable MRSP120 approaches (refer Subtopic A); (2) the second part discusses the students' digital learning experience; and provides suggestions for future improvement (refer Subtopic B). Students' preference method in generating HOTS in MRSP120 is revealed in Table II. Creating Skill is enhanced through TBL activities (62.5%) when they utilise the social networking in renovating their knowledge and skills. Supported by traditional method (55.2%), the quality of the skills and knowledge is confirmed via Evaluating Skill, based on comment and analysis by their instructor as the content expert. Furthermore, the students could make a good decision from Analysing Skill they have obtained from every implemented method in MRSP120. Obviously, OCL activities (60.5%) could help in Applying Skill in transferring knowledge and skill in their everyday life. In short, HOTS has been proven to have integrated within MRSP120.

TABLE II. HOTS Generated in T&L

HOTS	Theme/Construct (Students Vote)	Percentage Every Skill	Total Percentage
Creating	TBL (25) Traditional (8) OCL (7)	62.5% 20.0% 17.5%	16.4% 5.30% 4.60%
Evaluating	Traditional (21) TBL (14) OCL (3)	55.2% 36.8% 7.80%	13.8% 9.20% 2.00%

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Analysing	OCL (14) TBL (12) Traditional (10)	38.9% 33.3% 27.8%	9.20% 7.90% 6.60%
Applying	OCL (23) TBL (12) Traditional (3)	60.5% 31.0% 7.90%	15.1% 7.90% 2.00%
Total Percentages		400%	100%

A. Developing HOTS with MRSP120

Students have stated that each approach within MRSP120 is essential based on the condition. For example, students find that sharing ideas for continuous improvement within group is necessary before producing a product [28]. This is where the Team-Based Learning approach plays its role. Students inclined to think individually before they share with others in achieving goals [29]. Meanwhile, based on students' vote, Traditional Method and OCL play roles in encouraging the students to reflect on their basic knowledge to achieve Creating Skill. However, when it comes to Evaluating Skill, students prefer to learn through Traditional approach. This is because they would rather be criticised by the content experts i.e. teachers than their own peers. Apart from their peers' feedbacks, the feedbacks from their teachers are very crucial in avoiding misconception. During the lesson, the students have shown a more confident attitude and they are able to communicate their ideas and suggestions on any platform including online social media, blogs and web pages.

This phenomenon could lead to Guided and Experiential Learning skill [30][31]. In addition, the ideas or comments during the interactions could be rearranged and scrutinised to be related with their surroundings to transfer practice process authentically [32]. Thus, it would benefit the style of argumentation and the ability to manipulate the knowledge depending on the situation faced by them. Regarding developing Analysing and Applying Skill, OCL is the number one choice among the students. Students like to compare and differentiate graphics, generated by the computer when learning equation. Furthermore, every generating equation and information manages to motivate them to learn further and solve problems. This also indicates that social media tools could become a vital part of the learning process if implemented effectively [33]. TBL and Traditional Method practically impose equal impact in enhancing Analysing Skill to produce a good outcome or product and solving problems. Overall, the findings indicate that collaborative learning affords students enormous advantages [34]. Learning collaboratively encourages students to become more explanatory and self-directed [35].

Table III provides a detail elaboration on this. Moreover, skills of analysing could also then be extrapolated into applying purposes of performing problem-solving procedures which would significantly bond the Exploratory Learning ability [36]. Students may use a formula or strategies of using raw materials to produce a solution in the form of writing, calculation, concrete product or games tactics. However, step-by-step solution in Traditional Method and group discussion may also contribute in applying skill experience. This is because knowledge sharing session among the students especially with the presence of teachers is very crucial to strengthen the basic understanding of the topics. As time goes by, students would reach their destination to nurture Self-Directed Learning within themselves before successfully mastering Self-Regulated Learning in their whole life [31].

TABLE III. GENERATION OF HOTS IN MRSP120

HOTS via MRSP120	Theme/ Construct	Students' Ideas (Number of Recursion)
Creating via		
- TBL	Self-Directed Learning	*Sharing Knowledge* (5), *Combining ideas* (13), *Creating creative product* (12)
- Traditional	Guided Learning	*Explaining through example* (4), *Providing tips to fun learning* (2), *Planning in solving problem* (3)
- OCL	Exploratory Learning	*Developing virtual sketch to visualise product* (5), *Building ICT skill through difference software* (3)
Evaluating via		
- Traditional	Experiential Learning	*Criticising on mistakes* (14), *Proving formulae* (3), *Detecting the misunderstanding* (5)
- TBL	Experiential Learning	*Criticising product* (6), *Exchanging ideas* (5), *Evaluating argumentations and suggestion* (4)
- OCL	Experiential Learning	*Criticising and giving suggestion* (2)
Analysing via		
- OCL	Exploratory Learning	*Comparing product visually* (8), *Searching more information through difference web and blog* (4)
- TBL	Self-Directed Learning	*Compare and combine ideas to create product* (6) *Changing ideas on strategies* (6)
- Traditional	Experiential Learning	*Identifying method based on problem* (6), *Analysing students' working steps thoroughly* (5)
Applying via		
- OCL	Learning Transfer	*Displaying product design through online* (12), *Utilising formulae to solve online problem* (6), *Connecting the knowledge with real situation* (4)
- TBL	Learning Transfer	*Solving problem based on ideas and suggestions* (8), *presenting the collective ideas to audiences* (5)
Traditional	Learning Transfer	*Using formula learned to solve problem* (2), *Drawing graph accordingly to the question* (1)

B. Future Improvement of MRSP120

Students' opinions are very crucial in understanding the effectiveness of the MRSP120. Students suggest for more challenging activities such as quizzes, games, outdoor activities and a site visit to be included in the MRSP120 instruction. These activities will help in increasing motivation, creativity, and engagement [37]. This also means that strategies such as Problem Based Learning (PBL), Project-Based Learning (PBL), Problem-Oriented Project-based Learning (POPBL) or Sciences, Technology, Art and

Mathematics (STEAM) activities can be integrated into MRSP120 [38]. Some students suggest the important of emphasising the role of more knowledgeable peers in initiating discussion within group. Other than that, students believe that it is also important for teachers to provide emotional support either face-to-face and through online [39]. The stability of learning relies heavily on how teachers educate students academically and emotionally [40]. Another point of view is that the integration of the elements in the model could be more informal. Based on students' experiences, the activities can be designed to be experienced outside of classroom, on electronic gadgets, via apprentices, and role playing. Commonly, most of the Y and Z generations including Alpha enjoy learning from watching online videos, surfing blogs, webs, and social media [41]. By giving the opportunities to compose video or graphics using editing tools and then uploading on YouTube or Video Blogs to seek feedbacks from other viewers [13] would be a bonus as the appreciation on their social and technology skills, thus, also giving advantages for them. Hence, by participating in the online activities, it would be able to enhance students' thinking process with the effort given [42]. Students' participation is a meaningful interaction, thus, build a better understanding [43] with close relation to the real-world application. Social media applications like WhatsApp, Twitter, Facebook, and Telegram are being used as viral agents to spread ideas [44] and assist in developing HOTS elements among students [46].

IV. Conclusion

This study has implemented MRSP120 instructional design to develop HOTS. MRSP120 consists of three main components which are whole class teacher instruction or traditional method, Online Collaborative Learning (OCL) and Team-Based Learning (TBL) collaboration activities. Students are found to be attracted to OCL the most. This is due to their nature and interest in utilising numbers of digital devices and resources. Also, their willingness to argue, collaborate, and share knowledge has contributed to the development of HOTS. Nevertheless, the traditional method is also emphasised by the students as they agree the importance of content validity by the content expert while learning in the classroom. Face-to-face interaction allows students seek better motivation, which enforces their confidence on the learned topics. The integration of multi pedagogical approaches in MRSP120 may provide some insights to encourage teachers to make use of more approaches in their teaching. This is to ensure that every student's need is taken care of and they are given the same opportunity to succeed.

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