

Review Article

OVERVIEW OF BLENDED LEARNING: THE EFFECT OF STATION ROTATION MODEL ON STUDENTS' ACHIEVEMENT

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Abstract

This paper aims to review on blended learning models specifically on station rotation model includes the implementations and results of past studies on students' achievement. This paper starts with an overview of blended learning concepts that could be implemented in teaching and learning and the issue arising in the promoting better understanding of the concepts. The discussion leads to the potential of using a station rotation model of blended learning for future study as the review from the past studies revealed that this model had positive impacts on students' achievement. These results are so promising, and this model could be designed and implemented in future studies

Key words: Blended Learning, Station Rotation Model, Achievement.

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INTRODUCTION

Modern educational technology is a revolution due to the widespread reach of the internet along with the information and communication technology (ICT) [1], [2]. ICT stands for any application which involves the usage of communication devices includes radio, television, cellular phone, computer, and a variety of related services such as video conferencing and online learning [3]. The utilization of ICT makes teaching more effective and interesting and it also enhances students' learning which can create a modern learning environment [3].

In this revolution of ICT, teachers should take initiatives to find out innovative ways to fulfil students' learning needs, because the education system is always changing. Essentially, the teachers have to put effort to implement innovative teaching methods in the classroom [4]. Teachers have to immediately replace the old learning styles such as chalk and talk methods, in favour of more active learning activities by implementing creative teaching approaches.

Many innovative teaching approaches can be implemented for example collaborative learning, inquiry-based learning, project-based learning, blended learning, and many others. From the perspective of ICT, education can be categorized into three main categories, (1) e-learning, (2) blended learning and (3) distance learning (Kumar, 2008). Among them, blended learning has gained many spotlights in the education sector [5]. Blended learning is specified as the combination of various instructional media, delivery approaches and different kinds of pedagogical approaches [6]. The core of blended learning is the combination of both, offline traditional face-to-face (F2F) learning and online learning [6]–[8]. Blended learning covers the weaknesses of both, offline traditional F2F learning and online learning. It also helps students to study anywhere and anytime, makes it easier for them to access the learning activities, and increases their interaction and engagement [9].

It is the best move to combine the advantages of offline traditional F2F learning and online learning in a blended learning environment [4]. The blended learning approach is

reportedly one of the most effective strategies to implement without ignoring the teachers' role in the classroom. Moreover, blended learning also compliments the benefits of both, offline traditional F2F learning and online learning [6], [8]. Besides, the research by Philips [10] claimed that the students do see some importance in online learning. However, students did not want online learning to completely replace offline traditional F2F learning.

Blended learning is frequently implemented in the education sector and other sectors such as nursing, the working sector and many others outside Malaysia [11]. It is believed that blended learning, if implemented well, is very effective because, a teacher does not hold a passive role, but instead acts as a mentor or a coach who gives personalized instructions. Online learning itself cannot solely replace the teacher's role in instructing and teaching students. A significant part of this approach is the transition of their role from supplying knowledge to coaching students based on their abilities [12]. Teachers can engage, inspire and empower students to experience learning when they are in smaller groups within a blended learning environment [12].

BLENDED LEARNING

Blended learning is created as an environment which takes the values of both offline traditional F2F learning and online learning [13]. It is the new trend in teaching and learning of core subjects including science.

Blended learning is a commonly used method in schools and universities levels. Teachers already used blended learning in their teaching and learning process. However, the difference is the approach to design the learning experience [14]. As reported, blended learning has different perceptions for different people [13], [15]. Some of the researchers mentioned that the blended learning system combines face-to-face instruction and computer-mediated learning [8]. In contrast, some people argued that the term blended learning is ill-defined [13], [16].

They stated that the concept of blended learning can lead to misconceptions as it can be thought of blending in teaching only instead of learning. They mentioned that the true meanings of blended learning include "blended pedagogies", "blended teaching" and "learning with blended pedagogies". While some researchers have defined blended learning as follows:

- (i) The combination of instructional media such as audio, streaming video, live virtual classroom, videotape, CD ROM and collaborative learning [15], [17]
- (ii) The combination of different kinds of pedagogical approaches such as constructivism, behaviourism and cognitivism [15].
- (iii) The combination of offline traditional F2F learning with online learning (delivery method) [6], [15], [18].

Many debates are revolving around the exact meaning of blended learning. However, Bonk & Graham [18] stated that the most accurate definition which reflects the blended learning systems is the third definition. They emphasized the crucial role of computer-based technologies in blended learning. It is supported by Sloan Consortium where blended learning is defined as a combination of face-to-face instruction and online delivery. As highlighted, blended learning has a percentage of 30-79% of the contents delivered online [7]. There are a variety of delivery methods as highlighted by the

researchers such as traditional method, web facilitated approach and blended or hybrid learning.

Other than that, blended learning is stated as an instructional approach that combines different modes of instructional methods, instructional technologies, and delivery methods such as offline traditional F2F learning and online learning [15]-[17], [19]. Sometimes, blended learning is regarded as hybrid learning [7], [20]. Akkoyunlu and Soylu [19] stated that blended learning is a combination of various models of online and offline education, teaching techniques, learning resources and all types of relevant technology.

Blended learning is defined as a combination of offline traditional F2F learning and e-learning. Other than that, Allan [21] believed that "blended learning is the usage of different internet-based tools including chat rooms, discussion groups, podcasts, and self-assessment tools to support offline traditional F2F learning". These quotations give an insight that blended learning relates to various combinations of technology in the teaching and learning process, and every so often a mixture of technology and classroom-based learning. This study addresses the issues by giving a landscape of blended learning which includes time, place, focus, learning relationships, different ICTs, types of learner, and learning context [21]. Figure 1 shows an overview of blended learning.

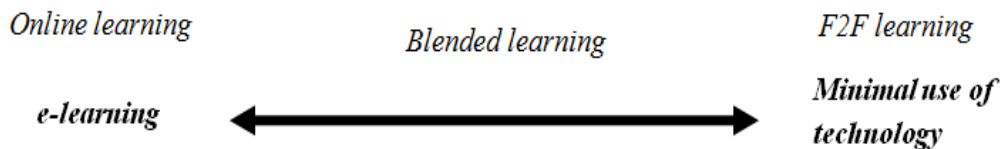


Figure 1: Overview of Blended Learning [21]

According to Garrison and Kanuka [6], blended learning is both effortless and complicated. The researchers considered blended learning as simple because it consists of both synchronous (face-to-face) and asynchronous (text-based internet) learning activities. At the same time, it is quite complex and very challenging to implement blended learning. For example, the suitability of the design needs to be considered in many contexts and limitless design possibilities. Other than that, Horn and Staker [22], [23] stated that there are uncertainties in blended learning in terms of the required expenses and the actual output. Meanwhile, they believed blended learning is a formal learning approach where students

can learn anywhere and anytime. Online learning has some interesting elements which are, the flexibility in time or place and the variety of the way of delivering.

BLENDED LEARNING MODEL

Horn and Staker [22] proposed six models of blended learning which are face-to-face driver, online lab, flex, self-blend, rotation and enriched virtual model. However, they removed two from the six blended learning models which are face-to-face and online lab because they believed that these were copies of other models. An overview of the models is given in Figure 2 [24]. The explanation for each model is given below:

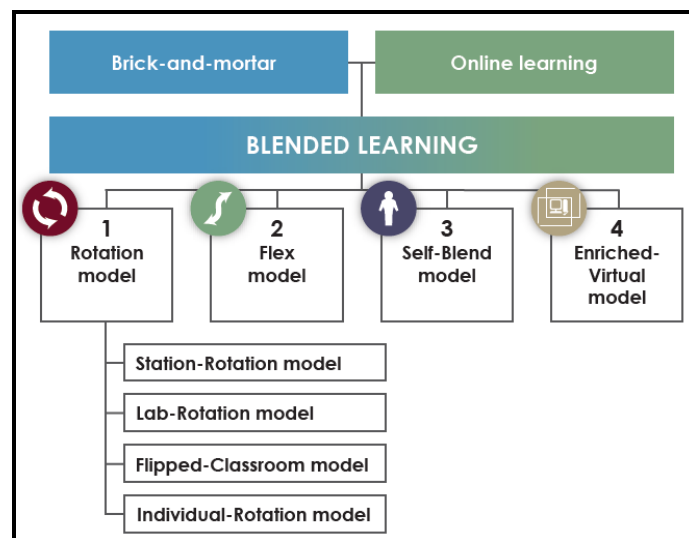


Figure 2: Categories of Blended Learning [24]

1. Flex model – Contents delivered mostly via an online platform. Students are flexible to move on their own

- among the delivery modalities. The teacher will be on the side of the students. Individual tutoring and small group sessions will be carried out if needed.
2. Self-blend model – The students learn one or more topics using the online platform with an online teacher. It will assist the offline traditional F2F learning. Students blend themselves by learning online individually and learning at schools with F2F teacher.
 3. Enriched-virtual model – Students take offline traditional F2F learning and learn the content and instructions alone using online learning. They divide the time on their own. In general, it is a normal school experience.
 4. Rotation – Students rotate between different learning methods. They rotate between online learning in offline traditional F2F classroom and online environments.
 5. Then, they also have to learn in F2F learning classroom. The rotation model is divided into four small groups.

6. Station rotation – Students rotate between different learning modalities which include one station of online learning. Other stations will include a few small groups or the whole class. The content includes tasks by groups, individual tutoring and assignments.
7. Lab rotation – Students rotate from their classroom to the learning lab to join the lessons.
8. Flipped classroom – Students rotate between offline traditional F2F learning at school and the delivery of content via online sources at their home after the school session.
9. Individual Rotation – Students will rotate based on a fixed individual schedule. The teacher will set their student schedules. The students do not need to rotate for every station or method.

Meanwhile, Staker and Horn [22] proposed four major models in the blended learning classroom. The detailed comparison of each of these four major models in the blended learning classroom is discussed in Table 1 below.

Table 1: Four Major Types of Models in Blended Learning Classroom [23]

Characteristics	Rotation model	Flex model	Self-blend model	Enriched-virtual Model
Setting	Within a classroom or a set of classrooms [12], [23], [25].	Learning online individually and learning at schools with a F2F teacher. Students learn mostly at school with a teacher using offline traditional F2F learning except for the homework [25].	Different from the enriched-virtual model because it is not a whole-school experience [23].	Whole school experience [23].
Rotation	Students rotate in a fixed schedule or according to the teachers' desires [12], [23], [25].	The content and instruction are fully delivered via online learning Backbone of this model is online learning [25].	Students can choose fully online methods to support their offline traditional F2F learning [23].	Students divide their time between offline traditional F2F learning and content delivery via remote online learning [23].
Learning method	Students rotate among stations. At least one station is an online learning station [23].	Students rotate individually among learning activities and offline traditional F2F teachers [23].	Students can take online learning at school or home [23].	It usually starts with a fully online learning method, then becomes a blended learning method [23].
Activities	The stations include direct instruction from the teacher, small group or whole class activities, group projects, individual tutoring and assignments [23], [25]. When the time is up, the teacher makes an announcement and instructs the students to rotate and go to the next activity at the next station [25].	Offline traditional F2F teacher will provide activities if needed – small group, group projects and individual tutoring [23]. Some have F2F teachers with the support of online learning, while some have only a little offline traditional F2F learning. They have different combinations too [23].	Students use online learning for some subjects and use offline traditional F2F learning for other subjects [25].	Students seldom meet F2F with their teachers every school day. It only happens when needed [25].
Station	Rotations have been used in many years, but what makes this blended learning is the involvement of online learning [12].	Some of them have more offline traditional F2F learning support, but others have minimum support for the traditional approach [23].	Students involve themselves in both online learning and offline traditional F2F learning [23].	Students will have F2F learning with their teacher and they are free to complete remaining works remotely [25].

Based on Table 1, it is clearly stated that all the models should have at best one station of online learning. The rotation model is quite flexible because students rotate to other stations according to the teachers' desires. The stations include activities in a small group or involving the whole class, projects in groups, individual tutoring and completing assignments [23], [25], [26]. Verstelle [12] believed that teachers have already mastered the act of rotation between different kinds of learning activities, but what would make it become blended learning is the involvement of online learning.

Types of Rotation Models

According to Staker and Horn [23], one of the blended learning models is the rotation model. Within the rotation model, there are four specific types which are station rotation, lab rotation, flipped classroom model and individual rotation model. Each specific type of rotation model is a little bit different from others; however, they are required to have at least one station which includes an online learning method [23]. The table 2 below summarizes the four specific types of rotation models in a blended learning classroom.

Table 2: Four Specific Types of Rotation Model in a Blended Learning Classroom [27]

Characteristics	Station rotation model	Lab rotation model	Flipped classroom model	Individual rotation model
Setting/ Rotation	Students rotate in a fixed schedule according to the teachers' desires within a classroom or a set of classrooms [25][12], [28]	Students rotate in a fixed schedule according to teachers' desires among locations in the school [28].	Students rotate in a fixed schedule between offline traditional F2F learning or projects in school and content delivery using online learning after school time independently [28]. Time in classes is used to discuss the concepts learned [12].	Students rotate in a fixed schedule among learning activities individually [28].
Learning method	At least one station is an online learning station [28].	At least one station is predominantly an online learning station in a computer lab [28]. Students rotate in computer lab for online learning [25].	The primary delivery of content and instruction from the teacher is delivered during online learning outside the school [25], [28]	At least one station is an online learning station [28]
Activities	Other stations: small group or whole class activities, projects in groups, individual tutoring, online individual learning, assignments, independent work at students' desks, direct instruction from a teacher [28]	Students rotate among different locations in the school instead of rotate in one classroom [28]	Students need to do homework online at night [25], [28].	Teachers will set student's schedules individually [25].
Setting	Students rotate in different stations in one classroom [25].	Very similar to station rotation; the lab will be free up for other activities within the rotation model [12].	Example: students use the internet to watch online videos for 10-15 minutes and complete questions on Moodle [28].	Example: students are given a specific schedule to rotate between online learning and offline traditional F2F learning [28].
Location	-	Teachers have been using lab rotation for many years, but the difference is that this model combines it with online learning [12].	Students practice and apply learning in school during offline traditional F2F learning [28]	-
Example	-	This model is common, but students need to compete with other students to use the computer lab [12]. There is also a limit of time to stay in a computer lab.	Example: students listen to teachers outside of the class time and complete the homework during class time with teachers [12].	-
Differences	Students rotate through all stations and not just the usual routines [25], [28].	It was found out that the lab rotation model is ideal for teachers who want to use software to access the learning materials or to repeat and relearn a specific lesson [12]. Students rotate out of their classrooms to computer labs to further their understanding of the learning matter [28] More supervision and careful guidance are needed to prevent the students from misusing the computer labs [12].	Students will not be passive learners because it is more like an activity-based learning method [12]. Students can control their own time, place, path and pace [28] Allows the teacher to use class time efficiently to enhance the understanding of the topic [12].	Students do not need to rotate every available station or modality [25], [28]

According to the table above, by using the station rotation model, students can rotate with an unfixed schedule based on the teachers' desires in a single classroom or a set of classrooms [25], [28], [29]. It is different from the other models because it does not set any usual routines in the classroom.

STATION ROTATION MODEL

From the four specific models above in Table 2, the station rotation model is selected for the review of past studies to conduct a blended learning classroom. It is because the classroom can be split into two, three or even four different stations based on the needs of the students and teachers [28], [29]. Meanwhile, the research by Truitt [29] reported that teachers witnessed an increase of 21% in the performance of students during the math block lessons using four different stations of the station rotation model. Their students' math

scores improved significantly. They stated that this learning is not only effective for a short period of implementation, but it is also sustainable for longer periods. In this research, the station rotation model was selected for further studies. Furthermore, Truiit [29] stated that the major reasons the station rotation model was selected are so that the teachers have more flexibility to work with their students. For example, a teacher can break the classes into different sizes of groups, give them collaborative assignments or distribute independent work to every student [28], [29].

As reported, there is no best model to follow [16]. However, different models may produce different learning experiences among students. It is supported by [30], there is no single best model to achieve success. They said there is no "one size fits all" approach to make sure the learning successful neither fast result nor the slow result, continuous effort or takes several years. The other models are not selected in this review for further studies due to some reasons, for example, lab rotation model is not used because it is ideal for teachers who want to use software to access the learning, more supervision and guidance needed to prevent the misusing the computer labs, and students need to compete with other students to use the computer lab. Then, the flipped classroom model is not selected because this model needs extra time for students to do some preparation outside the classroom or after and before the class session [25], [28]. Thus, by implementing this type of model, it allows the teacher to use the class time efficiently to

enhance the understanding of the topic only. This model commonly used in higher education [7], [16], [18], [19], [31], [32]. At last, the individual station rotation model is not selected due to students rotate with the teacher's schedule individually. Therefore, this paper review on past research to examine the results on students' achievement by using a station rotation model.

Research on Blended Learning Classroom using Station Rotation Model towards Learning Achievement

Station rotation is a simple model that allows teachers to have more time with individual students. A rotation model is where students rotate between learning stations in or outside the classroom. A few characteristics of station rotation models are explained by researchers. First, a classroom is divided into different stations to allow students to rotate between them. Second, the teacher sets the rotation schedule and sits at one station to give direct instructions. Third, each station consists of different activities even though it has the same learning objective. The task in the stations can be done individually, in groups or with the teacher. Lastly, there is at least one station which adopts the online learning approach. Blended learning can be applied to all the subjects, especially chemistry subjects, or science-related subjects for that matter. There are many reports on the benefits of blended learning. Table 3 shows the review for the designs of blended learning classrooms using the station rotation model.

Table 3: Review of Blended Learning Classroom using Station Rotation Model Towards Learning Achievement

Author	Objectives	Sample	Findings
Alsahi [33]	Study the effects of blended learning on ninth-grade students' achievement in science	112 students : experimental group (n = 61) and a control group (n = 51)	Blended learning had a positive effect on the science test scores of intermediate school students.
Isti'anah [34]	Investigate the achievement of students after implementing blended learning in an English grammar class	26 students of the second-semester students from English Department	Blended learning had a positive effect on the Grammar test scores
Oweis [35]	Study the effect of blended learning on students' achievement and motivation to learn English	34 3 rd and 4 th year students majoring in German-English	Significant effect shown for experimental group (learning via blended learning method) compared to control group (implemented offline F2F method) There was statistically significant impact ($\alpha = 0.05$) on students' motivation in experimental group (mean = 1.938) compared to control group (mean = 1.835).
Truitt & Ku [26]	Explore the experiences of learning in Station Rotation model	31 elementary students in a third-grade classroom	Finding proposed five positive themes; technology, learning, variety of activities, getting help, and fun and two negative themes; technology and challenging work.
Utami [36]	Determine the effect of the blended learning model on senior high school students' achievement	31 students in the experimental group and 32 students in the control group	The average of learning outcomes in the experimental group was 57.8 for pre-test and 82.5 for post-test Result shows the students in the experimental group had higher levels of learning achievement than the control group
Govindaraj [37]	Investigate effect of station rotation classroom activities towards students' learning.	150 college students for Physics subject	Students able to interact with the teacher and friends. Students experiences increase when involves in various activities at a different station. Only 11% of students disagreed this learning helps them to learn better due to some factors. Two reasons are the activities were either too long or too short and insufficient time to complete the task and in rush.
Ceylan [38]	Investigate the effects of blended learning on academic achievement of middle school students'.	53 students in 6th-grade classrooms in Turkey	Significant effect shown in students' academic achievement for the experimental group. Experimental group's test scores are greater than the control group's test scores.
Khader [39]	Investigate the students achievement between two different teaching method.	108 male and female students (3 rd grade Science)	Lack of a statistically significant difference due to the interaction between the teaching method and the gender of students.
Powell et al. [25]	Apply station rotation model for all core subjects	Case study: Spring city elementary hybrid learning school	The test scores on the Pennsylvania System of School Assessment (PSSA) have increased for all grades and subjects of the blended learning program. Comparison of subjects between offline traditional F2F learning and blended learning ; Reading : 63.9 % (offline) to 82.9 % (blended learning) Math : 61.4 % (offline) to 85.4 % (blended learning) Science : 63.0 % (offline) to 90.0 % (blended learning)
	Apply the station rotation model to improve math and English language (ELA)	Case study: blended learning in Randolph central school district	The station rotation model has been effective in improving math scores on state assessments. It shows positive improvement among students.
Eddeen et al. [40]	Evaluate the effectiveness of blended learning on the	427 students from King Abdulla II School for	Blended learning had a positive impact on academic achievement of the students.

	academic achievement of students	Information Technology at Jordan University	
Smith [41]	Investigate the impact of blended learning and F2F learning in K-12 school in Auckland, New Zealand.	Two Year 11 classes. Control group (n = 11) and experimental group (n = 19)	No significant difference observed. However, students who learned via blended learning (experimental class) rated their levels of learning more highly than those in the traditional class

Based on the analysis above, the station rotation model is used for all students in schools [25], [26], [33], [36], [38], [39], [41] and university level [11], [34], [35], [37], [40]. Interestingly, Powell and friends [25] implemented this model of blended learning for all core subjects for all grades in Spring city elementary hybrid learning school. The studies compared the subjects between traditional F2F learning and blended learning, and it was found that the test scores on the Pennsylvania System of School Assessment (PSSA) have increased for all grades and subjects of the blended learning program. This shows the very positive impact of this model to improve students' achievement in core subjects. It is believed that the station rotation model used in blended learning classrooms is effective and will receive good perceptions in the teaching and learning process [42], [43].

Additionally, many researchers reported that blended learning had a positive effect on learning and the mean score of post-test assessment was higher than pre-test assessment [11], [33], [36]. A possible reason is that various activities at the different station could enhance learning experience [37] thus leading to the improvement of students' score. Another possible reason is that the student could have a high cognitive level because they can get direct feedback from the teacher when learning using this model.

CONCLUSION

In this paper, a few blended learning models are discussed. This paper further discussed the rotation model of blended learning. Generally, all the rotation models should have at least one station of online learning. The rotation model is quite flexible because students rotate to other stations according to the teachers' desires. For future study, the station rotation model is considered to be designed in blended learning. This paper also reported the past studies that used the station rotation model in teaching and learning in schools and universities levels. This model had a positive impact on students' achievement.

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