



Using Five-Way Interaction Spaces In An Online Distance Learning To Promote Engagement, Challenge And Progress Among K-12 Students

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Abstract

The confounding impact of COVID-19 on education are not only extended on the school preparedness for the delivery of the new normal but rather on student achievement as well. Though there are some researches in the past decades that show positive impact of online distance learning on secondary students (Liu and Cavanaugh, 2012), its impact in the current times has to be revisited and validated including mechanism of delivery that promised good results. This has challenged school leaders to seek ways in innovating the online spaces (Li and Lalani, 2020; Erfurth and Ridge, 2020) to ensure a successful online distance learning delivery. Following the structures of the Education Action Research design, the study intends to describe the influence of the use of 5E (Bybee, 2006) and the 4 categories of interactions (Bounik and Marcus, 2006), as interaction mechanisms in online spaces. The researcher along with the school leaders went through the iterative process of PDSA to ensure the impact of the intervention (Miller, Prudente, Aguja, 2017). Three main variables were used to understand the outcome namely student engagement (Martin and Bolliger, 2018), student challenge, and students' progress. This study revealed that engagement and challenge increased with consistent implementation of the interaction opportunity in the lesson. This encouraged students to attend classes, be more satisfied, and consequently complete tasks against the school curricular benchmarks. The study has implications in the delivery of online distance learning, which on the course of the current pandemic situation will persist as a silver lining foresight of a better normal in the education.

Keywords: Engagement, Challenge, Progress, 5E Model, Online Space

A. INTRODUCTION

In the continuing implementation of online distance learning in Al Itqan American School (AIAS) to recommence the school operation during pandemics, there has been a backlash in sustaining the interest of students over time. If this is not addressed, student's education will be viewed as stressful and unproductive. In parallel to the questions raised in World Economic Forum in April 2020, this paper seeks to reflect on the question: "Could the move to online learning be the catalyst to create a new more effective method of education for students?" (Li and Lalani, 2020).

The impact of COVID-19 on the education in UAE is extensive as suggested by the research made by Erfurth and Ridge (2020). Among the three challenges in their research, the unreasonably high workload and demands of individuals may have confounding effects on student achievement. The high screen time, limited to no time for teachers to coordinate with colleagues and provide feedback to their students are interesting variables that caught the researcher to further investigate the phenomenon in the AIAS context. When teachers have limited time to provide feedback to students, it can potentially influence student engagement and satisfaction (O'Donovan, Outer, Price, 2019). This finding is advanced on the current situation at school where students started to show some signs of disengagement which when not addressed will provoke further to a plummeting student achievement (Spencer, 2020).

Erfurth and Ridge (2020) identified that training is one of the key challenges faced by the Ministry of Education (MoE) schools in the UAE. They confirmed that "all four groups – administrators, teachers, parents, and students – have received little to no formal training for distance teaching or

learning". Though some formal training was rolled out at the onset of the academic year to teachers at AIAS along with the webinars and asynchronous training options via the Sharjah Education Academy platforms for teachers and administrators, raising awareness of the utility of reflective teaching processes should be the bedrock of training development. Bawaneh, Moumene, and Aldalahlah (2020) recommended the need for teachers to think about every teaching activity in the classroom. "They should review, describe, analyze and evaluate the situation to get fresh reflective ideas for improving future practices". This finding also corroborates with the research made by Rhini (2018) that "keeping abreast with skills and knowledge would leverage a high-quality online education". Moreover, interesting findings of Lapada, Robledo, Arthur, Miguel, Alam, Zeba (2020) in their study discovered a deeper understanding of teacher effectiveness in the time of pandemics. They concluded that a teacher's length of experience and specialization dictates success as they are both strongly correlated with the readiness to distance learning education.

Learning walk is a tool used by the school to identify evidence of good practice. This was pioneered at some private schools in Sharjah particularly school clusters under the flagship of the School Improvement Advisor (SIA), Mr. Stephen Barnes. Barnes synergized ideas of good practices that support blended education from among leaders of different private schools. The collective effort run for weeks builds the 7 areas to define a good learning environment. In the pilot implementation of the learning walk at AIAS, student challenge and student engagement are areas rated low. This result can be deduced with student achievement where it can be a potential threat when not addressed (Martin and Bolliger, 2018; Farrell & Brunton, 2020).

The baseline assessment of the learning environment at the beginning of the academic year, as observed by the school leaders, was low with an overall rating of 2.19 in a 4-rating scale. This means that though there are some evidence of good practice in the online learning environment, they are not sufficient to guarantee success. Results of the school-made satisfaction survey administered to parents and students confirmed this. 86% of the students as against the target of 90% are satisfied with the conduct of the online lessons while only 67.78% of the parents are satisfied. Students and parents felt that online lesson delivery at AIAS has limited interactions to motivate them to learn. Though teachers use some strategies to promote it, they are not sufficient to affect interactions. Spencer (2020) suggested the concern around the use of student engagement strategies that tied up with the conventional teaching setting. He inferred that student empowerment plays a more vital role in creating a more engaging student. This will then promote positive student interaction with peers and teachers which are indispensable to outcomes like achievement, school completion, and postsecondary school successes (Pinzone and Reschly, 2021).

Progress is one of the indicators to measure student achievement. Students are making outstanding progress in lessons "when most of the students make better than expected progress about appropriate learning objectives aligned with the expected curriculum standards" (UAE School Inspection Framework, 2015, p.28). With student progress as one of the indicators of the student achievement, teachers should be pensive in assuring that every student is showing this attribute as they commit their time to online learning. However, effective teaching delivery in an online distance learning environment at a K-12 level was not fully modeled (Roblyer & Davis, 2008; Tallent-Runnels et al., 2006 as cited in Liu and Cavanaugh, 2012).

Students view plays a vital role in online learning successes. In the study made by Bawa'aneh (2021), he found out that "the strong infrastructure of the public schools in Ministry of Education (MoE) has strong student satisfaction". He also found out that male had more inclination towards the preference of having virtual learning as compared to girls who had more preference in the traditional school setting. This difference may post a disparity in progress when not addressed and as interesting as it gets, more defined interaction strategies should be in full swing in online classes to ascertain that every student attending school is making progress and therefore successful despite the social unrest brought by COVID-19 in their lives. In light of this, Shift: Disruptive E-learning website

provides hope on their facts about learning retentions. They claim that e-learning increases retention rates by 25 – 60% as compared to face-to-face with rates at a very low ranging from 8% to 10% at a maximum (Gutierrez, 2016). They explained that "students in the e-learning have more control over the learning processes as well as the opportunity to revisit the training as needed". On the other hand, a study was made to understand the neuropsychological impact of E-learning on children provided confounding results (Jha and Arora, 2020). According to the study, "while neuroplasticity offers the opportunity to adapt the sudden change in the modality of classroom transaction from face-to-face interaction to the technology-mediated learning, it may wreak havoc for the growing brain of children." The structural changes brought by multi-method screen exposure among young children may impede attentional competence, processing speed, verbal intelligence, and sustained attention. The study recommends educators in providing students with a novel approach in rolling out educational delivery mode particularly the teaching-learning process. Research of this study is keen on providing a novel scope on individual interactions that are relevant to reinforce cognitive processing.

Bybee's (2006) E instructional model shed a light not only on learning (Liu, Tzu-Chien, Hsinyl; Wu, Wen-Hsuan; Lin, Ming-Sheng, 2009) but also on instructional design processes of teachers (Hu, Gao, and Liu, 2017). The 5E steps - Engage, Explore, Explain, Elaborate and Evaluate provided the needed cognitive exercise to develop the understanding of the concept in the student's perspective (Bybee, 2006). "Engage" is a step where the students are introduced to the concepts and allow them to make connection with their prior knowledge. "Explore" engages the students in observing, using tools and materials, collecting and recording data. At this step, learners use activities to help them use the prior knowledge as a foundation to build new ideas, explore the understanding of the lesson and perform a preliminary investigation. "Explain" step allows the students to use the product of their understanding gained from engage and explore phases to demonstrate their conceptual understanding, process skills, or behaviors. "Elaborate" provides a space for the learners to extend their conceptual understating and skills in new experiences. This gives learners an in-depth and wider understanding of the concept. The steps culminate in the "Evaluate" phase where students are provided with an opportunity to assess their understanding and abilities. Teachers, likewise, evaluate student progress as against the learning objectives that are aligned with the expected curricular standards. These steps are anchored on the constructivism philosophy where students build their understanding of the concepts from prior knowledge and explore concepts on greater depths (Açıılı, Yalçın, Turgut, 2011). Students dive into the experience collaboratively through meaningful interaction with their peers and teachers to make meaning of what they are learning (Charalambos and Marina, 2009).

The theoretical construct with the emphasis of the importance of socially constructed meaning from the perspective of the participants and in the case of the classroom, the students, have been investigated in some researches (Charalambos and Marina, 2009). This is supported by research made by Bouhnik and Marcus (2006) where they emphasize the three level of interactions cited from the work of Moore (2001) and Picciano (2002) namely (a) interaction with the learner, (b) interaction with the content, and (c) interaction with the instructor. Bounik and Marcus (2006) introduced the fourth category of interaction, which is the interaction with the system which has a profound effect particularly on the e-learning process.

The combinations of these constructs – the Bybee's 5E (2006) and the 4 categories of interactions (Bouhnik and Marcus, 2006) provide a meaningful conceptual construct necessary to predict success in the e-learning environment. With these concepts, this paper intends to explore the use of Bybee's 5E in the context of the 4 interaction categories (Bouhnik and Marcus, 2006) intended to increase engagement and challenge and have students involve in cognitive processes in online spaces. The impact of these can be seen in the extend of change in the student challenge and student engagement measured in the learning walk and the progress ratings made by the students as against the success criteria in major subjects at K-12 level.

B. MATERIALS AND METHODS

Research Design

Educational Action Research (EAR) is used as the backbone to explore the five-way interaction via 5E (Bybee, 2006) and 4 Interaction categories (Bouhnik and Marcus, 2006) in the online distance learning. From the exploratory stance used to understand the issues on student engagement and challenge, it culminated in the implementation of intervention within 10 weeks. Furthermore, this research also employs the PDSA cycle use to improve an intervention process (Miller, Prudente, Aguja, 2017). Three main outcome variables were investigated to influence the use of the 5E model and 4 interaction categories, these are the student engagement, student challenge and student's progress. The results were further corroborated with student attendance and satisfaction ratings of students and parents.

Research Participants

52 randomly assigned teachers at AIAS participated in the delivery of the Bybee's 5E and 4 interaction categories in the online spaces. 9 administrators including the senior leadership team members along with the heads of the departments and supervisors participated in the joint observation in different classes. The progress ratings were obtained from 1302 students at K-12 level who attended the online lesson during the second term of the academic year 2020 – 2021. Participation to satisfaction were made voluntary assuring an acceptable margin of error at 10%.

Ethical Concerns

The conduct of the interventions was under the guidance of the school Principal and the school's SIA. All teachers and administrators who participated were informed of the purpose of the observation. Parents and students who participated in the survey is made voluntary. All the data used for this was approved for use by the school Principal.

Data Gathering Instruments

Learning walk is the main instrument used to gather evidence for student challenge and student engagement. Student challenge consists of 5 indicators while student engagement has 6. Each indicator is evaluated by 4 scales namely (a) "fully evident" with a weight of 4; (b) "mostly evident" with a weight of 3; (c) "some evidence" with a weight of 2 and lastly (d) "not evident" with a weight of 1. A digital link that contains ratings were provided to the observers to document their findings. The instrument went a rigorous validity spearheaded by the School Improvement Adviser. Leaders from 20 schools took part of the development of the tool to identify areas and indicators of good practice and the same were consulted to verify the final tool. The learning walk instrument was completed by the joint observers assigned per lesson. Both joint observers moderated the ratings, taking into consideration the evidence of good practice in the lesson.

Data Analysis

Descriptive statistics was primarily used for data analysis in this paper. The weighted average, percent, and percent difference calculations were used in presenting the data gathered. The weighted average was used to identify the overall rating of the student challenge and student engagement. The weighted average obtained is interpreted using the guide below.

Table 1: Interpretation Guide for the Weighted Average

Intervals	Interpretation
1.00 – 1.59	Not Evident
1.60 – 2.59	Some Evidence
2.60 – 3.59	Mostly Evident

3.60 – 4.00	Not Evident
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Percent and percentage calculations were used to describe the change brought by the intervention. Student’s Progress ratings were obtained by expressing the percentage of the number of success indicators met by the students as against the targeted number of criteria that were planned to achieve in the given term. Below is the guide in interpreting the percentage difference.

Table 2: Interpretation Guide for Percentage Difference

Intervals	Interpretation
0	No Change
0.1 – 20.99	Slight Change
21.00 – 40.99	Below Moderate Change
41.00 – 60.99	Moderate Change
61.00 – 80.00	Above Moderate Change
81.00 and above	Considerable Change

Student attendance ratings and satisfaction ratings were obtained from the available data at school. Attendance rating of a student was computed by obtaining the ration between the number of times a student attended the online distance learning in a day and the total number of classes for each day. The ratings in each class and grade levels are averaged to obtain the final average per grade level. On the other hand, satisfaction survey is calculated based on the response on indicator that measure their satisfaction on the online learning while those that do not reflection on this are not counted.

Methodology

With the end to enhance student engagement, student challenge and student progress via the five-way interaction steps in the online spaces, the following phases for implementation were conducted. The phases were based on the PDSA cycle (Miller, Prudente, Aguja, 2017).

Phase 1. Plan. The review of the learning walk data in the first term was pivotal in the development of the concepts and targets of this research. Data were reviewed at this phase and development of intervention came out towards the end of the first term. At the beginning of the second term, the school leaders headed by the Principal met the head of the departments in each subject areas and supervisors to explain and verify the relevance and potential impact of the 5E instructional model and 4 interaction categories in the online space. This led the team to identify the targets and the implementation timeline.

Phase 2. Do. At the onset of the second term of the academic year 2020 – 2021, teachers received 5 hours of initial formal training to structure the lessons ascertaining the design conforms the 5E framework and the 4 interaction categories in their lessons. Learning Matrix were made aligned with the 5E while their lesson presentation requires the embedding of strategies from the differentiation deviser (Petty, 2021) provided to them. Teachers were tasked to select strategies from the deviser that promotes interactions in four categories – learner to learner, learner to teacher, learner to content and learner to system. Teachers were given flexibilities in the selection of the strategies from the deviser based on the topics of their lesson, learning activities and needs & abilities of their students that show success in the completion of the learning objectives.

The Principal and the Vice-Principal spearheaded the training of the heads and the supervisors which in turn further train their respective teachers. Teachers were provided two weeks to structure their lessons. The initial outputs were inspected to ensure that they are indicative of the five-way design. Suggestions for modifications were made before implementation. The designs were implemented in the next seven weeks after the training.

Phase 3. Study. A two weeks trial implementation of the intervention was held to know the readiness of the teachers in the implementation of the five-way interactions. Learning walk data in the first two weeks were not used for interpretation. Instead, these data were used for coaching with teachers to ensure the quality of the implementation. A small group of training and one-on-one feedbacking was done to support the teachers in the implementation.

Phase 4. Act. Teachers were allowed to use the experience gain during phase 3 to reflect teaching practices (Bawaneh, Moumene, and Aldalahlah, 2020) and inform the decision for a quality 5E five-way strategy implementation in the lesson. Class for observations was assigned under the consent of the teacher in the last three weeks of the term and two observers were appointed to give the ratings. Joint observations held were not less than 20 minutes. This was followed by moderation by the two observers to decide the ratings to be given in the lesson. Moderation was made evidence-based where the final ratings shall only be based on the evidence presented by the observers. Teachers were also given a chance to present some evidence whenever needed to substantiate the claim. The data were corroborated with the progress ratings obtained by the students at the end of the term. Attendance ratings, satisfaction ratings and unstructured interview were also used to serve as supporting variables. Students unstructured interview was held towards the 8th week with willing students from grades 3 to 12 to substantiate the findings.

This paper also investigated other data that have bearings in the study at hand. These are the attendance and satisfaction rating. These data were obtained with the permission of the Principal and retrieved from the school database. The satisfaction survey was participated by 736 students from grades 4 to 12 out while there were 273 parents who participated the survey. Though they are not direct variables under study, their patterns of change were used to confirm the influence. As such caution must be taken in generalizing the results of this study due to varying sizes and questionnaire validity.

C. RESULTS AND DISCUSSION

Influence on Student Challenge. After the conduct of the intervention, student challenge and engagement ratings from joint observations were consolidated and tabulated which are presented in table 3. The indicator that has the highest obtained rating was "Students are challenged via differentiated teaching/learning activities" with a weighted average of 2.26 while student initiative was the lowest at 1.86. Both have the interpretation of "some evidence".

Table 3: Student Challenge Ratings

Indicators		Fully Evident (4)	Mostly Evident (3)	Some Evidence (2)	Not Evident (1)	Weighted Average	Interpretation
1	Perseverance and independence	2 (3%)	31 (45%)	29 (42%)	7 (10%)	2.18	Some Evidence
2	Thinking, problem-solving, and research skills are evident	1 (1%)	23 (33%)	43 (62%)	2 (3%)	2.12	Some Evidence
3	Student Initiative	3 (4%)	20 (29%)	23 (33%)	23 (33%)	1.86	Some Evidence
4	Students are challenged via differentiated teaching/learning activities	6 (9%)	31 (45%)	23 (33%)	9 (13%)	2.26	Some Evidence
5	Self-paced and	4	28	27	10	2.16	Some Evidence

Indicators	Fully Evident (4)	Mostly Evident (3)	Some Evidence (2)	Not Evident (1)	Weighted Average	Interpretation
optional activities	(6%)	(41%)	(39%)	(14%)		

Review of the notes made by the joint observers; it was found out that lessons observed showed 12 varieties of teaching strategies that promoted student challenge. These strategies include the use of choices; case study; tasks mixtures; prior knowledge; blooming questions; stepped activities; expert in the corner; Socratic dialogue; options; key words display; worksheets; group work through MS Team Channels, one notebook and breakout rooms; and exemplify. Majority of these strategies were taken from the “differentiation deviser” from the website of Geoff Petty (2021).

These strategies were very evident in the explore and elaborate phases of the lesson. In these strategies, students were found to interact with their classmates and teachers which promotes engagement. Students interacted with system during “engage”, “elaborate” and “explore” as they complete tasks in the teacher-made Nearpod activity, Flipgrid and Exact Path. Students interacted with the teacher during the “explain” part where teacher raised leveled “blooming questions” (Petty, 2021) and student were given sufficient time to respond. In many lessons, the teachers were observed to ask gathering, processing and reflective questions which engages the students to respond verbally. This interaction allowed observers to find out the number of “targeted touches”. Targeted touches are, coined from NGE Initiative trainer, the number of students who achieve the targeted learning objectives for the day. NGE initiative is a private company who train and guide school to be successful in national inspection. There were more targeted touches in classes with hierarchical questions compared to those classes with random questions. This corroborates the findings of John Hattie (2017) on the effect of classroom discussions with an effect size of 0.82. This effect size is way above the hinge point of 0.4 which suggests a greater than the above-average influence on achievement.

Influence on Student Engagement. The indicator on positive classroom environment is the highest at 2.84 interpreted as "mostly evident" while an indicator of linking lessons to their lives is the lowest at 2.29 with the interpretation of "some evidence".

Table 4: Student Engagement Ratings

Indicators	Fully Evident (4)	Mostly Evident (3)	Some Evidence (2)	Not Evident (1)	Weighted Average	Interpretation
1 Student participation is maximized.	13 (19%)	47 (68%)	8 (12%)	1 (1%)	2.76	Mostly Evident
2 Positive Classroom environment (socially, emotionally, physically)	18 (26%)	43 (62%)	7 (10%)	1 (1%)	2.84	Mostly Evident
3 Students link lessons to their lives – UAE Context	13 (19%)	19 (26%)	28 (41%)	9 (13%)	2.29	Some Evidence
4 Student’s Responsibility for their own learning is	11 (16%)	41 (59%)	17 (25%)	0	2.64	Mostly Evident

Indicators		Fully Evident (4)	Mostly Evident (3)	Some Evidence (2)	Not Evident (1)	Weighted Average	Interpretation
	evident						
5	Student's enjoy learning and are engaged	17 (25%)	34 (49%)	18 (26%)	0	2.71	Mostly Evident

The findings revealed that the five-way interaction model gave teachers a different way to present a lesson as compared to conventional strategies. Classes visited have either full class or with few absences. An interview with the supervisors on attendance evidenced that absences are caused by students having health issues particularly in the lower grades. They added that few students had internet issues at home at the time of the observation. An in-depth exploration of attendance revealed that there are 4 students in the lower grades during the second term who decided to do asynchronous as their parents are not available in the morning to assist them in the lesson. There were also 33 students across the middle and high school who has some issues in attendance in their online classes. These students claimed that they have very poor connection at home and felt isolated. This confirmed the concept of disengagement by Spencer (2020) along with the impact of no interaction (Bouhnik and Marcus, 2006). Marcus (2003) as cited in the research of Bouhnik and Marcus (2006) has identified the reasons of disengagement – “a high level of self-discipline is required”, “Absence of a learning atmosphere”, “lack of interpersonal, direct (non-mediated) interaction” and “In answering his or her questions, the teacher’s ability to widen the scope of his or her answer is limited” among the other 7 identified as predictors of dissatisfaction.

Successful classes with clear differentiated activities engage students meaningfully in the lesson. Some teachers are beginning to exemplify hierarchical questions which invite the students to participate however teachers who have derailed questioning hierarchies have less engaged students. It is interesting to note that when the five-way interaction was structured in the lesson, teachers frequently provide space for them to talk with their classmates and with their teachers which confirms the findings of Martin and Bolliger (2018). Instead of being passive listeners, students are invited to unmute themselves and orally share their response to the questions, felt obligated to open their camera so they can be seen interacting with their friends, complete their interactive tasks so others can see their work and receive feedback not only from the teachers but from their classmates as well.

In the lesson observation notes, it can be gleaned that teachers employed differentiation strategies that compelled them to show their understanding of the lesson in learning outcome form. These were evident in the elaboration, exploration, and evaluation phases of the lesson. Such opportunities allowed the students to express their understanding in a form that is attuned to their interests and identity. It is also noted that classes where activities are not made clear and explicit limits the students expressing their understanding thus showing little engagement.

Influence of the Student Engagement and Student Challenge over time. A positive change can be extracted when the ratings of the second term are juxtaposed with the ratings in the first term, baseline assessment. Student challenge has increased by 52.38% while engagement increases by 11.43%. When interactions are promoted in the steps provided by Bybee’s 5E, student engagement and student challenged increased.

Table 5: Difference between Baseline and the Second Term Ratings in Student Engagement and Student Challenge

Areas	First Term Rating	Second Term Rating	Difference	Percentage Difference (%)	Interpretation

Student Engagement	2.31	2.59	+0.27	11.43	Slight Change
Student Challenge	1.39	2.38	+0.99	52.38	Moderate Change

Influence on Student Progress. The data shows the progress rating of the students in the second term. Arabic and Islamic studies ratings show a high disparity as compared to English, Maths, and Science. In the lessons, teachers were able to see output that substantiate their claims of meeting the learning objectives during the interactions. Classes that have a meaningful and interactive “engage” steps hook the students to persist until the end of the lessons. However, there were teachers observed who struggled in providing a smooth connection of prior knowledge and the targeted concepts to be developed and as such interactions in these classes were very limited. Providing a clarity of instructions, questions and activities are predictors of success (Bouhnik and Marcus, 2006) which will impact their social construct (Charalambos and Marina, 2009).

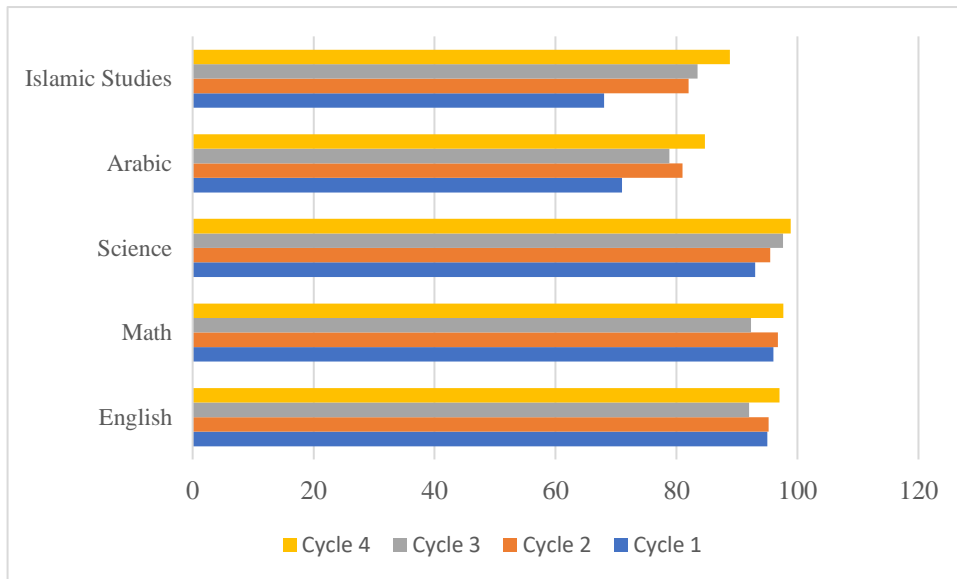
Table 6: Student Progress Ratings Across the School

Learning Cycle	English	Math	Science	Arabic	Islamic Studies
Cycle 1	95.00	96.00	93.00	71.00	68.00
Cycle 2	95.25	96.75	95.50	81.00	82.00
Cycle 3	92.00	92.33	97.60	78.83	83.50
Cycle 4	97.00	97.67	98.89	84.67	88.83
Average	94.81	95.69	96.24	78.88	80.58

With this finding, the researcher can link the increase in engagement and challenge with the five-way interaction. Teachers reported that students were able to submit the evidence of completion of tasks while other learning evidence can be readily observed virtually. Teachers had more evidence to support their achievement when spaces for interaction are provided via the Nearpod. Audio recordings of their understanding of the lesson is available and their answers to open-ended questions are archived. Number of interactions with the self-paced materials particularly the Exact Path also increased with the time on task average of 92 minutes per week as compared to 42 hours per week in the previous term across the school. More students are willing to open their camera and use their mic to interact with teachers and students. On the other hand, teachers also expressed some concerns. Many students extended their time interacting with their teachers and friends which limit the exposure time to develop other conceptual lessons assigned for the day. Teachers are yet to find ways on how to monitor the breakout room sessions to see how productive students were in the discussions. There were also instances where teachers are also overwhelmed with the number of submissions which cause the delay in sharing their feedbacks with the students.

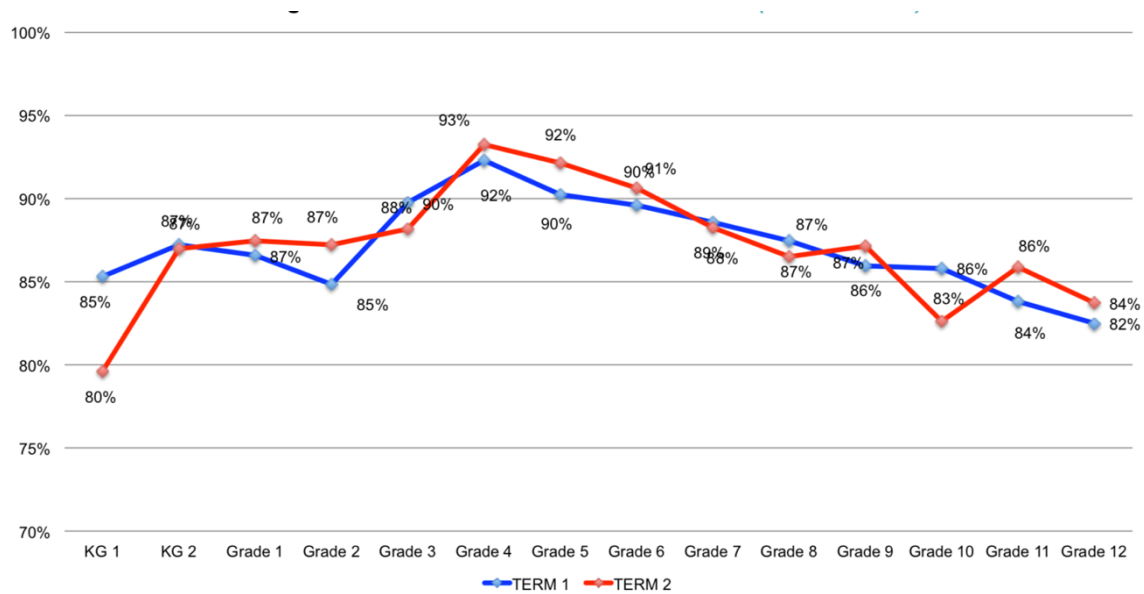
This guided teachers to construct a space for developing meanings Hu, Jiu-hua & Gao, Chong & Liu, Yang. (2017) and interaction (Bouhnik and Marcus, 2006). It is worth to mention that during observation, support to vulnerable students are also defined. This resulted in student's high attendance in the class and high participation which can be all correlate with satisfaction and engagement that has an impact on student engagement (Martin and Bolliger, 2018).

Figure 1: Student Progress Ratings Across the School



Influence on Satisfaction Rating and Student Attendance. The researcher also used other variables that can describe the influence of the four-way interaction through 5E in the online spaces. This includes student attendance (School Inspection framework, 2015) and satisfaction (Martin and Bolliger, 2018).

Figure 2: Student Attendance Rating Comparison



Attendance is one of the indicators of engagement (Gottfried. 2010). If students make themselves available in an online space, then it surely indicates a potential for engagement. The review of the attendance data detected the influence of the implementation of the four-way interaction. There was an increase in the attendance as observed in grades 1, 2, 4, 5, 6, 9, 11, and 12 as against their attendance during the first term depicted by the blue line graph. Overall, the attendance rating was 91.28% which is consistent with that of the attendance rating of the students during face-to-face setting. It is worth noting that, though the overall attendance in online learning decreases slightly compared to the first term with a rating of 92.41%, more than half of the levels shown an increase

rating. Attendance during this term is largely affected by the health conditions, internet conditions at home and few cases of disassociation due to lack of regular interactions.

Supporting the above findings further, the review of the satisfaction rating provided positive results when it comes to the students' and parent's satisfaction. Satisfaction of parents during the first term indicated a rating of 69% and it increases to 73% in the second term. 73% of the parents became satisfied as compared to 69% in the first term. On the other hand, there were 79% of the students in the first term were satisfied and this increases to 85% in the second term. Results of the unstructured interview with some students confirmed that they are more encouraged to come to school because the output for submissions during the required virtual classes were required for grading, teachers explained the lesson further and were able to clarify their questions about the lessons on the spot. They added that the well-being activities presented at the beginning of the lesson allowed them to reflect about themselves, speak with their friends online in the class, express their understanding voluntarily to their friends during the "explain" and "elaborate" phases of the lesson. They also confirm their interest in using variety of tools to express their understanding of the lesson. While others are happy sharing their answers verbally, others are contented when they submit their responses to open-ended activities, time to climb interactions or even recording the audio feature of the Nearpod. Others also expressed their disappointments in some classes where they have limited interaction with teacher especially in Physics subject. They explained that they had difficulty in understanding the lessons well with limited teacher interaction even with variety of supplementary resources provided. They also expressed their interest for the school to add more opportunities to have academic and non-academic interactions with their friends.

D. CONCLUSION AND RECOMMENDATION

The four-way interaction in an online space is fundamentally necessary to promote student engagement, student challenge and student progress among the students. The findings of this research approximated the influence of the intervention on the three main variables under investigation. It is worth noting that though the engagement slightly increased at 11.43%, the implementation of the four-way interaction through the 5E had increased the challenge by 52%. The instructional design has given a platform for students to interact with their peers through the collaborative spaces provided by the software used by teachers such as class notebooks in MS Team, MS team subchannels, and Zoom breakout rooms. Evidence of interaction with teachers through oral discourse and interaction with the system through the use of technology platform and LMS became evident. There were 12 differentiation strategies (Geoff, 2021) implemented which mostly appear in the elaboration, exploration, and evaluation phase which are made possible when the 5E design was structured. Students and parents increased their satisfaction in the online delivery spaces as compared to the first term.

The use of 5E as a platform to provide the 4 categories of interactions among students and teachers is recommended across the subject areas. The experience provided by these creates a social space that has been limited since the upsurge of online distance learning in March 2020. Caution has to be taken care of when implementing the design predicted by readiness of the teachers and the administrators. Teachers should decrease the learning expectations to a minimum to allow meaningful interaction in the online spaces. During the learning walk, observers have noticed the need to enhance the use of hierarchical questions to elicit deeper thinking. It was observed that teachers who elicited questions from the lower level and graduate to a higher level through the art of questioning have a greater number of students participating in class as compared to those teachers who were not successful in delivering explicit and clear questions. Since there were no sufficient evidence of the interaction of the learners with the content, a review of the processes for this interaction is highly recommended.

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To Promote Engagement, Challenge And Progress Among K-12 Students

Griffin, with her clear vision for school improvement made this intervention possible. Mr. Stephen Barnes, School Improvement Adviser from Sharjah Private Educational Authority (SPEA) for spearheading the development of the learning walk tool. This has become an indispensable component to measure the impact of the intervention. And most importantly, the supervisors and head of the department who has been committed to collect data in the classroom and mediate the findings with their assigned co-observers.

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