IMPLICATIONS OF UNIVERSAL DESIGN FOR LEARNING INFUSED COLLABORATIVE LEARNING APPROACH ON STUDENT ENGAGEMENT AND LEARNING IN PRIMARY EDUCATION

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Abstract

In the education systems based on conventional methods, only the teacher behaves as an active entity while students are passive learners. Pakistan is no exception to this, like several other developing countries where this method is still being followed since decades. Therefore, there is a need to introduce such practices, which enhance students' motivation and engagement to make them active learner. Though, creating an inclusive learning environment is quite challenging.

To address this issue, an experimental research has been conducted in science subject on fifth-grade students to measure their learning and engagement, in a school named Allied Schools, Excel Branch located in capital territory Islamabad, Pakistan. This is a medium cost school having a chain of schools across the country. A total of 25 students took part in this experimental research. The purpose of this research is to inculcate three basic principles of Universal Design for Learning (UDL) - provide multiple means of engagement, action and expression, and representation - with collaborative learning activities in primary school Science.

The research is divided into three phases. In the pre-intervention phase, a pre-test was conducted assessing students' learning on Science. During the intervention phase, students received UDL infused collaborative learning instruction. These students were observed on Student Engagement Walkthrough Checklist (adopted from 'Student Engagement Teacher Handbook' by 'International Center for leadership in Education' written by *Richard D. Jones*). In the post-intervention phase, a post-test was conducted, assessing the learning outcomes. The instructor's experience and observations on students' engagement form a crucial part to assess the success or otherwise of the intervention. Finally, the data gathered has been analyzed to take insights into UDL infused collaborative learning approach in science on student's engagement and learning. This research strives to contribute in the ongoing debates to reform the education system in Pakistan. It will eventually help educators to explore the inclusive collaborative learning approach in Scientific investigations.

Keywords: UDL, Engagement, Learning Outcomes, Science, Collaborative Learning, Inclusive Learning.

1 INTRODUCTION

The teaching practices based on old conventional methods are not in harmony with this era of technology and knowledge-based societies. Though, in Pakistan, most schools still consider students as containers in which a teacher has to pour knowledge. Research indicates that a classroom has a diverse environment, and an institution should provide attention to all students and facilitate each one of them [1]. This methodology of teaching is not coping with the need for skills to deal with 21st - century challenges. In today's world critical thinking, collaboration, creativity, and communication are the skills, which a student needs to learn whereas the traditional way of teaching does not support it.

This research draws on a clear shift from old methods of teaching in a primary school set up for a fifth-grade science classroom by introducing Universal Design for learning (UDL), and at the same time targeting one of the 21st-century skills i.e. collaboration and measuring its impact on students learning and engagement by using various activities specifically designed for students.

1.1 Universal Design for learning (UDL):

UDL is fundamentally founded on neurosciences, learning differences and developmental psychology [2]. UDL is composed of defined instructions, which cater all type of learners (visual, audio and kinaesthetic). UDL methodology supports learning in a very rich manner, in doing so barriers towards

learning are minimized while high standards of achievement for all are maintained [3]. A set of rules is followed during the compilation of the curriculum, for which there are guidelines. These help in defining objectives, procedures, ingredients and evaluations that are workable for every individual. UDL provides the flexibility of customization in teaching approaches keeping in view the fact, that the learning capability of all students is not equal. Multiple means of representation, action and expression and engagement are the three main principles that are the essence of UDL [4].

1.2 Student Collaboration:

Collaboration can be explained in a learning environment as a group of learners involved in the completion of a task, finding a solution for a problem or making a product together. In this learning method, learners face challenges as they must face difference in opinions as well as have an experience of defending their own ideas. This approach is considered helpful for the social and emotional growth of students. The activities which are based on collaborative approach influence student in doing elaboration and reorganization of their knowledge [5]. This setting provides a platform to oppose with fellow students, exchange of views and active engagement of students occur. [4] shows the proofs that those teams which work cooperatively have greater levels of thought of achievement and high retention rate of information as compared to those who prefer to work individually.

1.3 UDL and collaboration:

The guidelines provided by UDL with its full implementation in the development of curriculum results in acceleration of student's motivation, engagement, and involvement in subject [3]. In other words, the idea of direct proportionality can be stated between a curriculum based on UDL defined rules and self – efficacy of student.

In general, researchers have pointed out that UDL in instruction enhances engagement [6]. Therefore, this research combines UDL with a collaborative environment to measure its implications on the engagement of students in class. The research question for this study is 'What is the impact of integrating UDL and collaborative setting in a medium cost primary school of Pakistan on student engagement and learning outcomes?'

2 METHODOLOGY

2.1 Research setting and Participant

This study was conducted in in a branch of Allied schools. It is a medium cost school, have chain of schools across Pakistan. We have conducted research on 5th grade students in Allied School Excel Brach located in capital territory Islamabad. A pre and post-test only experimental study spanned over two weeks was conducted in science class having 22 students (females = 9, males = 14) aged 9 to 11 and a permanent resident of Pakistan. A pre-test was conducted based on the topics they had been taught through traditional method. After that they received UDL infused instructions in collaborative environment, and at the end of intervention a post-test was conducted.

2.2 Sampling Technique

This research adopted convenience sampling in the selection of school and class. The major factors included accessibility of this school, and the cooperation rendered by the school administration to conduct research and intervention according to research design that was different from school's instructional techniques. Also, the cost and time to carry out this study on a convenience sample were relatively reasonable, which made this technique preferable [7].

2.3 Research Design

In this study the 'Pre and Post-Test Only Experimental' approach was used. The purpose of using this research design was to measure the effect of UDL infused Collaborative learning instructional approach in comparison with the traditional instructions.

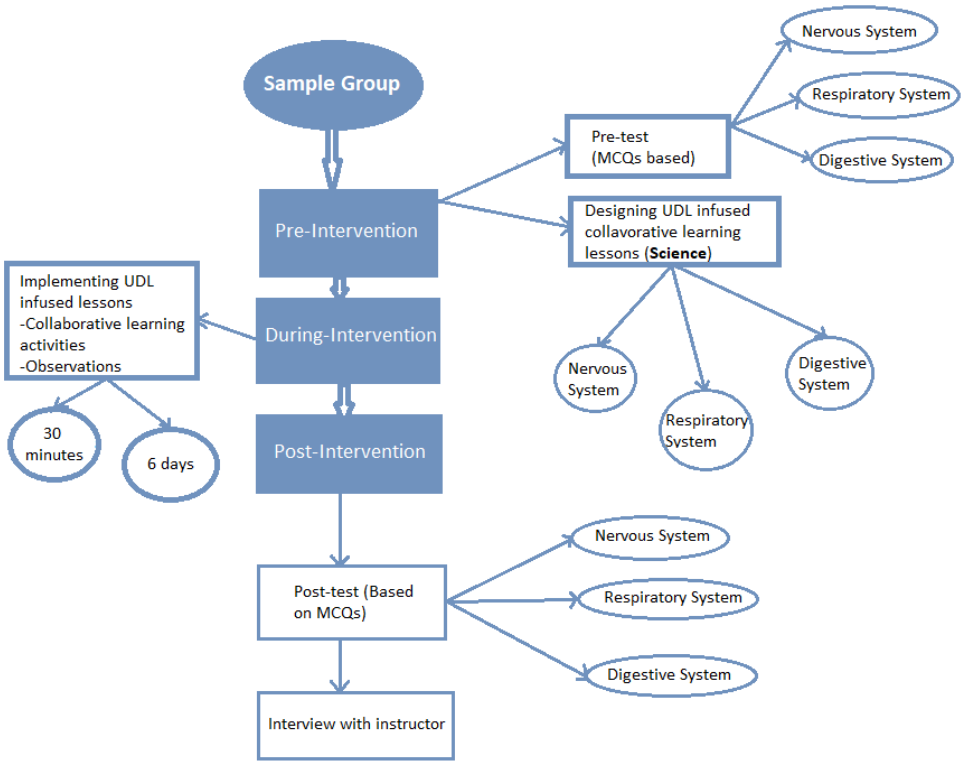

Figure 1.Experimental Design of UDL infused Collaborative learning approach

This research spanned over two weeks containing 8 lectures. Where the duration of each lecture was 30 minutes. On the very first day we had an ice-breaking session with students and conducted pre-test from three topics of science course which they had already learnt through traditional method. These topics were a) Digestive system b) Nervous system c) Respiratory system. And then all the three topics were taught in 6 lectures with UDL infused instructions emphasizing on collaborative learning. After that post-test was conducted, again from these topics keeping the same learning outcomes defined in pre-test. Also, at last day of intervention we had a semi-structured discussion session with students about the instructional techniques they had experienced with us. Predominately this is a quantitative research study having qualitative aspect of behavioral observation.

2.4 Phases in Research

This research was conducted in 3-phases i.e. pre-intervention, intervention and post-intervention. The data collection tools, their purpose, and validity has been discussed during all three phases in this section.

2.4.1 Pre-Intervention Phase

2.4.1.1 Taking pre-test

Three topics was assigned to us by school administration i.e. digestive system, respiratory system and nervous system. A pre-test was designed for the students with some defined learning outcomes. After that the test was conducted to access what they had learnt earlier in these topics through conventional or usual instructions.

2.4.1.2 Planning UDL-Infused Collaboration based Lessons:

In this phase the lesson plans were designed for earlier mentioned topics based on UDL principles emphasizing on collaboration in activities. We had also observed instructor's methodology of teaching. It was no more than just verbally delivering information, writing same content on board and repeating it without any kind of student involvement. While we designed our lectures based on all the three principles of representation, action & expression and engagement. Also, we designed some activities where peers worked collaboratively to come up with an idea, understanding of an idea or answer.

Table 1.Contrast in Existing Conventional Content and UDL Compliant Content

Existing Lecture Content	UDL Compliant Content		
Verbal presentation of content from book	**Multiple Modes of Representation**	**Multiple Modes of Expression and Action**	**Multiple Modes of Engagement**
Writing same points of verbal narration on board	Animation of human body systems	Students' notes taking	Group activities and group discussions.
Limited teacher-student Interaction	Presenting relevant posters, where critical points were highlighted	Oral/Verbal Presentation with freedom of language	Creating and telling stories
	Including short videos of 3-4 minutes in native language	Filling worksheets (with provided vocabulary help)	Physical activities related to the functioning of body systems.
	Writing difficult vocabulary on board	Topic relevant puzzle, word search and organization/ ordering collaboration-based activities	Student-teacher and student-student interaction

2.4.2 During Intervention Phase

The intervention phase was spanned over two weeks, four lectures of thirty minutes each week.

2.4.2.1 Delivering Content

To deliver the content, diagrams, short videos (in their native language Urdu) were embedded demonstrating different parts of (digestive, respiratory and nervous) systems and their working, relevant posters (some were animated), provided vocabulary, along with whiteboard representations for rehearsals. Digital Content were presented on laptops, because the school was not having multimedia facility.

2.4.2.2 Collaborative activities

Some activities were designed to work in collaboration with peers, to help each other to understand the whole process. Small groups of two and three members were made to perform different activities where students were had to discuss and work together to reach the defined goal. As the students were of small age group therefore, the activities process, and goals were clearly defined and depicted in front of students. Like they were required to solve puzzles collaboratively, counting breathing rate of peer after a physical activity etc.

2.4.2.3 Formative assessment

The lectures were highly interactive. We specially focused on student-teacher interaction during content delivery to avoid banking model. And during this interaction a lot of questions were asked from students to judge their level of understanding, also quizzes were conducted in lectures, that was considered as formative assessment. Also, the pictures of some activities were taken for the aspect of validation.

2.4.2.4 Making observations during class

While one member of our group was delivering lecture and facilitating activities other member was taking observations. These observations of students were based on Student Engagement Walkthrough checklist [8]. It measures student's physical engagement. The checklist items included: Positive Body Language, Consistent Focus, Verbal Participation, Students Confidence and Fun and Excitement. These items were rated from very low to very high based on observations. As the time span was too short therefore the study was based on collected observations and results were formalized on its basis. Also, the pictures of some activities and intervention were taken for the aspect of validation.

2.4.3 Post- Intervention Phase

2.4.3.1 Taking Post-test

Post-test was conducted at the end of study, based on subject questionnaires based on same learning outcomes as of pre-test. Conducting pre and post-test was effective and cheap way to collect students' and analyze their level of learning. Also, the purpose of both tests was to measure the learning of students.

2.4.3.2 Conducting an interview from instructor:

A semi-structured interview of instructor was conducted at the end of intervention, as she was also observing our activities. The purpose of interview was to collect her observations about students' engagement and learning during intervention. She considered videos and animations very helpful for student understanding. Notes were taken of this interview.

3 RESULTS

The confidence interval was 95 %. The data collected through various methods was analyzed using SPSS tool. Whereas Instructor's interview was conducted for qualitative analysis.

3.1 Quantitative Analysis

3.1.1 Student Engagement

As already mentioned that Student Engagement Walkthrough check list had been used to measure students' physical engagement. We analysed all the five protocols (positive body language, consistent focus, verbal participation, student confidence, fun and excitement) on Likert scale. Results for each checkpoint are explained below.

3.1.1.1 Positive Body Language (PBL):

A repeated measure ANOVA with Greenhouse-Geisser correction determined that PBL concentration differed statistically significant between the points (F (2.934, 61.623) = 0.513, P<0.0005). Bonferroni correction revealed that there was slight reduction in the PBL in fourth day and after that there is an increase in value.

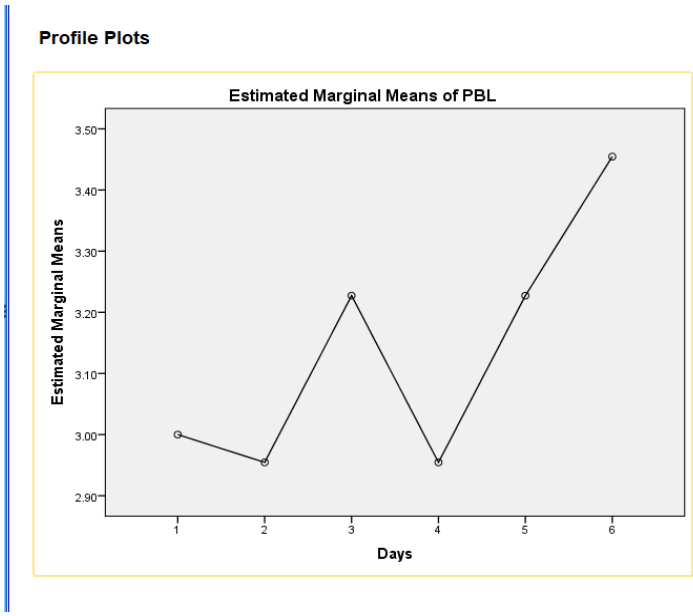

Figure 2. Analysis of positive body language for six days

3.1.1.2 Consistent Focus (CF):

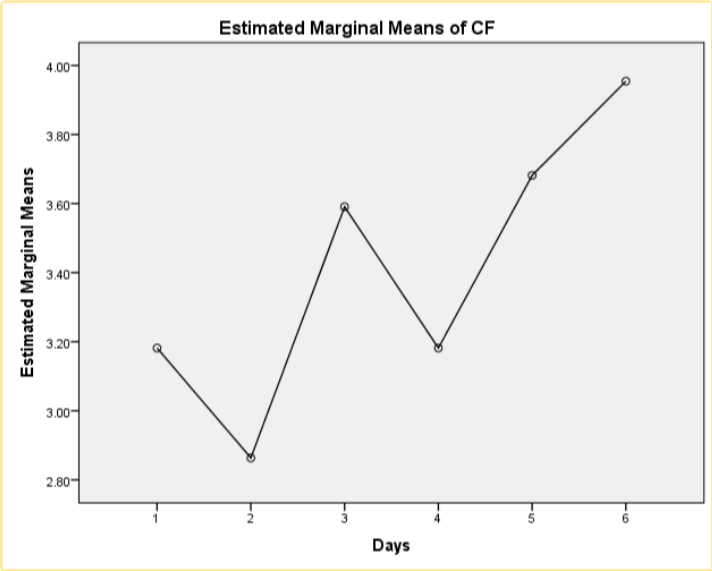

Figure 3. Analysis of consistent focus for six days

A repeated measure ANOVA with Greenhouse-Geisser correction determined that CF concentration differed statistically significant between the points (F (2.596, 54.509) = 1.735, P<0.0005). Bonferroni correction revealed that CF in fourth day and after that there is an increase in value. Bonferroni correction revealed that CF was same on day one and day 4 and there is slight increase in the value on day 5 (3.18 ± 1.43 mg/L vs 3.68 ± 1.28 mg/L, respectively).

3.1.1.3 Verbal Participation (VB):

A repeated measure ANOVA with a Greenhouse-Geisser correction determined that VB differed statistically significant between the points (F (4.029, 84.606) = 1.000, $P <$ 0.0005). Bonferroni correction revealed that VB of students was same on day 4 and day 5 and on day 6 students were more engaged and were taking interest in every activity.

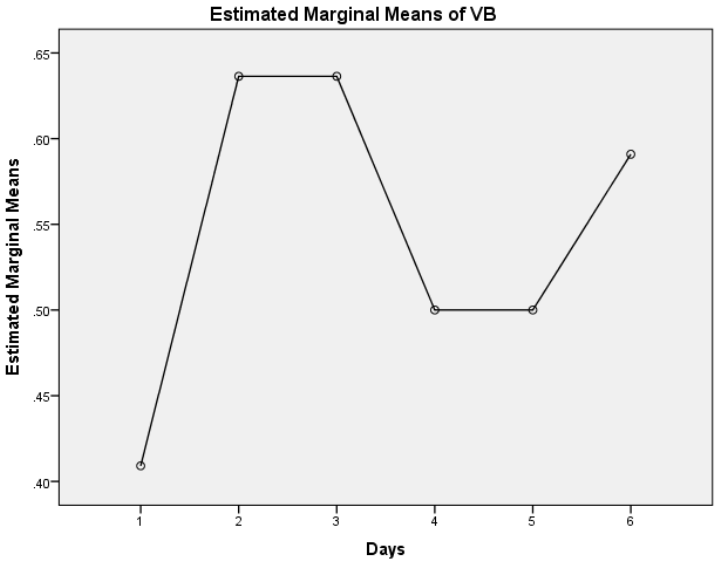

Figure 4. Analysis of verbal participation for six days

3.1.1.4 *Student Confidence (SC):*

Repeated measure ANOVA with a Greenhouse-Geisser correction determined that SC differed statistically significant between the points (F (3.425, 71.929) = 2.351, $P <$ 0.0005). Bonferroni correction revealed that student confidence increased in the last day which shows that engagement level also increased. We can conclude that collaborative activities cause more engagement.

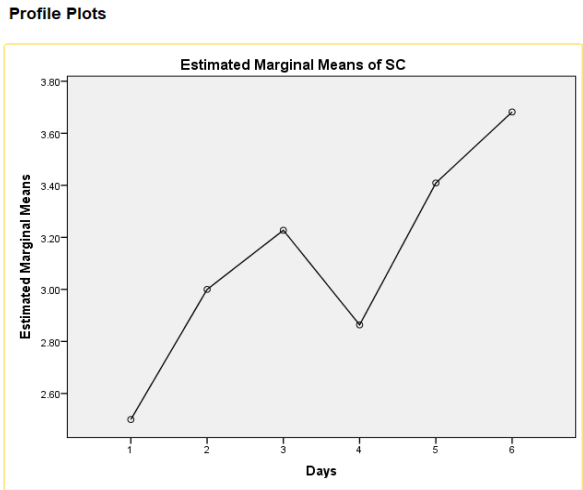

Figure 5. Analysis of Student Confidence for six days

3.1.1.5 *Fun and Excitement (PBL)*

Repeated measure ANOVA with a Greenhouse-Geisser correction determined that FE differed statistically significant between the points (F (2.870, 60.264) = 1.833, $P <$ 0.0005). Bonferroni correction revealed that fun and excitement of student increases or decreases gradually among the days but due to collaborative activities there is significant increase in the excitement level.

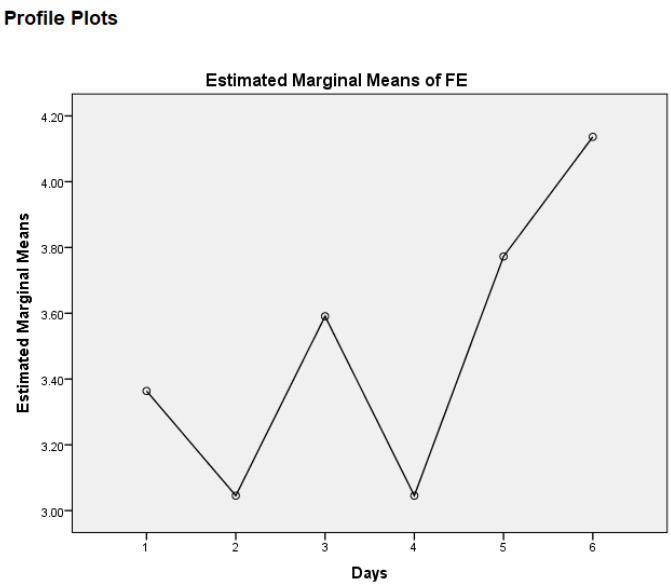

Figure 6. Analysis of fun and excitement for six days

3.1.2 Pre and Post-test Analysis

	Post-test - Pre-test
Z	-3.532[b]
Asymp. Sig. (2-tailed)	.000

Figure 7.Pre and post-test statistics

While we analyzed the data of pre and post-test, the data of pre-test was not normalized. As, the data was skewed for one variable therefore, results were conducted through non-parametric Wilcoxon signed-rank test. This test showed that, there was a significant change in the measures of pre-test and post-test (Z=-3.532, p=0.000).

As shown in Fig 8. median rating for pre-test was 4.0 and 10.0 for post-test i.e. students scored higher in post-test than the pre-test, which shows that UDL-compliant collaborative instructional approach has a positive impact on students' learning.

			Statistic	Std. Error
Pre-test	Mean		4.0625	.37046
	95% Confidence Interval for Mean	Lower Bound	3.2729	
		Upper Bound	4.8521	
	5% Trimmed Mean		4.0694	
	Median		4.0000	
	Variance		2.196	
	Std. Deviation		1.48183	
	Minimum		1.00	
	Maximum		7.00	
	Range		6.00	
	Interquartile Range		2.00	
	Skewness		-.121	.564
	Kurtosis		.455	1.091
Post-test	Mean		9.3750	.41708
	95% Confidence Interval for Mean	Lower Bound	8.4860	
		Upper Bound	10.2640	
	5% Trimmed Mean		9.4722	
	Median		10.0000	
	Variance		2.783	
	Std. Deviation		1.66833	
	Minimum		6.00	
	Maximum		11.00	
	Range		5.00	
	Interquartile Range		2.75	
	Skewness		-.981	.564
	Kurtosis		.178	1.091

Figure 8. Descriptive of pre-test and post-test

3.2 Qualitative Analysis

3.2.1 Interview of Instructor

During our intervention the instructor of science subject was constantly observing our activities. Therefore, at the end of intervention we decided to conduct an interview from her. The feedback of the teacher on teaching methodology was as follows

"Videos that you have shown to students are very helpful to present the content. I found students participating more in discussions as compared to their everyday lecture." This was a semi-structured interview to have the instructor's inputs.

3.3 Discussion on results

Pre and post-test analysis showed a significant increase in students' performance. Which proves UDL a successful framework to improve student learning. Whereas, if we analyse students' engagement based on results, there was a decrease in their engagement on day four. The reason for decline in engagement specifically on day four is associated with certain limitation like students' absenteeism.

And another reason is that, more individual activities were performed than collaborative on this day to measure the progress of individuals. This lack of collaboration can be the cause of loss of engagement (positive body language, consistent focus and student confidence). Whereas, after that there was a consistent increase in students' engagement. Therefore, through this observation and analysis, it can be stated that UDL framework along with collaborative learning environment increases student engagement and learning in classroom. This approach can generate positive results in limited resources also, like this study was conducted. The intervention time was too short, more practice of this framework can bring more positive results.

4 CONCLUSIONS

The focus of this experimental research was to investigate the impact on fifth-grade science students' engagement in content and their learning, when one of the 21st-century skills i.e. collaboration is being integrated with UDL. The implementation of UDL in curriculum displayed a significant increase in the performance of the students. It also shifted the paradigm from the teacher-centric classroom towards student-centric. The results from pre and post -test supported it.

When the level of engagement was analysed by introducing collaborative activities, the gain on engagement was positive. Results demonstrated a significantly positive response from students, as on the last day they showed full interest and enjoyed peer collaboration. Because talking to peers during a study in general, is not allowed in schools.

Student absenteeism, time constraint, non-availability of multimedia were the limitations that affected the results. Regardless of these barriers, students expressed positive feedback about different activities that they had performed. The school instructor also showed interest in the UDL-supported lesson plans and gave us constructive remarks.

As for further research, students' engagement can be examined by integrating creativity and critical thinking in UDL complaint lesson plans, specifically designed for schools following conventional methods.

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