



PEDAGOGICAL AND TECHNICAL ASPECTS OF ONLINE LEARNING EXPERIENCES AND THEIR EFFECT ON STUDENTS' ACADEMIC BEHAVIOR AND PERFORMANCE IN SCIENCE CLASSES

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ABSTRACT

The overall purpose of this study is to examine the pedagogical and technical aspects of the online learning experiences of the 117 Grade 9 students of Pedro Guevara Memorial National High School and their effect on their academic behavior and performance in science classes. This study used a descriptive method of research in which survey questionnaires were used to collect data. The pedagogical aspect of the synchronous mode of teaching in terms of live online meetings, instant messages, and virtual classrooms were observed beneficial in improving students' engagement and maintaining interest in learning. The pedagogical aspects of the asynchronous mode of teaching in science in terms of on-demand audio and video, a self-paced learning guide, recorded presentations and demonstration, and downloadable documents were observed to be beneficial and can help the students to enhance their performance. Likewise, the technical aspects of online classes in science as to Internet connection and device performance were observed to be beneficial in improving students' engagement and maintaining interest in learning. The students' academic behavior i.e., study habit, control and independence, as well as focus and concentration helped them enhance their performance in Science. The students' academic performance in the second quarter shows that they learned and that using different online modes of teaching enhanced their performance. This means that the pedagogical and technical aspects of the online learning experiences influenced the students' academic behavior and performance.

INDEX TERMS—pedagogical aspect, technical aspect, students' academic behavior, students' academic performance

1 INTRODUCTION

One and a half billion students around the world, according to UNESCO, were engaged in remote learning at the height of the COVID-19 pandemic in March 2020. In the Philippines, the coronavirus pandemic has turned the spotlight on one of the problems in the education system, making education accessible to all, under any circumstances.

In this prevailing situation, the teaching force discovered new approaches to teaching and learning to overcome the very real challenges this current reality gives rise to. As such, teachers, especially in science are exploring what online teaching pedagogy will give substantial learning experience to students. Teachers began to experiment with personal challenges, small group work, project-based learning, and the recording of short videos. Teachers began to explore online teaching pedagogy such as Zoom/ Google meets rehearsals. Some discovered open education resources, materials, labs, videos, simulations, games that may help them find new ways of engaging their online learners.

In addition to teaching pedagogy, the pandemic opted the education system to use available and recent technology that is integral in achieving significant improvements in the teaching-learning process. Used to support both teaching and learning,

technology infuses classrooms with digital and technical learning tools. Technology bridges the gaps between teachers and students to help and guide them to improve their instruction and personalize learning.

In line with this, the researcher strongly believes that online learning opportunities and the use of open educational resources and other technologies can increase educational pedagogy and productivity by accelerating the rate of learning; reducing costs associated with instructional materials or program delivery, and better utilizing available resources.

On the other hand, the researcher also wants to find out the effects of pedagogical and technical aspects of online classes on science students' academic behavior. Academic behavior refers to the students' actions and the ability to maintain good performance in the classroom. As positive behavior of students can improve academic performance, it is ideal to examine the changes in academic behavior of students utilizing online science classes.

Thus, the researcher wants to examine the pedagogical and technical aspects of online learning and its effect on students' academic behavior and performance in science classes in Pedro Guevara Memorial National High School.



2 OBJECTIVES

The primary aim of the study was to examine the pedagogical and technical aspects of the online learning experiences.

Specifically, this study aims to know the level of use of pedagogical aspects of the synchronous mode of teaching in science in terms of: Live meetings; Instant Messages; and Virtual Classrooms, the level of use of pedagogical aspects of the asynchronous mode of teaching in science in terms of: On-demand audio and video; Recorded presentations and demos; Self-Paced online learning guide; and Downloadable documents, the level of technical aspects of online classes in science as to: Internet connection; and Device performance the level of students' academic behavior as to: Study Habit; Control and Independence; and Focus and concentration, the level of students' academic performance in the second quarter, to examine pedagogical and technical aspects of online learning as to: Technical preparation; Study habits; and Availability of online materials and to know if pedagogical and technical aspects of the online learning experience significantly affect students' academic behavior and performance.

3. METHODOLOGY

The descriptive survey method will be utilized in this study. According to Sevilla (2008), descriptive survey research is concerned with conditions of relationship that exist, practices that prevail, beliefs and processes that are going on, effects that are being felt, or trends that are developing. The process of descriptive survey research goes beyond mere gathering and tabulation of data. It involves an element of interpretation of the meaning or significance of what is being described.

The instrument used in the study will be a questionnaire checklist which focused to determine the pedagogical and technical aspects of online learning experience of students' academic behavior and academic performance in science classes. In the mentioned questionnaire, a five-point rating scale was used to describe the pedagogical and technical aspects of online learning experience of students' academic behavior and of academic performance in science classes.

The survey questionnaires were divided into five parts. Part 1-4 is the student's response to the survey questionnaires; Part 5 is the open-ended questions given by the students to examine their performance and behavior in conducting online classes

For problem 1-4, the weighted mean and standard deviation was used to know the level of pedagogical and technical aspects of online learning experience of students' academic behavior and academic performance in science classes.

To find if there is a significant relationship between the variables a regression analysis was used.

4. LITERATURE REVIEW

In an important sense, pedagogy is the overarching concept; and refers broadly to the deliberate process of cultivating development within a given culture and society. From this point of view, pedagogy has three basic components: (1) curriculum, or the content of what is being taught; (2) methodology, or how teaching is done; and (3) techniques for socializing children in the repertoire of cognitive and affective skills required for successful functioning in a society that education is designed to promote [2]

According to [6] synchronous learning refers to all types of

learning in which the learner(s) and instructor(s) are in the same place, at the same time, for learning to take place. This includes in-person classes, live online meetings when the whole class or smaller groups get together. In synchronous learning, students usually go through the learning path together, accompanied by their instructor who can provide support while students are completing tasks and activities.

The term e-meeting stands for 'electronic meeting.' It is also referred to as an online meeting or virtual meeting. A virtual meeting, however, may also refer to a meeting with artificial intelligence or fictitious character. [14]. Online meetings—or virtual meetings held using an internet browser or computer application—are increasing in popularity across organizations large and small as they seek to connect geographically dispersed teams, increase productivity, and reduce travel costs. A deeper understanding of online meetings can help you and your team hold more successful virtual meetings and improve collaboration.

[10] Have discussed Instant messaging (IM) as a form of text-based communication in which two persons participate in a single conversation over their computers or mobile devices within an Internet-based chatroom. IM differs from "Chat," in which the user participates in a more public real-time conversation within a chatroom where everyone on the channel sees everything being said by all other users.

[4] It stated that a virtual classroom is a digital learning environment that allows teachers and students to connect online in real-time. Virtual classrooms utilize video conferencing, online whiteboards, and screen sharing to allow educators to hold live lectures, virtual office hours, and discussions with students in an interactive setting.

Asynchronous online teaching is where teaching materials are posted online, and learners work through them in their own time, communicating with each other and the teacher via discussion boards or forums, or even by email [8]. Good asynchronous teaching will include a variety of media, including (but not limited to) audio and video clips. With an asynchronous mode of teaching, the learner can work at their own pace and at times of day which are convenient for them.

Video on demand allows viewers to request immediate access to video content on their PCs or TVs. VoD provides a wide selection of video programming including sports, entertainment, educational programs, and feature films. In general, TV is based on broadcast technology, while VoD is provided as a unicast transmission. VoD is also very commonly used for video conferencing. Although VoD is very popular, it is not widely used due to the bandwidth limitations of current networks. [13]

[5] Discussed that pre-recording your lessons is ideal when presenting asynchronously, as students can watch the recording at their leisure while recording a synchronous lecture is perfect for persons that can't attend. Recorded lessons can also be uploaded to a learning management system (LMS) for all to watch after the fact.

A self-paced learning module is an orderly set of instructions designed to facilitate the learner's mastery of a body of knowledge or a procedure. When combined with other modules, learners can master a comprehensive body of knowledge or a complex process [11].

Downloading is the transmission of a file from one computer system to another, usually a smaller computer system [16]. From the Internet user's point-of-view, to download a file is to



request it from another computer (or from a Web page on another computer) and to receive it.

Access to computers or smart devices is one of the important factors for understanding the level of internet access for a region [7]. However, internet access is not uniformly distributed within or between countries. A digital divide exists between many countries and regions. Good internet access is associated with regions with high-income populations, a high development index, and high technical development.

Students that can use online tools effectively have a lot to gain in the workplace. While certain roles require exceptional digital skills such as marketers and those working in IT, the majority of roles in a business require some level of digital know-how. The utilization of gadgets in learning at school plays an important role as a source of learning and supports the process of learning to be comfortable so that the creation of a learning process that is effective and efficient to improve student learning outcomes [3].

[15] Opined that the researchers have analyzed the pupil's achievement regarding the classification high, average, and low achievers, in this conventional classification, the point of reference in the average score of groups or a standard norm, but study habits differ from person to person, hence in an attempt to help the learners progress by developing suitable study habits, we need a different set of parameters that takes into account of the individual capabilities.

The ultimate aim of any school is to ensure that students in our care can develop into adults capable of looking after themselves, thrive on the challenges that life throws at, experiment with risks, and develop their ways of doing things successfully [1]. The problem of course is that the world is perceived to have become a much more dangerous place, as a result, we are more reluctant to expose our children to risk, this inevitably leads to people who are less able to thrive in the challenging world we are preparing them for. This conflict is one that teachers and parents continue to battle with.

Concentration is the ability to direct one's attention following one's will. It means control of the attention. It is the ability to focus the mind on one subject, object, or thought, and at the same time exclude from the mind every other unrelated thought, ideas, feelings, and sensations. Concentration is a state, in which one's whole attention is engrossed in one thing only, and being oblivious to everything else. During concentration, the mind focuses on the object of concentration, and only one thought occupies the mind. The whole energy of the mind becomes concentrated on this one thought. [12].

In traditional classroom-based courses, there is an ongoing problem with student retention. Sometimes, students don't connect with the course materials or instructors [9]. You may have noticed attendance suffers, and soon enough, some students quickly fall behind their peers. While there are many reasons for the drop-off, it is an issue that continues to plague offline courses.

5. DISCUSSION

Table 1. Level of Synchronous Mode of Teaching Science in terms of Live Meetings

Statements	Mean	SD	Remarks
Live Meeting allows teachers to communicate with the students, enhancing their products to effectively manage tasks during online classes.	4.26	0.85	Strongly Agree
Teachers build strong relationships and better communication with the students as concerns and questions that were raised were answered instantly.	4.10	0.98	Agree
Live meetings are excellent for keeping the learning group on track, collectively, and can also help to pace the students appropriately	4.22	0.88	Strongly Agree
Live meetings are beneficial for improving student engagement and maintaining interest levels	4.12	0.85	Agree
Teachers provide some degree of direct instruction to the learning group even if it is online.	4.32	0.79	Strongly Agree
Weighted Mean: SD	4.21: 0.875		
Verbal Interpretation	Very High		

To measure the level Level of Synchronous Mode of Teaching Science in terms of Live Meetings weighted mean and standard deviation was used. The weighted mean and standard deviation indicate very high use of pedagogical aspects of the synchronous mode of teaching in science in terms of Live Meetings and observed to improve student's engagement and maintain interest to keep learning.

Table 2. Level of Synchronous Mode of Teaching Science in terms of Instant Message

Statements	Mean	SD	Remarks
Instant Messaging allows a student to chat in 'real time' especially if there are class announcements.	4.66	0.78	Strongly Agree
Instant Messaging allows students to collaborate and brainstorm with their friends and classmates.	4.54	0.76	Strongly Agree
It is convenient in a way that having no data allowance does not hinder the student from seeing a chat or an instant message from his/her adviser.	3.13	1.46	Moderately Agree
Instant Messaging allows the teacher to communicate to its class as a whole or an individual.	4.48	0.74	Strongly Agree
Instant communication is easily and quickly achieved because of Instant Messaging.	4.50	0.84	Strongly Agree
Weighted Mean: SD	4.26: 1.110		
Verbal Interpretation	Very High		

To measure the level Level of Synchronous Mode of Teaching Science in terms of Live Meetings weighted mean and standard deviation was used. It shows that in terms of instant messaging, it has been observed that it is beneficial to increase student participation and maintain interest in learning as it allows them to collaborate with their classmates and friends. They were able to get the information that they needed in an instant.

**Table 3. Level of Synchronous Mode of Teaching Science in terms of Virtual Classrooms**

Statements	Mean	SD	Remarks
Virtual classrooms allow teachers and students to enhance literacy to technology.	4.50	0.76	Strongly Agree
Students can view, communicate, interact, and discuss various topics using virtual classrooms.	4.44	0.82	Strongly Agree
Virtual classrooms allow teachers and students to organize the files and information of the subject to have easier access.	4.57	0.75	Strongly Agree
Platforms that were used were made flexible, and there are no restrictions on getting late to the class or missing out on lectures.	3.97	1.02	Agree
Learners not only learn the subjects/courses online but also keep learning how to be a pro in using digital platforms.	4.55	0.77	Strongly Agree
Weighted Mean: SD	4.41: 0.857		
Verbal Interpretation	Very High		

To measure the level Level of Synchronous Mode of Teaching Science in terms of Virtual Classrooms weighted mean and standard deviation was used. The result shows that by using virtual classrooms, students get to familiarize themselves with using the platform allowing them to increase their technology literacy. This gives them more venues to interact and discuss topics with ease of access.

Table 4. Level of Asynchronous Mode of Teaching Science in terms of On-demand Audio and Video

Statements	Mean	SD	Remarks
On-demand audio and videos allow the teacher and students to understand and reinforce the learning process	4.24	0.80	Strongly Agree
A favorable teaching environment is provided with the use of on-demand audio and video as supplementary materials,	4.28	0.83	Strongly Agree
On-demand audio and video increase and enhances the engagement of students and teachers.	4.26	0.85	Strongly Agree
Explaining a topic digitally with the help of on-demand audio and video makes the lesson clearer for the students.	4.28	0.82	Strongly Agree
On-demand audio and video is a great source of additional information and knowledge regarding the lesson	.36	0.88	Agree Strongly
Weighted Mean: SD	4.29: 0.834		
Verbal Interpretation	Very High		

To measure the level Level of Asynchronous Mode of Teaching Science in terms of On-demand Audio and Video weighted mean and standard deviation was used. It shows that the audio and video create a favorable environment for learning which gives reinforcements to the learning of the students. It also provides additional information which helps the lessons to be clearer for the students.

Table 5. Level of Asynchronous Mode of Teaching Science in terms of Recorded presentations and Demonstrations

Statements	Mean	SD	Remarks
Students can review the past topics whenever they felt the need to.	4.62	0.75	Strongly Agree
Recorded Lectures, presentations, and demos appeal to be effective as supplementary instructional materials	4.42	0.75	Strongly Agree
Recorder lectures, presentations, and demos provide a clear understanding with the use of pictures, graphs, and infographics.	4.40	0.80	Strongly Agree
Recorded lectures, presentations, and demos provide the students with the feeling of face-face discussion.	3.79	1.04	Agree
Recorded presentations and demos work effectively in giving students a real experience of classroom intervention.	3.97	0.90	Agree
Weighted Mean: SD	4.24: 0.904		
Verbal Interpretation	Very High		

To measure the level Level of Asynchronous Mode of Teaching Science in terms of Recorded presentations and Demonstrations weighted mean and standard deviation was used. The result demonstrate that recorded presentation is efficient as supplementary material for learning. With the use of pictures, graphs, and infographics the video provides a clear understanding for the students. The recorded presentations and demonstrations work effectively by giving students a real experience of the classroom intervention. The presentation works.

Table 6 Level of Asynchronous Mode of Teaching Science in terms of Self-Paced Online Learning Guide

Statements	Mean	SD	Remarks
Provide students to control the amount of material they consume per day with regards to their comfortability.	4.04	0.89	Agree
Students were able to control the duration of time they need to learn the new information properly	4.03	0.96	Agree
The self-paced method allows students to design their own learning experience according to their interests and learning preferences	4.26	0.95	Strongly Agree
Teachers provide guidance and proficiency to the self-paced learners, tailoring the learning environment according to the students' needs	4.25	0.79	Strongly Agree
Self-paced learning allows students to access course materials at their speed and focus on things that they find challenging and breeze past things that they already know.	4.30	0.79	Strongly Agree
Weighted Mean: SD	4.18: 0.884		
Verbal Interpretation	High		

To measure the level Level of Asynchronous Mode of Teaching Science in terms of Self-Paced Online Learning Guide. The result reveals that self-paced learning allows students to learn at their own pace and focus on what they find difficult and go through what they already know. It gives the students control over the design of their learning.

**Table 7. Level of Asynchronous Mode of Teaching Science in terms of Downloadable Documents**

Statements	Mean	SD	Remarks
Students, who have no permanent gadgets to use, can access the file provided by the teacher anytime.	3.85	1.18	Agree
Students can go back to the topics they are having a hard time understanding.	4.53	0.82	Strongly Agree
Students' questions regarding the documents that were uploaded online can be addressed later on for clarification.	4.36	0.79	Strongly Agree
Availability of the materials uploaded by the teacher is not a problem given that there is an internet connection.	4.34	0.87	Strongly Agree
Downloadable documents are a way to give the students the written topic of what is or will be discussed by the teacher.	4.46	0.74	Strongly Agree
Weighted Mean: SD	4.31: 0.922		
Verbal Interpretation	Very High		

To measure the level Level of Asynchronous Mode of Teaching Science in terms of Virtual Classrooms. The result shows that downloadable documents help the students by giving them a preview of the next topic. It assists students with no permanent gadget to use as they can access it anytime to serve as their reviewer.

Table 8. Level of Technical Aspects of Online Science Classes as to Internet Connection

Statements	Mean	SD	Remarks
Provides doorways to a wealth of information increasing opportunities for learning especially in the new normal setup.	4.39	0.83	Strongly Agree
Allow students to extend their range of learning amidst the pandemic.	4.35	0.89	Strongly Agree
Internet connection made distance learning and communication between students and teachers possible.	4.48	0.83	Strongly Agree
The Internet makes the learning process more interesting and diverse and leads to an increase in cognitive activity	3.97	0.99	Agree
The Internet allows students to be in constant contact with their classmates and teachers even if it is not done face-to-face.	4.44	0.82	Strongly Agree
Weighted Mean: SD	4.33: 0.892		
Verbal Interpretation	Very High		

To measure the level Level of Asynchronous Mode of Teaching Science in terms of of Downloadable Documents. The result indicates that remote learning and communication between students and teachers is now possible via an internet connection. Through the Internet, students can keep in touch with their classmates and teachers, even if they are not face-to-face.

Table 9. Level of Technical Aspects of Online Science Classes as to Device Performance

Statements	Mean	SD	Remarks
A good device allows the learners to cope up with the new normal trend of education.	4.53	0.76	Strongly Agree
Gadgets help the new setup to improve the efficiency of teaching methods and learning capacities of students	4.40	0.87	Strongly Agree
Devices of students that are capable of downloading a document, help them lessen their expenses by having a softcopy instead of a hardcopy.	4.50	0.82	Strongly Agree
The performance of a student's device can enhance the confidence of students learning in the new normal setup.	4.38	0.84	Strongly Agree
The versatility of digital devices helps every student to customize their learning experience under their personal needs	4.37	0.86	Strongly Agree
Weighted Mean: SD	4.44: 0.830		
Verbal Interpretation	Very High		

To measure the level Level of Asynchronous Mode of Teaching Science in terms of to Device Performance. The result reveals that good devices enable learners to cope with new general trends in education. The gadget helps the new setting improve the effectiveness of students' teaching and learning skills

Table 10. Level of Students' Study Habits

Statements	Mean	SD	Remarks
I have a regular schedule for studying the lesson.	3.99	0.95	Agree
I possess effective study skills that enable me to cut down on the number of hours spent studying, leaving more time for other things in life.	3.94	0.85	Agree
I am capable of focusing on tasks assigned in a given time allotment.	4.21	0.94	Strongly Agree
I can perform and finish school work before the deadline.	4.37	0.92	Strongly Agree
I am disciplined in studying even without the guidance of a teacher.	4.11	0.93	Agree
Weighted Mean: SD	4.13: 0.927		
Verbal Interpretation	High		

To measure the Level Student's Study habit weighted mean and standard deviation was used. The result reveals that students can perform and finish school work before the deadline and they are capable of focusing on tasks assigned in a given time allotment.

**Table 11. Level of Students' Control and Independence**

Statements	Mean	SD	Remarks
I know how to manage time and the things I need to achieve in a day, even if a teacher is not watching throughout.	4.26	0.98	Strongly Agree
I am motivated to study as if it is not a requirement, but a result of hard work and self-gain.	3.90	1.07	Agree
I attend my class, pass my requirements, and review for exams and quizzes, before the deadline.	4.32	0.95	Strongly Agree
I develop learning goals based on the personal learning strengths that I discovered myself.	4.38	0.84	Strongly Agree
I can assess and evaluate my learning process.	4.27	0.94	Strongly Agree
Weighted Mean: SD	4.23: 0.971		
Verbal Interpretation	Very High		

To measure the of Students' Control and Independence weighted mean and standard deviation was used. The result reveals that students can perform and finish school work before the deadline and they are capable of focusing on tasks assigned in a given time allotment.

Table 12. Level of Students' Focus and Concentration

Statements	Mean	SD	Remarks
I can focus and concentrate on a given task until I finish them	4.18	0.96	Agree
I can concentrate on the lecture and discussions during classes.	3.97	0.92	Agree
I can give attention to important details and information during classes.	4.26	0.79	Strongly Agree
I always have a prepared mind to take in new knowledge and information.	4.21	0.89	Strongly Agree
I can focus and concentrate on given tasks more effectively when I am aware of the time allotted in every activity.	4.37	0.90	Strongly Agree
Weighted Mean: SD	4.20: 0.900		
Verbal Interpretation	Very High		

To measure the Level of Students' Focus and Concentration weighted mean and standard deviation was used. The result reveals that by knowing how much time is allotted to any activity, they can focus and focus more effectively on a given task. They can also pay attention to important details and information during the lesson.

Table 13. Level of Students' Academic Performance in the Second Quarter

Grade	Frequency	Percentage	Descriptive Equivalent
90 - 100	97	82.91	Outstanding
85 - 89	17	14.53	Very Satisfactory
80 - 84	3	2.56	Satisfactory
75 - 79	0	0.00	Fairly Satisfactory
Below 75	0	0.00	Did Not Meet Expectations
Total	117	100.00	
Weighted Mean	92.15		
Lowest Grade	83		
Highest Grade	96		
Standard Deviation	3.265		
			Outstanding

The table above shows the level of students' academic performance as to Second Quarter, out of 117 students, the grades "90 to 97" got the highest frequency of ninety-seven (97) or 82.91% of the sample population and with the descriptive equivalent of Outstanding. And the scores "85 to 89" got the frequency of seventeen (17) or 14.53% of the sample population and with the descriptive equivalent of Very Satisfactory. While the grades "80 to 84" got the lowest frequency of three (3) or 2.56% of the sample population and with the descriptive equivalent of Satisfactory.

The (Weighted Mean = 92.15, SD = 3.265) and with Lowest grade = 83 and Highest grade = 96 shows that the level of students' academic performance as to the Second Quarter has a descriptive equivalent of Outstanding.

6. CONCLUSION

In the light of the findings and analysis of the study, the following conclusions were drawn:

There is a "significant effect in the use of pedagogical and Technical aspects of online learning experience to the students' academic behavior and performance" at a 0.05 level of significance. It shows that the null hypothesis stating that the use of the pedagogical and technical aspect of online learning experience has no significant effect on student's academic behavior and performance of the grade 9 students of Pedro Guevara Memorial National High School is rejected, it can be inferred that there is "a significant" effect between them.

7. RECOMMENDATION

1. Online teachers can use different strategies and techniques in doing their videos and recorded presentations that can involve the learners and become interested in particular topics. Teachers can enroll themselves in free online courses and attend webinars in which they will gain additional skills and techniques for making their videos and presentations. Their presentation should be more interactive and engaging.
2. The online teacher must use technology to enhance the course content. By utilizing the positive aspects of technology, the online teacher can provide a quality educational learning experience. Effective online pedagogy emphasizes student-centered learning and employs active learning activities. Teachers should learn the new technologies that are emerging so that they can integrate them into their teaching process. With the use of technology, lessons and activities can be more flexible and fun for the students.
3. Furthermore, this research could also be used in other schools to further observe the Pedagogical and Technical Aspects of Online Learning. This can make the researcher's study more reliable as a larger population would allow for a better generalization of the data. This study can be shared with other schools and be a basis for their study in their school.
4. Finally, feedback received should be taken into consideration to determine the progress of the researchers in achieving their objectives. Shifting the study's focus to interventions that rely on proactive approaches to resolve the issues will be a great follow-up for this study.



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