Virtual Teaching Methods Made Easy by Understanding Learning Styles: An ESL Study in a Physics Lab

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Abstract

The study began with a notion; while learning a concept using the English language in an ESL- virtual context, the teaching methods, instructions, reading materials, and demonstrations may not be sufficient for qualitative experiential learning. Unknown to learning styles, instructors improvised on their teaching methods and their virtual processes. The study intends to examine existing methods for a virtual classroom setting, the learning styles of the students, absence of Kinesthetic experiences while learning in a Physics Lab. Documenting evidence of language learning from a science session. Method incorporated began with analyzing responses using a questionnaire, analyzing teaching materials with learning processes using Physics concepts to examine and document learning styles compensating for the other. The findings of the study show that stimulus-activating materials help Learning styles to change and compensate among the 65 students. The teaching method administered, materials provided validate learning in a virtual classroom effectively, despite the absence of kinesthetic experiences missing during the post 2nd wave pandemic in India. A considerable population was able to use the subject-specific knowledge in a context unrelated; signifying simulating learning experiences; the importance of understanding learning styles, adopting new materials and methods to improve learning opportunities for students in a virtual environment.

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INTRODUCTION

The covid-19 pandemic created an atmosphere for the teachers and learners to depend on the virtual for teaching and learning. The present study concentrated on analyzing the learning styles of the students to provide tailor-made materials. The students cannot access the laboratories which are essential in a physics classroom and which is making them lack the kinesthetic experience. Dhawan [1] explains that the learning process cannot reach its full potential until students practice what they learn. Now is the time for the teachers to find new teaching methods and materials for the students according to their learning styles. Kelum A.A. Gamage and et al states that the covid-19 has created a challenge across the higher education landscape, where academics had to switch to remote teaching and different approaches to achieving laboratory delivery. As a result, students have not been receiving face-to-face teaching, and access to laboratory

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facilities has been limited or nearly impossible [2]. The laboratories cannot be accessed and many of the institutions are still relying on the virtual for classroom teaching and learning. This should not stop the students from learning the concepts in a way that they could use them effectively. As the core of our teaching goal is to cultivate students' ability of autonomous learning, the ability to raising and solving problems, and the ability of innovation and entrepreneurship [3]. The goal of the teachers is not only to teach the students' classroom concepts but to make the students cultivate the ability to use the knowledge in real life.

BACKGROUND

During the post-covid second wave, the teachers and learners were still dependent on the virtual for their classes with their methods for teaching in a class of students with different learning styles. Technical issues like lack of proper gadgets and network connectivity issues continue. The students and teachers are attending the classes from where they can and most probably from an informal setting like their home. Receiving education in a virtual mode is hindering the learners from the practical application of their knowledge. There is very limited or no hands-on experience for the students as they cannot access the laboratories. The teachers may also find it difficult to explain the practical lab session to the students and make them understand.

2.1 The setting.

English Language Learners in an ESL context bring a plethora or spectrum of experiences into the classroom to negotiate, comprehend and produce language using a concept in various contexts. Presentation of concepts from simple to complex in Physics help students processes the information. But can the same minds use such information creatively outside the class and Laboratories?

2.1.1 Purpose. The study aims to assess teaching methods by mapping them with learning styles to document that learning is significantly getting better despite the fact that one of the learning styles (Kinesthetic) is absent.

2.1.2. Profile of the students. The sample contains 65 undergraduate students who were in the initial year of their courses of Engineering. The considered sample were students of a technical university that offers a wide range of STEM courses located in Andhra Pradesh, India. The students were aged between 17-18 and the average age is taken as 17.5. From the sample 41.5% are female and 58.4% are male. For the convenience of the sample and the researcher, the questionnaires were given to the sample in the form of a google form.

2.2 Objectives of the study.

The teaching methods of the teachers and the learning styles of the students are the two components that are essential in a classroom. The students should be able to learn new vocabulary and knowledge from the classroom. As an article states that classroom discourse should not just be used as preparation for the experiment or as after-experiment analysis, but rather should be used to foster learning progression, to search for new knowledge, or to answer new questions[4]. The objectives of this study are as follows:

1. Are the teaching methods with instructions sufficient for learning in a virtual classroom?
2. Can the less preferred learning styles compensate for the dominant kind of learning style?
3. How can knowing the student's learning styles help a science teacher in creating content and experience-rich classrooms virtually?

METHOD

3.1 Instruments

The instruments that are used in this study are questionnaires and observation of teaching methods and materials. The data was collected from the questionnaires. The teaching methods and materials observed were the PowerPoint presentations, videos of the experiments recorded by the instructor in the laboratory. The researchers observed a live laboratory session of the physics class.

3.2 Questionnaires.

For this study, the data collected from 2 questionnaires were used. Both the questionnaires contain 16 questions each. The first questionnaire contains multiple-choice questions to identify the learning styles and preferences of the students. The second questionnaire contains questions for testing the conceptual correctness of the students.

3.3 Observations

3.3.1 Observation of the PPT slides. The PPT served as reading material for the learners. The PPT of the vernier calipers, micrometer screw gauge, and spring constant experiments had 10, 7, and 12 slides respectively. The first slide of each PPT gives the name of the experiment and a picture of the instrument with its parts. The second slide contains the aim, apparatus of the experiment followed by the explanation of the theory like the laws and formulae that are used in the experiment. The next slide gives the stepwise procedure of the experiment followed by the tabular form and the pictures of an actual tabular form on a paper with observations which serves as a model for the learners to understand the tabular form better. The last slide contains questions from the entire experiment using which the learners can test their understanding of the experiment. The language used in the slides was simple and clear. The aim of the experiment give the usage of the instruments which are demonstrated in the video, it could have been more useful for the learners if other possible implementations are provided.

3.3.2 Observation of videos. The videos observed had demonstrations of experiments named vernier calipers, micrometer screw gauge, and spring constant. The documented observations will help organize and explain the procedures, instructions, explanations, and demonstrations to help students learn in a virtual environment. The videos are for 7 minutes 27 seconds,12 minutes 10 seconds, and 2 minutes 36 seconds respectively. The videos contain construction, aims, and demonstration of the experiment. The videos also show formulae, data obtained(measurements), tabular forms, and graphs. The instructor also provided the values in the tabular form along with the results at the end of the demonstration.

3.3.3 Observation of lab session. Using Zoom meeting the lab session starts with the instructor sharing a PowerPoint presentation (PPT), explaining the aim, apparatus, description, and formula of the experiment. Then the instructor plays the video without any pause. Later the video was played again for the second time and the instructor explains by pausing whenever necessary by asking the students to observe. The values would be taken by using the instrument of the respective experiment in the video and the application of the formula in which the obtained values will be substituted in the formula followed by an explanation for filling the tabular form and plotting graphs. The students can pose their questions using the chatbox and the other way is to ask the instructor by unmuting themselves. The instructor has 8 sets of data points, which are the values obtained by experimenting. Now, 6-8

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students will be called out and given a set of data which they need to observe, calculate, make a tabular form and plot the graphs in their class time. The results obtained by the students will be observed by the instructor.

FINDINGS AND DISCUSSION

4.1 Analysis of learning styles questionnaire

The first questionnaire is for finding out the learning styles of the 65 students and their learning preferences. The learning styles that were tested are visual, aural, read/write, and kinesthetic. The responses of each student were analyzed individually to know their learning preferences. To find out the overall learning preferences of the 65 students, the results scored by each student of the four learning styles visual, aural, read/write, and kinesthetic were combined. A simple percentage was applied to the score results and the preferred learning styles of the students can be seen in figure 1

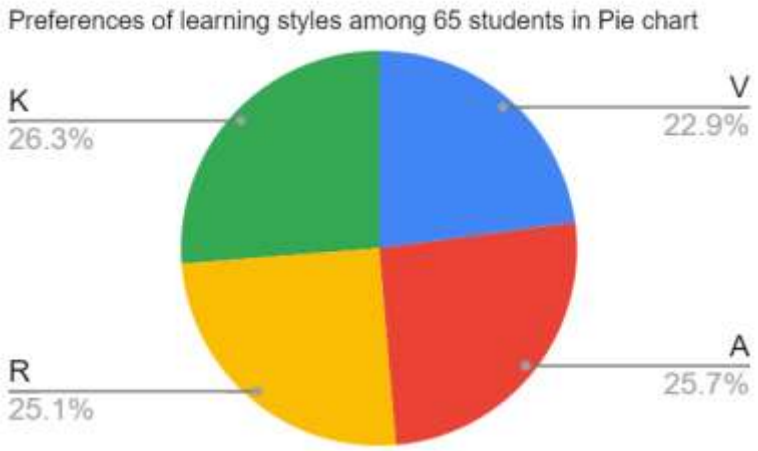

Figure 1. Preferences of learning styles

Out of the total students 22.9%preffered the visual learning style and 25.7% preferred the aural learning style. 25.1% preferred read/write learning style and 26.3%preffered kinesthetic learning style making it the highest preferred learning style. Figure 2 is also showing the preferred learning styles of the students in a bar graph.

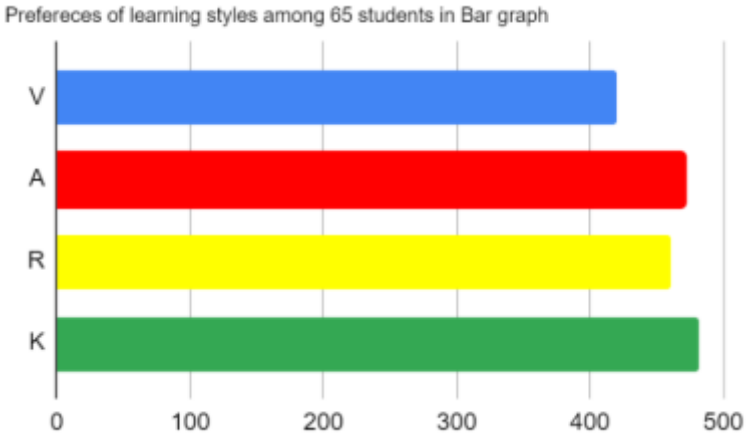

Figure 2. Preferences of learning styles

According to the results the most preferred learning style to the least preferred learning styles are kinesthetic(26.3%), aural(25.7%), read/write(25.1%), and visual(22.9%).

4.2 Analysis of concept correctness questionnaire

The second questionnaire tests the concept correctness of the students and contains 16 questions. Out of which 12 questions test the physics vocabulary of the students and the other 4 test the students' application of the learned physics concepts in the classroom in a real-life situation where it is applicable. 41 responses out of 1040 responses were not considered for this analysis as shown in table 1.

Table 1. Answers not considered.

Answers not considered	No. of answers
Don't know	21
Incomplete	4
N/A	3
No response	7
Wrong	6
Total	41

The 12 questions that test the vocabulary related to physics have questions like 'What is a helical spring?', 'What is a vernier scale?/ 'Define apparatus.' And alike. For the other 4 questions, the students were asked questions like 'Explain Zero-error in a screw gauge' and questions about what other professions and other areas of life the learned concepts and experiments were used? As per the student's responses and the scores, the percentage of the responses that we're able to apply the classroom learned concepts of physics outside the context was 71.53%. The result shows that students were able to understand the concepts and apply them in real life.

4.3 Discussion

Findings from the learning styles questionnaire revealed that students are more inclined towards kinesthetic learning style. The physics classroom and its laboratory session is a practical session for the students. Because laboratory experiments have thus been identified as one of the most effective ways of simplifying and clarifying complex concepts [5]. The students in the laboratory session learn by experiencing the experimental procedures through their hands(kinesthetically). But as the students cannot be in groups as per the post-second wave covid-19 norms and had to learn from the virtual classes offered by the institution. The students have to depend on the other three learning styles as one of the learning styles which is the most preferred one, the kinesthetic learning style is absent. Findings from the second questionnaire revealed that the students were able to understand the concepts they learned through virtual classes and were able to apply that knowledge in a context outside the classroom such as using the physics conceptual knowledge in their real life and daily life situations.

As Denisova stated that in addition, along with a variety of technologies, forms, and methods, as well as teaching methods, information and communication technologies in the training allow you to achieve a positive result in teaching physics to students of technical universities [6]. Incorporating technologies into teaching

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methods can result in new teaching methods and materials for the teachers. The teaching methods and materials used in this study are assisting with the learning styles visual, aural, read/write. As the students were able to use their visual learning style by watching the recorded videos and the PowerPoint presentations. The aural learning style is utilized by listening to the instructor speaking in the recorded video and while explaining the experiments. The read/write learning style is utilized while reading the PowerPoint presentation and writing down the data points and calculating them and plotting the graphs.

CONCLUSION

The study was conducted in an ESL context. The purpose of this study is to identify the learning styles of the students and provide the materials by the teacher that can make their learning effective. The absence of the kinesthetic learning experience for the students in a virtual setting is addressed and the findings demonstrate that the students were able to apply the subject-specific knowledge of physics in related contexts outside the classroom as well. The limitation of this study is the absence of a virtual physics lab for the students. One of the findings of the study is that the other learning styles which are visual, aural, read/write compensated for the kinesthetic learning style that is needed in a physics lab to an extent, as the kinesthetic learning experience cannot be replaced. This study highlights one of the ways to improve the non-existing laboratory experience of a physics classroom among ESL technical university students using materials that are tailor-made along with specific instruction.

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