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Title of the Study: Developing E-learning Materials for Addressing Alternative Frameworks in Physics at Senior Secondary Level

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## Abstract

The word 'physics' comes from the Greek word 'physis' which means nature. Physics is considered as the fundamental branch of science as it provides the base for almost all the branches of science. It attempts to provide explanations of the events and natural phenomena occurring around us. However, many of the physical explanations of the natural world may be difficult to comprehend as they are counter intuitive i.e. contrary to our common sense understanding and they are derived from everyday experiences. Various studies have provided the ample evidences that the number of students have great difficulties in understanding the basic concepts of physics and students' inability to understand these concepts of physics lead them to form alternative frameworks. The term alternative framework is an architectural term and it was coined by Driver and Easley in 1978. This term can be understood such as a particular student has an idea which appear to be logically coherent and ordered. The student consistently uses this this idea to respond various situations resulting in form of various alternative conceptions, such as a student has following ideas related to the physical phenomenon:

a) In collision of truck and car, speeding car exerts more force on slow moving car.

b) In collision of a moving car with a still truck, only moving car exerts force on still truck.

In these two context or cases, the two ideas are logically consistent: active agent exert force and passive agent exert no force. Thus, this is the central idea behind subscribing these two alternative conceptions. Thus, the idea passive agent does not exert force is the alternative framework.

There were total 26 type alternative conceptions and five (05) type alternative frameworks identified by the investigator. These alternative conceptions arises due to the consistently use of alternative frameworks in different situations. Almost all students subscribed alternative conceptions in pre and post-test assessment. In many cases, the students responded differently in different situation, although all situations probe same conception. Large number of students subscribed alternative frameworks and it was found that the some students completely modified their all alternative frameworks related to the force and motion but other failed. The most obvious finding which emerged from the analysis is that the developed e-learning materials were helpful (at some extent) to address the alternative conceptions related to the force and motion as well as alternative frameworks. The students' progress was not simple 'All' or 'None' type but totally depend upon the situations. The situations generate cognitive conflicts in students' mind and students' perceived information may contradict to each other. This contradiction evokes the students to response the situations on the basis their understanding. This is the reason, why some students responded partially correct to the different situations related to the same conception in spite of intervention of e-learning materials.

The developed e-learning modules partially addressed lack of conceptual coherency among the students' ideas. If student had developed conceptual coherency then they can easily differentiate and integrate two or more related concepts. The main reason of this lack of coherency could be more emphasis on cognitive factor of the learning and to ignore other factors completely. The students often do not change their previous knowledge on the basis of just anomalous data which is contradicting with their previous knowledge. This is again shows that the context play important role in students response in a question.

The intervention was variously effective for different students. On one hand some students moved from most of their alternative conceptions to the scientifically accepted ideas while on other hand, some students showed least modification. This shows that different learners respond differently to a teaching-learning situation and universally applicable and appropriate interventions may be difficult to construct.

Every module addressed different conceptions, therefore the purpose of each module was also different. Different module elicited different responses from the students. But investigator realised if some more examples from daily life were included in the modules, then the students could understand concepts better. These type materials can enhance a well-designed curriculum and the efforts of a good teacher, but they cannot replace them. Thus if we blend this facilitative learning materials (e-learning modules) with traditional classroom teaching, it may give more meaningful result.