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Title of thesis : ***A study of the effectiveness of an instructional design developed for bridging the gap between shared and alternative conceptions of future physics teachers.***

Abstract

The present study investigated the effectiveness of an intervention, which consisted of five modules developed by the researcher, in bridging the gap between the alternative conceptions held by future teachers and the corresponding shared conceptions. The area chosen for investigation was optics.

Major Findings

The responses to the queries posed during the course of the intervention have been taken as the primary means to access future teachers' ideas but the possibility that participants' overt responses may not always be truly indicative of their tacit understandings cannot be completely ruled out. Further ideas of the participants who chose not to respond to a particular item remain obscure. There also have been a couple of instances in which participants who gave an indicative evidence of subscribing to a particular shared 'idea' did not respond to the matched post-query and this could be difficult to interpret. Also, there have been cases where the participants who have not responded to a particular pre interventional assessment item have responded positively to the matched post interventional query. Such cases have not been considered as evidences of conceptual change. Interestingly, there also have been 5 cases of regression. The incidence of 'no response' is higher in case of free response type items, both during pre- and post-interventional assessment. This may be indicative of the future teachers' difficulty in being able to clearly express their thoughts and ideas. Certain queries/thoughts that were opined to be facilitative for forging certain shared understandings may have to be re thought. The study supports the view that alternative conceptions are tenacious and that future teachers with advanced academic training may themselves hold many alternative ideas. The ambiguous and irrelevant responses given to certain queries show, that the future teachers may experience difficulty in articulating their own thought processes. Further, it is to be observed that not only may learners differ in their responses to the same module but also that certain modules tend to elicit more positive responses from the participants. Certain alternative conceptions have been found to be revised by more participants as compared to others. It is to be borne in mind that the participants of this study were future teachers with a specified prior engagement with the subject matter and the results may not be easily transferable to a different setting. The findings of the present study therefore need to be interpreted with caution because the sample was limited but certain pointers that emerge need to be forcefully flagged.

Lack of Coherence of Ideas

There was no evidence of a systematic coherence in ideas of the participating future teachers. The participants are found to invoke different reasoning in different situations and the referent ideas may sometimes be contradictory to each other. Despite giving an evidence of subscribing to a particular 'shared conception' under a specific situation, future teachers were found to respond intuitively in a different setting. This again lends support to the claim that the context plays an important role in determining learners' responses to a particular question. The findings therefore counter the theory- like or 'framework' stance of looking at learners' ideas and uphold the fragmented view**.**

Partial Progression of Ideas

It was observed that conceptual change is an ongoing process and cannot be looked at through the simplistic 'all' or 'none' lens i.e. it would be difficult to simply say in certain cases whether conceptual change has 'occurred' or 'not occurred'. In many cases, learners give an evidence of being at various levels of transition. These future teachers demonstrate a partial revision of views and therefore may be said to have begun to progress towards a conceptual revision There is also evidence to show that conceptual change may not always be a linear process.

Amenability of Conceptions to Revision

Certain conceptions appear to be more readily amenable to revision through this kind of treatment of the subject and certain patterns seem to have emerged. An examination of the nature of conceptions that have been readily revised suggests that the formation of these conceptions is closely related to the understanding of symbolism (particularly the graphical symbolism) used in optics and how these symbols connect with actual experience. Consistently highlighting this dichotomy between reality and its depiction is thus a useful pedagogical exercise. 'Predict and tell' activities in which students are encouraged to respond to all questions by first tracing the path of light and then linking it to the path of sight are found to be useful.

Individual Differences in Responses to Intervention

The intervention proves to be variously effective for different future teachers. Participants' response to the intervention ranged from one extreme to the other. This shows that different learners respond differently to a teaching-learning situation and universally applicable and appropriate interventions may be difficult to arrive at.

Difference in Response Elicitation by Different Modules.

Each module was written with a specific purpose and pertained to a particular aspect of the nature of light and optical phenomena. The response to the different modules has also been different from each other. Modules that have elicited positively indicative responses to a larger fraction of queries/tasks may be taken to have been able to appropriately cue and guide the participants' understanding but at the same time the fact cannot be overlooked that certain kind of understanding may be more agreeable to this kind of external guidance. Interpretation of words and images are examples of this type of understanding.