Perceptions of high school leaners' difficulty with kinematics graphs

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Abstract. Learners in schools seem to have difficulty with conceptual understanding and problem-solving in kinematics graphs. The study investigated what are the learners' perceptions on the teaching and learning of kinematics graphs, and to find out from them what could make them enhance their learning and performance. A purposeful sand random study was done with Grade 11 leaners doing physical science and mathematics using a questionnaire. Descriptive and statistical analysis was done. The results indicated that learners only learnt to pass kinematics without conceptual understanding and struggled to relate it to algebra.

The use of graphs in physics

Given that it influences how well teachers enhance their teaching abilities, the problem of learners' understanding techniques needs to be thoroughly examined (Reutzel, Smith and Fawson, 2005; Williams, Stafford, Lauer, Hall, and Pollini, 2009). This growth in the instructors' capacity to instruct was assessed using a battery of comprehension techniques that focused on the acquisition of knowledge from reading science books along with curriculum-based reading and maintaining science topic knowledge. The researcher believes that this research still pertains to first-year college physics students, even though it will be carried out with high school physical science teachers as the participants. It takes this collection of comprehension techniques to teach algebraic and kinematic graphs.

The inclusion of data management, as suggested in the Further Education and Training (FET) mathematics curriculum (DoE, 2003), is crucial for the successful and efficient teaching of graphs in algebra and kinematics. As previously said, the researcher will look into whether math professors are capable of imparting mathematical knowledge and skills to students in a way that allows them to apply and utilize such skills in other subject areas, such as kinematics in physics. This explains or has to do with possible reasons why certain lecturers of physical science are not equipped to teach physics.

Graphs in algebra and graphs in Kinematics

According to Djan (2014), students who do not possess the fundamental conceptual understanding and skills related to graphs (algebraic) in order to solve issues in kinematics graphs would perform poorly in high school physical science classes. According to Kalobo (2014), statistics instruction in schools is necessary to improve the efficient application and interpretation of these fundamental graph abilities.

Therefore, using resources from the learners' past understanding of drawing a table of acquired data, teachers should be able to introduce and explain graphs to students (Kalobo, 2014). The students will acquire and formulate the conceptual abilities necessary to plot, analyse, and interpret a graph, or to analyse and interpret a pre-existing graph, in this way (Kalobo, 2014, Phage, 2015).

Methods and findings

The pragmatism paradigm and a mixed-method approach were employed in this investigation. This approach is predicated on the idea that concepts can be contextualized and generalized by analysing their "transferability" to other settings. It is based on the fundamental idea that qualitative and quantitative approaches can complement one another by highlighting the advantages and disadvantages of each type of research.

Findings

According to the findings, students received an average score of almost 50% on six questions pertaining to the concept of "integration." They scored 30.2% on the nine "differentiation" questions that showed "acceleration (a)" and 40.34% on the two questions that showed "velocity (v)"; 67% on the three questions that dealt with "points (coordinates) on graphs"; 50.42% on the four questions that dealt with "equations/forms" and 55.73 percent on the four questions that dealt with "constant function values."

Students who answered five questions about "integrating the distance (s)" and "integrating velocity (v)" received average scores of 23.06% and 24.7%, respectively. The average score for the learners was 2023% on the nine questions about "differentiation of acceleration (a)" and 17.09% on the other nine questions about "differentiation of velocity (v)". The average score for the two questions about "points (coordinates) on graph" is 50.5%; the average score for the four questions about "equations/forms" is 24.75%; the average score for the six questions about "constant function values" is 21.37%; and the average score on the four questions regarding "physics knowledge" is 18.19%.

Conclusion

The study's findings show the divergent opinions of the physical science teachers in high school. The results show that even though learners don't have a lot to say—that is, they don't hold teachers accountable for their subpar performance—about how they are taught and learn kinematics using the skills and knowledge of algebraic graphs, they don't have the necessary prior knowledge nor the capacity to apply and relate that knowledge to solve kinematics graphs.

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