


Chapter 2

The Use of Rubrics for Drawing Graphs in Physics Education

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ABSTRACT

In physics classes, graphs are utilized for various topics to make sure students better understand the relationship between variables. Graphs are especially useful for showing the relationship between dependent and independent variables in experiments carried out in lab classes. There are various sub-steps to drawing a graph. In order to draw a graph, students should have a good grasp of physics subjects; moreover, they should know the characteristics of graphs and be able to form the graph according to the steps. Using rubrics to assess students' drawings at the end of this process, which involves multiple skills, would ensure that the assessment is both more detailed and more reliable and valid. Moreover, using rubrics in teaching how to draw a graph would contribute to students' understanding of the graphs' characteristics; it would also help students clearly see the steps as well as contribute to the improvement of students' drawings through self and peer assessment.

INTRODUCTION

Some subjects within physics include abstract concepts. This makes it difficult for students to understand the subjects and decreases their level of success. Visual materials are used to concretize abstract concepts so that they could be more easily understood. Using visual materials such as figures, schemas, graphs, and pictures enables more effective teaching by increasing students' curiosity and motivation (Arpaguş et al., 2011). Graphs, one of these visual materials, make data easy to understand, summarize, arrange, interpret, and present; they can provide information in an effective way various data sets cannot (Demirci & Uyanık, 2009; Taşar et al., 2002). Line graphs are frequently used especially in physics classes to show the relationship between concepts. Visually presenting the relationship between two continuous dependent and independent variables, line graphs are an indispensable part of experiments in positive sciences (McKenzie & Padilla, 1986). The relationship between various concepts in physics classes is

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shown by employing graphs. In order for students to understand the relationship between these physics concepts, they need to understand and interpret graphs correctly (Demirci & Uyanık, 2007). In this respect, their graph skills or their graph reading-interpretation and drawing skills, should be at an adequate level. Studies on physics education show that students' graph drawing skills are lower compared to their graph reading-interpretation skills (Eryılmaz-Toksoy, 2020; Yeltekin Atar & Aykutlu, 2023). Drawing a graph involves the following consecutive steps: selecting an axis, tagging an axis, scaling the axis, data entry, forming a point, and connecting the points (Aydın & Tarakçı, 2018; Gültekin 2009; McKenzie & Padilla, 1986; Yeltekin Atar & Aykutlu, 2023). Students' drawings are influenced by different skills and knowledge such as their knowledge of physics, mathematics, and rationalization. This complex and multifaceted nature of graph drawing makes it challenging to determine the difficulties students face and to improve their skills (Angra & Gardner, 2018). In this respect, students' graph drawings should not be assessed as correct or incorrect. Studies show that rubrics can be used to teach students how to draw graphs and then to assess them (Angra & Gardner, 2018; Yeltekin Atar & Aykutlu, 2023). By using rubrics designed according to pre-determined criteria, students can be shown to comprehend what is expected of them when it comes to drawing a graph related to physics topics. Moreover, students' performances can be assessed in detail by using rubrics to evaluate their graph drawings. In light of all this information, this study aimed to assess how rubrics could be employed in evaluating students' drawings and in teaching them how to draw graphs. It is believed that examining how rubrics could be used in drawing graphs in physics education would be significantly beneficial for physics teachers, field experts, and students in physics classes. Consisting of six parts, namely, Introduction, Method, Background, The Use of Rubrics for Drawing Graphs, The Advantages and Disadvantages of Using Rubrics for Drawing Graphs, and Conclusion, this study is believed to contribute greatly to different disciplines such as mathematics, positive sciences, and social sciences, in which students utilize graphs.

METHOD

Having examined studies in the literature on rubrics, this study was designed as a traditional review. Traditional/literature/narrative/descriptive reviews examine two or more studies on a specific subject, and they are carried out to introduce a specific topic, to summarize it, or to fill a gap within the literature (Karaçam, 2013; Yılmaz, 2021). Traditional review studies, which are carried out by experts in the field, can be sometimes defined as "compilation, review, theoretical analysis, literature review" (Yılmaz, 2021, p. 1460). In this traditional review, rubrics, and the studies on the use of rubrics in physics education and graph drawing, were examined, and the ways rubrics can be used for drawing graphs were inspected.

BACKGROUND

In this part of the study, general information in the relevant literature concerning rubrics, as well as studies which use rubrics for different ends in physics education were presented.

Used in evaluating performance, rubrics consist of pre-determined performance criteria to assess students' work (Mertler, 2001). Rubrics are not only a tool to assess students, but they also allow students to see their own performance (Andrea, 2005; Oaklef, 2009). Providing feedback on to what extent students have reached the pre-determined criteria and how they could improve their performance (Moskal, 2000),

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