Communicating performance criteria to students through technology

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ABSTRACT (ABSTRACT)

A project that uses computer and video technology to help students understand the criteria used to evaluate their statistics projects is described.

FULL TEXT

Mathematics education at all levels of schooling is currently undergoing change. Recommendatians for improving the teaching, learning, and assessment of mathematics have been translated into standards that furnish guidelines for implementing change in mathematics classrooms (NCTM 1989, 1991, 1995). These standards emphasize the importance of engaging students in performance activities that require solving complex and realistic mathematics problems, reasoning about content and solutions, communicating understanding, and making connections among mathematical concepts.

Performance activities enable learners to demonstrate a wide variety of knowledge and skills. However, unless students understand the task and how it will be assessed, their work may be lacking. If students know what is expected of them, they are more likelv to perform well. The challenge for teachers is to find ways to communicate the criteria to students. In this article we describe a project that used computer and video technology to help students understand the criteria that were used to evaluate their statistics projects.

COMMUNICATING PERFORMANCE CRITERIA

Teachers should communicate perfonnance criteria by publicly stating the assessment criteria before having students engage in an activity. Making the criteria accessible and understandable to students will produce an "open" assessment process for them. This philosophy is described in the Openness Standard in NCTM's Assessment Standards for School Mathematics (1995, 17-18). When students understand the learning goals and the ways they are expected to achieve them, it is easier for them to align their performances to the criteria. Moreover, it is easier for them to set high expectations for themselves and consequently monitor their own progress (Diez and Moon 1992; NCTM 1995). One way to communicate such expectations clearly to students is through the use af technology.

A LIBRARY OF EXEMPLARS

Technology can be used to convey performance criteria ta students in a library of exemplars (Frederiksen and Collins 1989). We developed such a library for twenty-one high school students who were learning about descriptive statistics (Lajoie et al., in press; Lajoie, Lavigne, and Lawless 1993; Lavigne 1994; Lavigne et al. 1994). The library of exemplars gives students several models of proficiency that will serve as a gauge for perfonnance for a statistics activity.

The activity required that students work in groups of two or three to develop their own statistics projects. We had students work in small groups rather than individually to reduce the complexity of the task and to promote a discussion of criteria. Once the criteria were understood, graups could set goals for accomplishing the task and align their performance to criteria seen in the library of exemplars.

The criteria and the way the groups would be assessed were explained verbally to groups befare they engaged in the task. These criteria included the following:
1. Quality of the research question. How clear was the question? Were all variables specified? Were all levels of each variable discussed? (5 points)
2. Data collection. Were any systematic procedures employed to avoid potential bias in the data-collection process? (10 points)
3. Presentation. How was the data presented to the class? Were the charts or graphs appropriate? Were the data represented clearly? (10 points)
4. Data analysis. What type of data analysis was used? What was the quality of the interpretations? Was the analysis appropriate for the data? (10 points)
5. Presentation style. How well was the presentation organized? How well were the graphs and statistics used to answer the research question? How thorough were the explanations? (10 points)
6. Creativity. How original was the mini-experiment? (5 points)
A possible overall score of 50 points was allocated to each group project.
Three types of assessments were made. First, teachers assessed groups on each criterion. Second, each group rated itself on the criteria by discussing its perfonnance and reaching a consensus in its assessment. Finally, each group assessed other group projects in the same manner.
The criteria for performance were made more visible by using exemplars to infonn groups of the types of knowledge and perfonnance they were expected to demonstrate on projects. Exemplars were developed by selecting videotapes ofpast groups that demonstrated different levels of performance on the criteria. Weaker (average) and stronger (above-average) examples af perfonnance on each criterion were selected and digitized so that they could be included in the library and presented on the computer.
A student could access infonnation about each of the criteria at any time during the project by clicking on the computer screen. To select the "data presentation" criterion, for instance, a student would click on the image corresponding to this standard (see fig. 1).(all figures omitted) The student would then receive information about the criterion (see fig. 2).
Text describing how to develop a research question, for instance, would be read by the student. Examples of how other students performed on this criterion would also be viewed. The student could see how average or above-average performance appeared by viewing videoclips. By clicking on the average performance, the student would see a videoclip showing a student from last year's class presenting the following research question to classmates: "What is your favorite fast-food restaurant?" This videoclip conveyed to the student the type of performance that was acceptable on the research-question criterion. By clicking on the above-average performance, the student would see a videoclip showing the student from the average example restating the group's question to "What is your favorite fast-food restaurant among Harvey's, Burger King, McDonald's, and Lafleur's?" This videoclip demonstrated stronger performance on the criterion because the categories given to the sample were specified. A student was expected to discuss such differences in performance with the group by responding to textual prompts (see fig. 2). After viewing information about each criterion and discussing differences among performance levels, the group could develop its own project and align its performance to criteria accordingly.

USING TECHNOLOGY TO COMMUNICATE STANDARDS

Using technology to inform students about performance criteria has several advantages. One advantage is that computers can motivate students to interact with information in various ways--by reading text, looking at pictures, watching and listening to videoclips, and controlling the choices they make. Computers make information about criteria more readily accessible than a handout that can be easily lost or misplaced.
A second advantage to using technology is that it can help teachers make criteria more visible to students by giving them multiple ways to illustrate information with sound, video, and graphics rather than only through text. This multimedia approach is particularly useful when cammunicating criteria that are based on abstract content (Lajoie, in press). Demonstrating such content and communicating how students will be assessed on it are often

difficult. However, technology can supply students with concrete examples of other students' performances on relevant criteria. Such examples may be more salient to students than abstract descriptions found on a handout. For instance, exemplars were particularly effective during our project for modeling the effect of bias in the data-collection process. One group that viewed the library of exemplars discussed how the findings ofits survey were influenced by the imbalance of gender in the sample. On this basis, the group concluded that its results were misleading.

Technology can also ensure that the criteria are communicated to students in a standardized way. Teachers can be assured that their explanations and examples are consistent for each student or for each class in which the same subject is taught. Consistently communicating standards allows teachers to give students a common language with which to discuss issues related to the assigned task. Through discussions with teachers and peers, students are more likely to acquire a common understanding of the criteria.

Finally, communicating performance criteria through technology is advantageous for teachers in that the time spent developing computer materials, tutorials, or programs is a long-term investment. These materials, once developed, can be used for curriculum in subsequent classes and can be easily revised should the teacher's goals change. Moreover, teachers can work together to develop and add to these materials.

USING EXEMPLARS FOR SELF- AND PEER ASSESSMENT

The library of exemplars was designed to help groups monitor their own progress as well as the progress of other groups. Teachers can monitor students' or groups' progress on criteria and examine whether students' or groups' assessments of their own progress are congruent with the teacher's assessment of the same work (Lajoie, in press). Incongnent student and teacher assessments can occur when performance criteria are not clearly communicated to students or when students do not understand the criteria. Our work with high school students suggests that making criteria open and visible to groups through technology helps them closely align their assessment of their own work with the teachers' assessment.

In our project, groups' assessment of their own work was not always clasely aligned with their assessments of other groups' performance. Groups assessed their own performance more favorably than they did other groups' performance. The rea: son for this misalignment is unclear. Groups in competition with, or critical of, each other may tend to inflate their own scores when compared with other groups.

Teachers can use technology to develop a medium, such as the library of exemplars, to communicate performance criteria successfully to students. Such a library helps students align their performance with criteria that reflect abstract statistical content. At the moment, the library described in this article is not available to teachers commercially. We are currently working on a revised version and hope to distribute it commercially to teachers in the future. HyperCard (Apple Computer 1989) and Quicktime (Apple Computer 1989), the computer software used to develop this library, however, are readily available. Teachers interested in learning more about this technalogy or in using the existing library can contact either author.

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