What if Socrates uses Mathlets?

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Introduction

Any educational design would be beneficial as long as it could associate the technology and the teaching way of an old man who still guides us in many respects. On the one hand, we have Socrates (469-388 B.C.) the head of critical thought, brainstorming, creativity, in other words dialectic. On the other hand, we have java applets, the so called mathlets, which enable the unseen to be seen. It may seem as a conflict to search for linkages between the teaching method of an ancient philosopher and a new way of technology integration into mathematics education. However, this study aims to use Socratic questioning or in other words, the power of recollection for the students to analyze mathlets with indepth mathematical reasoning.

Theoretical framework

Socrates brought into attention the term "dialectic", or "question-answer". He referred to this method as the only admissible method of education, which is no matter of mere conjecture. According to Socrates, while all opinions are equally true, one opinion is better than

the other and wise man is the one who by arguments causes good opinions to take the place of the bad ones, thus reforming the soul of the individual or the laws of a state by a process similar to that of a physician or the farmer.

Socrates believed that human beings had all the answers to all of the questions if only they knew how to ask the right question. In education, we have been using his ideas in so called Socratic Method and teachers were guiding students to find the answers within. Socratic Method has been used two folded both as a seminar to reach many students at once and as a one to one dialectic between teacher and the student.

Recently, mathlets gained importance due to their potential in their capability of giving students a sense of first hand experience of mathematical inquiry. A mathlet is a small scale interactive learning environment which is designed to address key ideas in science and mathematics (Confrey et al, 1998). They are compact, free to use, easy to find, and easy to use since they do not require any programming language knowledge.

Mathlets have the capability of introducing multiple, mostly dynamic representations of the same topic in mathematics. This ensures that students are able to see and observe the effect of different parameter changes and dynamic visualization. Socrates was a man who was surely ahead of his time and if he lived we believe that he would conjecture the possibility of usage of his ideas reflected on the image of the mathlets.

Research Design and Procedure

To begin with, derivative of a given function and tangent line will be taught by the teacher as usual to the third year high school students. A pretest, which is developed by the help of the web site where the java applet is positioned, will be administered (see Fig. 1). This web site includes a set of graphics, which is given in a 3×3 grid and each function below is the derivative of the function above. Students are required to identify with each column of the grid either the first and second derivatives of the function, the function whose derivative is the one given below or the integral function of the preceding function. This kind of activity enables students to see even the relationship between integral of a function and the derivative of a function. The graphics from this web page with the same idea of grids will establish the pretest questions.

Furthermore, students will be taken to the computer lab with their mathematics teacher. The first author of this paper is a teacher in a private school for 10 years. The subjects of the study will be drawn out of the original set of students of hers from her school. In the lab section the two applets presented in the appendices of
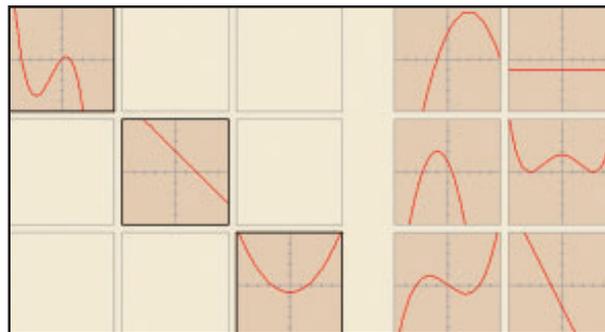

Figure 1. Pretest graphics

this paper; The Derivative Plotter and The Definition of the Derivative applets will be used. The teacher is preparing a lesson plan to accommodate these applets. She will use questioning in terms of Socratic dialogue and in the spirit of the Socratic seminars. Socrates believed that a teacher couldn't teach anything new to the students that they didn't know already. Hence, the questioning of the teacher will employ the idea of recollection.

As Richard (1993) mentioned once, the role of the skilled teacher/facilitator is to keep the "inquiry train on track," but, also, to allow the students to "travel to a viable destination" of their own design. This way of thinking clearly could be seen via Socrates himself "I shall only ask him, and not teach him, and he shall share the enquiry with me: and do you watch and see if you find me telling or explaining anything to him, instead of eliciting his opinion." within his conservations with Meno. Meno was a slave to whom Socrates used the first examples of a Socratic dialogue while teaching geometry to him. Our set of questions will be prepared keeping these example questions in view. This way, it is hoped that the students would manipulate java applets (mathlets) in a more enriching and productive manner and they could get the use these mathlets in a much productive way possible.

Finally, a parallel version of the pretest will be given to the students as a posttest. Then the students who will demonstrate unique ways of thinking with applets (those who got higher scores from the posttest and those who were identified as advanced mathematical thinkers by their teacher) will be interviewed to analyze their thinking with applets after the use of Socratic dialogue. In this interview protocol, unstructured interview protocol will be used to see and identify the possible effects of Socratic dialogue on students' thinking with applets. Here, students' self report will be adequate.

Findings and Analysis

It is conjectured that not only will the students take the responsibility for their own understanding but also they

will master how to ask the right questions to get to the thoughtful answers. Their metacognitive abilities could be heightened and they could use this ability while learning other topics in mathematics.

Findings will be analyzed in terms of thinking processes and reasoning skills with both the topic at hand and also with the mathlets mentioned. A triangulation of the data from both quantitative gain scores and from the qualitative interview results will be carried out.
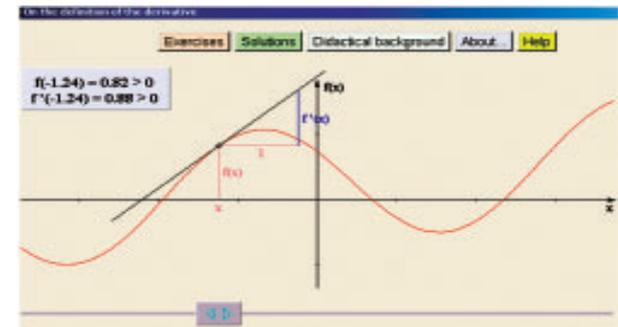
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Appendix 1. Derivative Plotter
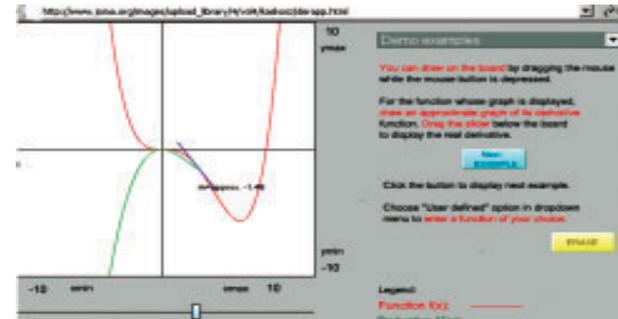
http://www.joma.org/images/upload_library/4/vol4/ kaskosz/derapp.html

Appendix 2: On the definition of the derivative

http://www.univie.ac.at/future.media/moe/galerie/ diff1/diff1.html