Categorizing CAS Use within One Reform-Oriented United States Mathematics Textbook

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ABSTRACT

Mathematics teachers in the United States frequently use textbooks to guide their classroom instruction (Grouws & Smith, 2000; Weiss, Banilower, McMahon, & Smith, 2001). Recently, three US high school (age 14 – 18) mathematics textbook programs have been developed which incorporate computer algebra systems (CAS) to varying degrees. A framework adapted from Heid and Edwards (2001) was developed and used to categorize the different roles of CAS as embedded within textbook activities designed for students within one program's advanced algebra textbook (Flanders et al., 2010).

Altogether, CAS played six distinct roles within this textbook. Of the 226 tasks that were connected to CAS use, 52% were isolated/non-formulaic, 4% were isolated/formulaic, 7% were pattern generation, 2% were parameter manipulation, and 3% were method execution, and 32% were a variety of different calculator specific roles such as a spreadsheet. CAS use was also categorized in terms of active or passive student engagement. An example of active engagement is where the student must use CAS to perform some task or solve a problem while passive engagement is where the use of CAS is portrayed in the textbook within an example that students are simply asked to read about. The analyses showed that 37% of the tasks were passive and 63% of the tasks were coded as active student interaction with CAS. CAS instances were also coded in terms of whether the technology was a primary method to solve problems or a secondary method such as when students are asked to use CAS to check their solutions to problems that they solved with paper and pencil. A total of 68% of the tasks were primary uses of CAS and 32% were secondary.

A framework adapted from Stylianides (2008) was used to examine how CAS was to promote reasoning and proof. Out of 226 tasks where CAS was used, 30% or 68 tasks were devoted to reasoning and proof. The majority of these 68 tasks (65%) asked students to notice a symbolic pattern that was generated on CAS. That is, these tasks asked students to use CAS in a certain way (e.g., manipulating the parameters of a quadratic equation and noting how the graphical representation changes) and state with certainty the patterns that they detected. In fewer instances, (24%) students were asked to make conjectures or state with less certainty the patterns that they believed to exist after using CAS. CAS were used by students on only 4 occasions (6%) to test a

conjecture to see if it always held and the technology was rarely used in developing proofs (6%). The implications of these results on students' use of technology and its role in reasoning and proof will also be discussed.

Keywords

proof, reasoning, curriculum, computer algebra systems, reform

References

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