

Case Study Using Maplets for Calculus with Continuity Concepts

A model for the research and development of educational applets for mathematics

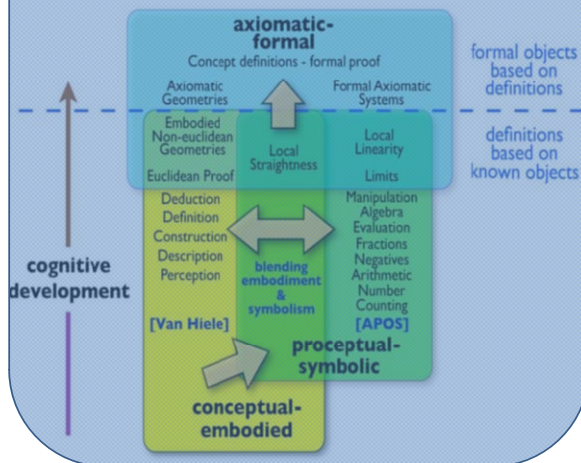
CONCEPTUAL FRAMEWORK

Investigate student use of Maplets as a tool based on Instrumentation theory research developed by Paul Drijvers and Luc Trouche.

GOALS

- Identify strategies that promote conceptual understanding.
- Document and analyze features of technology that promote students' understanding.

Determine student level of understanding for continuity using David Tall's 'Three Worlds' model:



References

- Drijvers, P., & Trouche, L. (2008). From artifacts to instruments: A theoretical framework behind the orchestra metaphor. In G. W. Blume & M. K. Heid (Eds.), *Research on technology and the teaching and learning of mathematics: Vol. 2. Cases and perspectives* (pp. 363-392). Charlotte, NC: Information Age.
- Tall, D.O. (2008). The transition to formal thinking in mathematics. *Mathematics Education Research Journal*, 20(2) 5-24.

METHOD

Record computer activity and voice of students as they 'Think Aloud' while using Maplets:

The screenshot shows a Maplelet window titled "Left and Right Limits and Continuity, using a Graph". It features a graph of a function $f(x)$ with a jump discontinuity at $x=4$. The interface includes input fields for limits and function values, with feedback buttons for "Hint", "correct", and "incorrect".

Step 1 - Enter the limit from the left, the limit from the right and the value of the function in the boxes at the right.

Graph: $f(x)$ vs x . The function is defined for $x < 4$ and $x > 4$, with a jump at $x=4$.

Input fields and feedback:

- $\lim_{x \nearrow 4} f(x) =$ 5 (incorrect)
- $\lim_{x \searrow 4} f(x) =$ 3 (correct)
- $f(4) =$ 5 (correct)

NOTE: The one-sided limits and function value are integers. Notice the 3 numbers are independent, i.e. they may or may not be equal.

Step 2 - Decide if each statement is True or False.

- $\lim_{x \rightarrow 4} f(x)$ exists: T (incorrect), F (correct)
- f is continuous from the left: T (correct), F (incorrect)
- f is continuous from the right: T (incorrect), F (correct)
- f is continuous: T (correct), F (incorrect)

Check: incorrect Show

The limit from the left is the height the graph approaches as x approaches 4 from the left.

Programmers: D. B. Meade & P. B. Yasskin © Copyright: Maplets for Calculus 2002-10 M4C v1.3 July 2010 Maple 15.00 (Windows)

An excerpt from a recorded student session is found at <http://www.math.sc.edu/~meade/VM1/3013/>



Investigators

- Ray Patenaude, PhD candidate at the University of South Carolina is a mathematics teacher at South Pointe High School, Rock Hill, SC.
- Dr. Edwin Dickey, University of South Carolina, is advising Mr. Patenaude and Ms. Adams on this project.
- Paula Adams, PhD candidate at the University of South Carolina and mathematics teacher at Indian Land High School, SC assisted in this study.



Supported in part by NSF DUE CCLI (Phase I) and TUES (Type 2) Grants 0737209 / 1123170 (Meade) and 0737248 / 1123255 (Yasskin).