Using Technological Innovation to Improve the Problem-Solving Skills of Middle School Students

Educators' Experiences with the LEGO Mindstorms Robotic Invention System

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In fall 1998, members of the mathematics department and the Institute for Interactive Technologies at Bloomsburg University met to discuss a problem of mutual concern: students' difficulty determining the best way to begin to solve a problem, even when it is derived from applications of simple mathematical concepts. Students often voiced feelings of frustration and confusion when approaching a word problem and didn't seem to fully understand the problem-solving process. In an attempt to find a nontraditional method to help students understand the importance of approaching problem solving as a process, the group applied for, and subsequently received, a grant from the Pennsylvania Department of Education. The grant was to support the creation of an innovative problem-solving course that would use a combination of logic, hands-on experience, and a modicum of trial and error to help students identify the processes behind effectively solving problems. The course was carefully designed for middle school students: students interested in innovative technology and, more important, at a critical point in the development of their attitude toward and aptitude for problem solving.

The group of Bloomsburg educators used the grant money to develop a course that could be taught to local middle school teachers. The key component of the course was the inclusion of a new product by the LEGO Corporation, called Mindstorms. The Mindstorms system is a programmable robotics kit that uses an interfaced computer program to enable students to design, construct, and manipulate their own robots. The idea was to introduce the system to middle school teachers, familiarize them with the system's operation and benefits, then encourage them to use it in their own classrooms. To that end, the university used a substantial portion of the grant to purchase ten Mindstorms systems and then donated them to the Central Susquehanna Intermediate Unit for classroom teachers to borrow.

During summer 1999, a group of eight middle school teachers from as many school districts enrolled in the resulting course, "Implementing LEGO Mindstorms in the Middle School Classroom." The course proved to be as innovative as the Mindstorms system itself. The first week (twenty hours) of the course involved familiarizing the classroom teachers with the Mindstorms system. Teachers were given a multitude of demonstrations, asked to experiment with the product, and provided with technical support when needed. The teachers were then brought together for a series of discussions concerning the educational value and practicality of the system. They discussed the benefits of using the product in the classroom and explored ways in which it could be introduced into the curriculum. The course was also designed to help teachers explore various problem-solving techniques as well as examine why students become frustrated and confused when presented with exercises that involve solving mathematical problems. Course participants also discussed ways in which the LEGO Mindstorms robotics invention system could foster heightened enthusiasm among students, encouraging them to examine their own thought processes as they approach problems. The course also examined the benefits of the system as it relates to cooperative learning and group problem solv-

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Students remain highly engaged throughout the process because they visualize their robot as a toy.
less inclined to solve complex problems that necessitate experimentation? Finally, what promise does the system hold for those students not enrolled in courses for the gifted or for those students who are not mathematically oriented? Would the system prove more or less useful to them? Perhaps as the robotics invention system grows more popular in both homes and schools, those questions will be answered.

REFERENCES

