

A Study of Laptops in Science Education

David Devraj Kumar

Florida Atlantic University, Florida, USA

Purpose and Theoretical Framework

A study of laptop computer use in K-12 science was conducted using the criteria of infotech hierarchy of use (Owen, Calnin, and Lambert, 2002), models of laptop use (Concentrated, Dispersed, Class Set, Desktop, Mixed) (Rockman Et Al, 1997; Belanger, 2000), and grade level (elementary, middle, secondary). (Laptops include Notebook, Powerbook and Pen-point computers.) According to Owen, Calnin, and Lambert (2002) an “infotech curriculum is more than just an alternative to computer education approaches that have been traditionally offered in schools. There is a move away from a situation where the teacher has the major control over the knowledge acquired by students. The

infotech curriculum is a quadratic involving teacher, students, content, and notebook [laptop computer] use. In an infotech curriculum, students have individual access to their own notebook computer which is integral to the day-to-day learning activities planned by the teacher...[and] students come to regard the computer almost as an extension of themselves” (p. 137). Advantages include increased opportunity for independent learning, problem-solving skills and research skills. Owen et al. (2002) described the following hierarchy of computer use in an infotech curriculum: Support (e.g., database management, graphic presentation), Link (e.g., email, videoconference), Resource (e.g., researching the Internet), Tutorial (e.g., drill and prac-

tice), Curriculum Adjunct (e.g., subject specific data analysis, graphing), Curriculum Alternative (e.g., robotics, mathematica), and Exploration and Control (e.g., simulations). This is a comprehensive hierarchy, and it takes into consideration complex science skills and processes, and provides a systematic way of looking at laptop computer use in science classrooms. See Owen et al. (1997) for a more details on the infotech hierarchy.

Procedure

The analysis sample (N = 16) resulted from a systematic search of the ERIC and WilsonSelectPlus databases. The sample represented North America, Asia, Australia and Africa. The sample was analyzed using the infotech hierarchy of use, models of laptop use and grade level use.

Findings and Discussion

Findings indicate the following: Laptop computers are often used in secondary classrooms for preparing and presenting student projects, data management, decision-making, inquiry activities, and problem-based learning, with improvement in student achievement and writing skills. Laptops are also used for outdoor activity-based science instruction. Minority and disadvantaged students tend to benefit from laptop use, and their participation in science learning improves. Students with learning disabilities seem to improve study strategies as they access and manage information with laptops. The kind of input (key board, induction pen) seems to have an effect on problem solving in chemistry. Whether these are novelty effects caused by widespread computing is an important question. Also, whether the laptop by itself, or in conjunction with other multimedia presentation software, impacted the outcomes is uncertain (Siegle and Foster, 2000). About 75% literature sources analyzed are from North America which indicates inequity in laptop use. How to enable developing nations to reap the benefits of ubiquitous technologies is an important question with implications for science education, technology and socio-economic policy. The small sample size in this analysis shows the need for more evaluative information on laptop computer applications in science education.

Ubiquitous technologies such as laptops should not be touted as a panacea for science education reform. "Technology is... neither intrinsically effective nor ineffective in improving education" (Schneiderman, 2004, p. 33). They offer great hope for improving K-12 science teaching and learning, provided more higher level infotech curriculum applications (Curriculum Adjunct, Exploration and Control) are developed and imple-

mented with increased accessibility across socio-cultural barriers.

References

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