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# Teaching and Learning with Mobile Technology in High School

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**Human Factors & Ergonomics** (HF/E) discovers and applies information about human behavior, abilities, limitations, and other characteristics to the design of tools, machines, systems, tasks, jobs, and environments for productive, safe, comfortable human use <sup>1</sup>. HF/E knowledge has been applied to the benefit of various types of simple and complex systems, including work, military, and air traffic control systems, to name a few. However, the benefits that application of HF/E science might bring to educational systems have yet to be widely recognized.

Educational ergonomics is that field of HF/E science concerned with the interaction of educational design and performance <sup>2</sup>. It is concerned with how and why design characteristics of the educational process and system influence variability in performance of participants in the system and the system as a whole. It is poised to address the various elements of the educational process, including...

- Physical designs of instructional materials, environments, and technologies,
- Designs of different skills, tasks, classes of knowledge, and curricula targeted for learning,
- Social and interpersonal designs of interactions of participants in the system,
- Design, management and administration of jobs, supervisory relationships, organizations, policies, and programs of educational systems,
- Designs of communities in which education occurs <sup>3</sup>.

Schools are complex systems, consisting of many dimensions and interacting and interfacing elements, including people (students, teachers, administrators, etc), technologies (computers, books, etc), and physical facilities (classrooms, lockers, etc). In this discussion, we will focus on three of these important elements: teachers, students, and computers.

Use of computers within the curriculum of K-12 education offers tremendous potential benefits. For example, use of computers has the potential to add demonstrable pedagogical value, encourage authentic pedagogy, promote augmented education, support different learning styles, and enhance core relationships between teachers and students <sup>4</sup>. However, there are also a number of concerns that have been raised or experienced firsthand by educators, such as computers being a distraction to students and teachers' lack of basic computer skills or lack of knowledge in integrating computers into the curriculum. Several studies have also found that K-12 students experience visual and musculoskeletal discomfort that they associate with computer use, similar to reports from college students and adult computer users. Further, assessment of the impact of computers on cognitive development reveals mixed results.

Due to the multidisciplinary nature of Human Factors, HF/E researchers and practitioners are able to address the many facets of educational systems, with a goal towards making these systems more human-centered in design, which in turn, should promote enhanced performance of both students and teachers. HF/E knowledge and methods can be applied in the research and design of educational systems, in support of recommendations for improving K-12 education, that were provided in *Rising Above the Gathering Storm*. As an example, the report states that "...we must emphasize the need for research and evaluation to serve as a foundation for change in K-12 mathematics and science education. In particular, a better understanding of what actions can be taken to excite children about science, mathematics, and technology would be useful in designing future educational programs." Skillful, appropriate incorporation of computers into the curriculum can be a vehicle for creating excitement in children, about school in general and STEM subjects in particular. HF/E practitioners and researchers can draw upon their skills and knowledge of cognition, systems design, human-computer interaction, and research methods to address this and other recommendations for improving K-12 education.

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<sup>1</sup> Sanders MS and McCormick EJ. Human factors in engineering and design. Seventh ed. New York: McGraw-Hill, Inc.; 1993.

<sup>2</sup> Smith TJ. Educational ergonomics: Educational design and educational performance. Proceedings of the International Society for Occupational Ergonomics and Safety, Fairfax, VA, 2001.

<sup>3</sup> Ibid.

<sup>4</sup> Staley DJ. Adopting digital technologies in the classroom: 10 assessment questions. Educause Quarterly 2004; 20-26.