

Future Learning Devices

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Over the years, many around the world have thought about the design of devices (often involving computers or microprocessors) that might be most useful in educational settings (Berg, 2003). This entry briefly examines the literature related to learning devices as they have been conceived of in the past and might be developed in the future.

As early as 1945 Vannevar Bush, the American scientist, sketched out a plan for something very much like what is known today as hypertext. Bush's article "As We May Think" foresaw that the scientific world would be overrun with too much information, and thus in order to progress, man needs to develop technology to address this problem. Calling his device "memex," Bush argued that it should use association because that method mirrors the way humans think. The problem to overcome is that these associations are very intricate and leave quickly fading trails. Part of what this device does is link documents together, much like hypertext ultimately generated.

However, Johnson (1997) points out that one important aspect of Bush's device has not been replicated—the ability to have a memory of thinking, or thinking trails. Bush felt that this ability to capture thinking trails was crucial in future thinking devices so that individuals and groups could trace connections and the branching of thinking in order to examine their own processes and learn from them. Those thinking about learning devices in the future may focus on the organization and collection of these thinking trails.

Studies of virtual teams have shown that this process memory is one of the common problems encountered (Weiser & Morrison, 1998). Often, team members working on different tasks lose the thread of inquiry, and such a device to help track group thought process is posited by Weiser and Morrison. Future learning devices might chart thinking trails, suggest possible connections with other trails, and help share patterns with other learners.

Another function of learning devices that scholars have considered is the ability to help structure work-based learning (Berg, 2003). This task would be accomplished by a device that connects knowledge trails produced outside of work with the information needed to accomplish specific employment-related tasks. The device would suggest relevant information sources outside of work, virtual learning communities, and thinking trails that could have an immediate impact on a user's work.

General characteristics of learning devices include a software component and an input device to record various types of information, including photographs and print material. While a great deal of the information needed for this device would already be digitized, in order to make the information personal and particular, the user would require the ability to input information. The information held in the device would need to be accessible anywhere. Much like the Internet, the user would need to be able to access the personalized learning device at work, school, home, and in transit. The learning device would be something that an individual keeps for a lifetime and it would go with him or her everywhere. As a result, all that one has learned over a lifetime might be perpetually accessible for review.

The device must be dynamic and continually in the process of updating information for the user. This function is likely to include a certain amount of artificial intelligence able to understand the user's needs and interests, and find the necessary information. Much of this could be accomplished by the intelligent agents that are currently being discussed and developed (Huhns & Singh, 1998; Shneiderman, 1995).

Some scholars (Johnson, 1997) argue that the interface of this lifelong learning device should be based on purpose rather than current metaphors. Metaphors and virtual university icons fail to center the interface on the real learning process. Traditional university metaphors are particularly unpro-

ductive because they do not focus on individual student needs and thought processes. Most importantly, the interface should reflect the feeling of a community of people—not an individual, private desktop.

Simulation has been one of the most successful training tools thus far developed. Military uses, flight simulation, and successful popular games such as *SimCity* and *Civilization* are examples of early successes. Future learning devices are likely to include simulation and role-playing opportunities, particularly in team environments in which learners can experience the simulations together.

Random connections suggested by computers and other learners emerge as another important characteristic of learning machines. Using simple programmed randomness, computers can suggest connections between thoughts that will serve as a powerful learner brainstorming tool.

Finally, the technologies used in future learning devices are changing rapidly. However, probably the greatest need is in research on the pedagogy linked to the new technology. It is likely that evolving learning theory is the area in the future that will most impact the construction of learning devices.

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