

Media for Inquiry, Communication, Construction, and Expression

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Dewey, J. (1943). *School and society*. Chicago: University of Chicago Press.

Bruce, B.C., & Levin, J.A. (1997). Educational technology: Media for inquiry, communication, construction, and expression. *Journal of Educational Computing Research*, 17(1), 79-102.

The key to appropriate use of new technologies is understanding what they can and can't do. It is important to find a way to organize the tools, techniques, and applications to accommodate better to a constructivist and integrated view of learning. One way of organizing and thinking about educational is Bruce and Levin's (1997) framework of media for inquiry, communication, construction, and expression which builds off Dewey's (1943) four categories.

Media for Inquiry, Communication, Construction, and Expression

For Bruce and Levin, the motivation to develop a taxonomy arose in the midst of a debate concerning future directions for educational technology within their university. They were struck by the fact that forms of technology use that we considered to have excellent pedagogical potential did not fit within prevailing categories that other participants in the debate were using. Some of participants appeared to adopt a technocentric model of technology use, one that seems natural, but can in fact be quite limiting. Moreover, they sensed an implicit, but powerful behaviorist bias, even among some of those eager to embrace innovative uses of technology. This bias seemed to limit the student's role in learning with the new technologies. They also felt that in foregrounding the technology, the debate obscured the students' activities and learning, which ought to have been the central issue.

The "Interests of the Child"

In response to this debate, Bruce and Levin began to search for a way to organize the tools, techniques, and applications to accommodate better to a constructivist and integrated view of learning. They assumed that the ideal learning environment would, as Peter Marin once said, satisfy children's curiosity by presenting them with new things to be curious about. It would engage children in exploring, thinking, reading, writing, researching, inventing, problem-solving, and experiencing the world.

Thus, they argued that the basis for learning ought to be what John Dewey (1943) identified nearly a century ago as the greatest educational resource—the *natural impulses of the child*. Dewey wrote that there are four such natural impulses: to (a) inquire or to find out things i.e. *inquiry*; (b) to use language and thereby to enter into the social world i.e. *communication*; (c) to build or make things i.e. *construction*; and (d) to express one's feelings and ideas i.e. *expression*. Dewey saw these impulses, rather than the traditional disciplines, as the foundation for the curriculum. The educational challenge is to nurture these impulses for lifelong learning. As Dewey wrote:

These fourfold areas of interest--the interest in conversation, or *communication*; in *inquiry*, or finding out things; in making things, or *construction*; and in artistic *expression*--we may say they are the natural resources, the un-invested capital, upon the exercise of which

depends the active growth of the child. . . What are we to do with this interest--are we to ignore it, or just excite and draw it out? Or shall we get hold of it and direct it to something ahead, something better (p. 48)?

Bruce and Levin suggested that it made much more sense to build a “taxonomy” of educational technology based, not on a formal instructional model, nor on hardware and software features, but rather, on the “impulses” to learn and grow. Dewey’s four categories match these uses of educational technology surprisingly well.

Why think of technology as media?

In addition, Bruce and Levin wanted to emphasize the mediative aspect of technologies. That is, they view the effects of technologies as operating to a large extent through the ways that they alter the environments for thinking, communicating, and acting in the world. Thus, they provide new media for learning, in the sense that one might say land provided new media for creatures to evolve. This view of media encompasses, but extends, the familiar idea of media as a place to put information. Today, interactive, multimedia technology provides us with a new way to draw upon children's natural impulses. These new media hold an abundance of materials including text, voice, music, graphics, photos, animation, and video. But they provide more than abundance. Bringing all these media together means that we can vastly expand the range of learning experiences, opening up the social and natural worlds. Students can explore the relations among ideas and thus experience a more connected form of learning. Perhaps most importantly, these new media are interactive, and conducive to active, engaged learning. Students can choose what to see and do, and they have media to record and extend what they learn. Learning is thus driven by the individual needs and interests of the learner.

Bruce and Levin chose the term "media," rather than "tool," "program," or "application," for several reasons. They wanted to shift the focus from the features of hardware or software per se to the user or learner. "Media" suggests the mediational function of technologies, which link the student to other learners, teachers, other technologies, ideas, and the physical world. Moreover, as technologies become embedded in social practices, they tend to become invisible; they focus less on the fact that they may be consciously employed as a tool to do a task, and come to see the task itself as central, with the technology as substrate.

There is an additional reason for considering technologies as media. Learning in almost any subject today means not only learning the concepts within that area, but also, how to use technologies in that endeavor. Thus, the traditional lines between learning *about* technology and learning *through* technology are beginning to blur. For example, learning science entails learning how to use computers as media for collecting and analyzing data, for modeling phenomena, and for communicating results. For these activities, science students need experience with the technological media scientists use; they need to learn how *to think through* new media.

The Taxonomy

Combining this focus on Dewey's interests of the child with the view of technology as media, Bruce and Levin (1997) devised the following taxonomy. For each subcategory, they list several examples of existing applications that fit best in that position.

A. Media for Inquiry

According to Dewey, the child is interested in “finding things out” (p. 47). The child has not much instinct for abstract inquiry. . . .the instinct of investigation seems to grow out of the combination of the constructive impulse with the conversational. There is no distinction between experimental science for little children and the work done in the carpenter shop. . . Children simply like to do things and watch to see what will happen (p. 44). Keeping with this Bruce and Levin suggested the following examples of how one could think of media for Inquiry.

1. Theory building--technology as media for thinking.
 - Model exploration and simulation toolkits
 - Visualization software
 - Virtual reality environments
 - Data modeling--defining categories, relations, representations
 - Procedural models
 - Mathematical models
 - Knowledge representation: semantic network, outline tools, etc.
 - Knowledge integration
2. Data access--connecting to the world of texts, video, data
 - Hypertext and hypermedia environments
 - Library access and ordering
 - Digital libraries
 - Databases
 - Music, voice, images, graphics, video, data tables, graphs, text
3. Data collection--using technology to extend the senses
 - Remote scientific instruments accessible via networks
 - Microcomputer-based laboratories, with sensors for temperature, motion, heart rate, etc.
 - Survey makers for student-run surveys and interviews
 - Video and sound recording
4. Data analysis
 - Exploratory data analysis
 - Statistical analysis
 - Environments for inquiry
 - Image processing
 - Spreadsheets
 - Programs to make tables and graphs
 - Problem-solving programs

B. Media for Communication

According to Dewey, there is the social instinct of the children as shown in conversation, personal intercourse, and communication The language instinct is the simplest form of the social

expression of the child. Hence, it is a great, perhaps the greatest of all, educational resources (p. 43). This led to the following possibilities of media for communication...

1. Document preparation

- Word processing
- Outlining
- Graphics
- Spelling, grammar, usage, and style aids
- Symbolic expressions
- Desktop publishing
- Presentation graphics

2. Communication--with other students, teachers, experts and people around the world

- Electronic mail
- Asynchronous computer conferencing
- Synchronous computer conferencing (text, audio, video, etc.)
- Distributed information servers like the World-wide Web
- Student-created hypertext environments

3. Collaborative Media

- Collaborative data environments
- Group decision support systems
- Shared document preparation
- Social spreadsheets

4. Teaching Media

- Tutoring systems
- Instructional simulations
- Drill and practice systems
- Telementoring

C. Media for Construction

According to Dewey, the child's impulse to do finds expression first in play, in movement, gesture, and make-believe, becomes more definite, and seeks outlet in shaping materials into tangible forms and permanent embodiment (p. 44). Bruce and Levin suggest some examples of this...

- Control systems--using technology to affect the physical world
- Robotics
- Control of equipment
- Computer-aided design
- Construction of graphs and charts

D. Media for Expression

Combines construction and communication. Make the construction adequate, make it full, free,

and flexible, give it a social motive, something to tell, and you have a work of art (p. 44). Bruce and Levin argued that this aspect of technology has often not found the level of support that it requires but they do offer some examples of what this could look like.

- Drawing and painting programs
- Music making and accompaniment
- Music composing and editing
- Interactive video and hypermedia
- Animation software
- Multimedia composition

Conclusion

Considering technologies as media for inquiry, communication, construction and expression allows us, as educators to rethinking how we use technologies in our teaching. A particular tool is not necessarily designed for one particular purpose. Tools can, and in fact, need to be repurposed to fit the need of the moment. The idea of creative repurposing is important because most technologies that teachers use have not been typically designed for educational purposes. Technologies including standard productive or office software, blogs, wikis , and GPS systems were not designed for teachers, and as such, teachers must re-purpose them for use in educational contexts. It is through this creative repurposing of tools to meet the fundamental impulses of the learners that we can truly achieve the potential of these new media.