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Social-Cultural Perspectives of R & D in Educational Technology

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The purpose of this article is to conceptualize a research and development framework for educational technology based on social-cultural studies of the mind. In recent years, the focus of research and development in educational technology has been grounded increasingly in theoretical underpinnings such as situated cognition, distributed cognition, activity theory, and other dimensions relating to social-cultural perspectives. Fundamentally, these notions stress the tight interrelations between the individual mind with *others* and the environment or authentic context(s). These contexts include both the physical and created practices of varying communities in which activity is mediated by cultural artifacts or tools (Hung, 1999). In this vein, it is suggested that research should focus not only on the products or outcomes of learning but also on the historical and genetic processes that lead to the resultant phenomena The two fundamental premises of such social-cultural studies are:

1. Culture, though man-made, both forms and makes possible the workings of the human mind; thus, learning and thinking are always situated in cultural settings and always dependent upon the utilization of cultural resources (Bruner, 1996).
2. Since human action and learning are primarily socio-culturally situated, even when the individual sits in solitude and contemplates something, he or she is socio-culturally situated by virtue of the mediational means he/she employs (Wertsch, 1998).

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Current educational technology research from such perspectives includes: *Cognitive Apprenticeship Environments* (e.g., Brown, Collins, & Newman, 1989; Chee, 1995), *Computer-Supported Intentional Learning Environments* (e.g., Scardamalia & Bereiter, 1992), *Reciprocal Teaching Methods* (e.g., Palincsar & Brown, 1984), *Fostering a Community of Learners* (e.g., Brown & Campione, 1990), *Anchored Instruction* (Cognition and Technology Group at Vanderbilt, 1993), and others. There has also been recent emphasis on environments supporting (interdisciplinary) project work within an activity context.

One of the foci of research in the above studies would be toward understanding participants' (and not just third-person observer theoreticians' views) objects and points of view, wherein attention is not only on detailed processes but also on how these processes are situated in the context of broad patterns of activity (Bredo, 1994; Kuutti, 1996). Predominantly, process data is considered and supported by the use of varied data-collection methods. The research analysis is on holistic activity structures, focusing on non-routine authentic tasks (e.g., in mathematical problem solving), in which knowledge is socially constructed. The learning in such contexts focuses on creating and constructing knowledge through contextually embedded cognitive tools (e.g., mind-tools, epistemic structures, and planning and monitoring features) within activity structures. These tools should, in particular, support the interactional processes between teachers-students and students-students. The above perspective is congruent with *Activity Theory* (Hung & Wong, 2000; Jonassen & Rohrer-Murphy, 1999). Activity Theory is a cross-disciplinary framework for studying different forms of human practices, factoring in the processes of context as developmental processes, both at the individual and social levels, inter-linked at the same time, including the use of artifacts (Kuutti, 1996).

Using Activity Theory as a framework for analyzing the learning environment, we have the following components: subjects, community, tools, rules and procedures, division of labor, and object or goal (see Figure 1).

In any activity in which learners have to be engaged, there must be a pedagogical object or goal that can be perceived as an instructional objective, which perhaps produces an outcome, for example, in the form of a project. In the process of engaging in the activity task, there are also rules and procedures for the accomplishment of the object. These rules and procedures are for issues such as: (a) the use of the learning environment, (b) the management of the activity, and (c) the processes and products to be accomplished. The community of people that can be involved in the activity includes other students, teachers, and practitioners (Hung, 1999). Division of

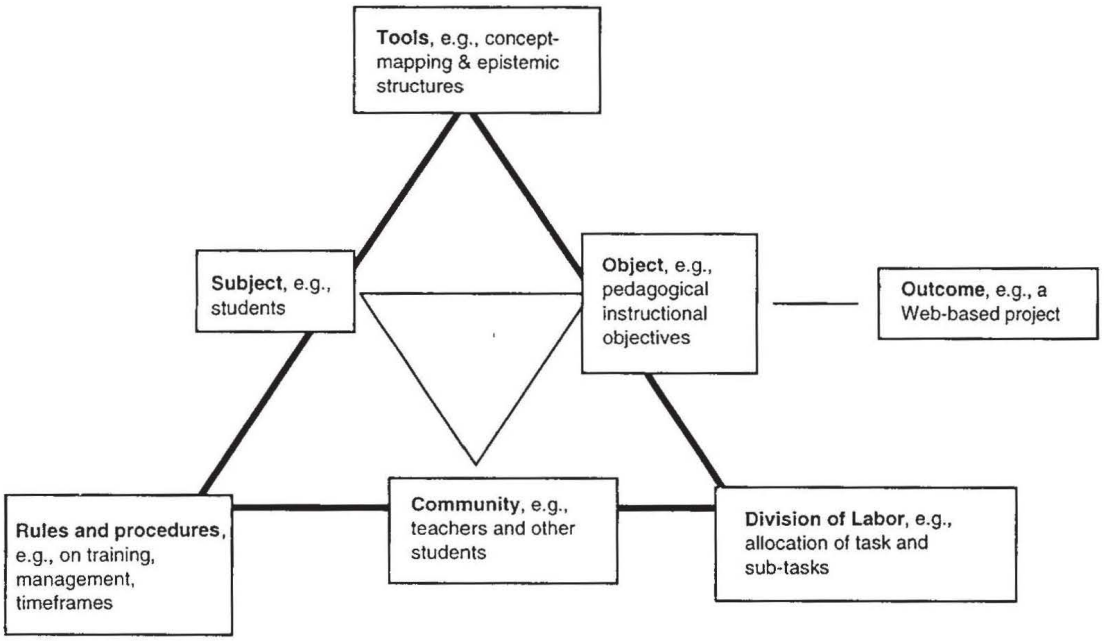

Figure 1. Structure of an activity.

labor, and process and products are considered in terms of *interaction, media, learning strategies,* and *evaluation.* Interaction is central in learning, in particular, if we adopt the perspective of situated action. Situated action models emphasize the emergent, contingent nature of human activity—the way activity grows directly out of the particularities of a given situation. In other words, situated action focuses on the moment-by-moment interactions between actors, and between actors and the environments of their action (Suchman, 1987). Media, particularly video-based technology, has an important influence on the developing child (Greenfield, 1984), and the kinds of learning strategies to be used to scaffold the child according to his/her learning abilities has been emphasized in research literature (e.g., Hedegaard, 1996). Needless to emphasize, evaluation of the above notions within the research and development framework cannot be undermined (Campione, 1996).

Based on the above framework, specific questions can be formulated as follows:

- **Pedagogy (What and Why)**
  1. What (and why) are the types of *teacher-student* and *student-student* interactions that enhance learning?
  2. What (and why) are the media types and instructional strategies that support the desired interactions?
  3. What (and why) are the instruments available to evaluate the learning outcomes of these interactions?
- **Mediational Tools (How)**
  1. How can tools support *teacher-student* and *student-student* interactions that enhance learning?
  2. How can tools be used to facilitate the strategies and delivery of the selected media to support the desired interactions?
  3. How can tools be used to facilitate and automate the application of instruments and procedures to evaluate the learning outcomes of the interactions?
- **Management and Timeframe (How and When)**
  1. How (and when) do we manage/support (i.e., rules and procedures) *teacher-student* and *student-student* interactions?
  2. How (and when) do we manage the application of learning strategies? How would the learning strategies facilitate the learning interactions and transactions?
  3. How (and when) do we plan and implement the evaluation process?
- **Roles and Training (Who)**
  1. Who are the key participants that will support and facilitate the desired interactions?
  2. Who needs to be educated and trained in the application of the selected media/environment and strategies to support the desired interactions?
  3. Who are the key agents that require training in the application of the instruments and procedures for the evaluation of the learning?

Table 1. Multi-dimensional educational technology R&D framework.

Learning Dimension	Research and Development Dimension				
	Pedagogy *Student-Tool-Object*	Mediational Tools *Rules-Tool-Division of Labor*	Management and Timeframe *Student-Rules-Community*	Roles and Training *Community-Object-Division of Labor*	Process and Products *Student-Community-Object*
Interaction Media Learning Strategies Evaluation	*What? and Why* questions	*How?* questions	*How? and When?* questions	*Who?* questions	*How?* questions

- **Process and Products (How)**
  1. How do we manage the evaluation of the learning outcomes for both processes (i.e., interactions between students, teachers, etc., through the use of media and particular learning strategies?
  2. How do we evaluate products?
  3. How do we evaluate processes and products holistically?

R & D Framework for Educational Technology

Based on the above notions, we conceptualize a multi-dimensional framework for research and development, namely considering: cognitive and socio-cognitive and broader policy (cultural) issues as these components co-exist and are interwoven within an Activity Theory perspective (Hung & Wong, 2000). Translating these components, the categories of interaction involve:

- *Student-Tool-Object Interaction*—the choice of tools and artifacts, including the choice of media-support and learning strategies in relation to the object.
- *Rules-Tool-Division of Labor Interaction*—the rules to facilitate tool use in relation to the division of labor within the activity.
- *Student-Rules-Community Interaction*—the rules which facilitate the interactions between student(s) and community, e.g., teachers and practitioners.
- *Community-Object-Division of Labor Interaction*—the division of labor which facilitates the community in achieving the object, e.g., role of teachers and students.
- *Student-Community-Object Interaction*—the dimensions of students' interaction with other students and teachers in order to achieve the object.

From these five categorizations, we denote the interactions in more general terms:

1. **Pedagogy** considerations—*Student-Tool-Object Interaction*, because this interaction concerns the goals to be achieve by whom and how.
2. **Mediational tools** considerations—*Rules-Tool-Division of Labor Interaction*, because how the tool(s) are to be used is important.
3. **Management and timeframe** considerations—*Students-Rules-Community Interaction*, because we need to understand the management, i.e., the rules, of how the learning and evaluation within the activity context is to take place and in what timeframe.
4. **Roles and training** considerations—*Community-Object-Division of Labor Interaction*, because we need to ask who is involved and their specific roles and functions; and the kinds of training requirements for the accomplishment of the object in relation to specific tasks.
5. **Process and Products** considerations—*Student-Community-Object Interaction*, because we need to ask how the process interactions are to take place in order to achieve the product(s).

The learners and the context in which they participate are considered in relation to pedagogy, mediational tools, management and timeframe, roles and training, and process and products (see Table 1).

Conclusion

This article has attempted to provide some guidelines for educators to use in exploring the feasibility of technology-oriented tools in teaching and learning based on social-cultural underpinnings, using activity theory as a framework for analysis. We hope that such a framework will provide a concrete basis for understanding the impact of educational technology tools for learning, including instructional and policy implementation issues. □

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