Activity Theory as a Framework for Project Work in Learning Environments

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Recently, researchers have argued for learning to be situated in rich contexts, because robust or useable knowledge can be appropriated by engaging in tasks and situations that are authentic (Collins, 1996). Moreover, learning which begins in rich, situated contexts can be ‘transferred’ if intentions to decontextualize or generalize the concepts or knowledge constructions across situations are made (Bereiter & Scardamalia, 1989). Authenticity in school curricula can be supported by investigations that are open-ended, with answers that are not predefined by any particular perspective or discipline. Students then can be engaged in the social construction process of knowledge. Project work can be seen as a form of open-ended contextual activity-based learning and part of an instructional process that places great emphasis on student problem solving as a collaborative effort carried out over a period of time. Blumenfeld et al. (1991) have described project-based learning as centered on relatively long-term, problem-focused, meaningful units of instruction that integrate concepts from a number of disciplines or fields of study.

Students pursue solutions to authentic problems by asking and refining questions, debating ideas, making predictions, designing plans and/or experiments, gathering information, collecting and analyzing data, drawing conclusions, and communicating their ideas and findings to others. (Krajcik, Blumenfeld, Marx, & Soloway, 1995, p. 483)

In this article, we propose activity theory as a framework for project work. Within the framework proposed, we describe learning to be the transactional process between subject, object, and community.

Activity Theory

A broad range of educational research has shown that it is not possible to fully understand how people learn or work if dimensions of context are left out (Hung, 1999). Thus, the recent motivations underpinning these studies include understanding the relations among individuals, artifacts, and social groups.

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 at the same time, including the use of artifacts (Kuutti, 1997). Activity theory originated within the cultural-historical school of Soviet psychology (Wertsch, 1981) with the ‘concept of activity’ as probably the most important concept. One of the earliest Soviet philosophers of psychology, S. L. Rubinshtein (1889-1960), noted that activity is not merely external behavior; rather, it is inextricably linked with consciousness. It is the key to understanding the relationship between consciousness and the objective world. Hence, conscious learning emerges from activity or performance, not a precursor of it (Jonassen & Rohrer-Murphy, 1999).

Following Rubinshtein’s work, we see the development of Soviet psychology from L. S. Vygotsky’s work (in the 1920s and 1930s) to the work of his students, in particular A. N. Leont’e.v. Although Vygotsky did not dwell specifically on the concept of activity in any great detail, his work had many ramifications in the theory of activity in its current form, for example, his notions of mediation by tools and signs. It was Leont’ev who developed an integrated framework for the theory of activity. Fundamentally, Leont’ev claimed that activity should be analyzed at various levels—activities, actions, and operations (the hierarchical structure of an activity). Activities are distinguished on the basis of their motive and the object toward which they are oriented; actions, on the basis of their goals; and operations, on the basis of the conditions under which they are carried out (Wertsch, 1981). Soviet psychology also places emphasis on social interaction within an activity context and the processes of internalization that take place through interaction and mediation. Through internalization, actions can become automatic and unconscious operations. Activities are thus not static or rigid entities; they are under continuous change and development.

An activity always contains various artifacts (e.g., instruments, signs, procedures, machines, methods, laws, forms of work organization) and these artifacts have a mediating role. For example, an instrument mediates between an actor and the object of doing; the object is seen and manipulated within the limitations
Figure 1. Processes within an activity.

set by the instrument or tool. In addition, artifacts are created and transformed during the development of activities themselves, carrying within them a historical culture—a historical residue of that development. Moreover, activity theory takes into account cultural factors and developmental aspects of human mental life (Bodker, 1991; Leont’ev, 1978). The various features of the ‘theory of activity’ fit together into a coherent framework when we consider that in the Vygotskian school, the notions of internalization are concerned with the process of the ability to carry out socially formulated, goal-directed actions with the help of mediating tools (Wertsch, 1981).

Following Soviet psychology, the notions of activity theory have been subsequently followed up by current researchers in Social-Cultural Psychology (for example, Wertsch et al., 1995). In addition, activity theory has also been introduced to the field of Human-Computer Interaction (for example, Bodker, 1991), Constructivist Learning Environments (for example, Jonassen & Rohrer-Murphy, 1999), and Instructional Design (for example, Wilson, 1999). These studies all emphasize the need to consider the larger context. For example, instructional designers need to understand the practitioner culture to at least some extent in order to design effective products (Wilson, 1999).

A team of people working together on a project can be seen as a basic unit engaged in an activity. The team has objectives to be achieved with certain outcomes. Within the team, the members function as a community of learners operating under explicit and implicit rules of working together, governed through some form of division of labor, and mediated by tools (see Figure 1, which is adapted from Cole & Engestrom, 1991). To reiterate, an activity is a form of doing directed at an object, and activities are distinguished from each other according to their objects (i.e., intentional objectives). Rules can include timelines and the process of how the project should be executed. Division of labor comprises the different functions and roles respective team members perform. Tools could be spreadsheets and communication devices, including paper and pen.

From Figure 1, tools can be perceived as mediating between subjects (as part of the community) and objects. Extending the notion of mediation, rules mediate between subject and community, and division of labor mediates between object and community. Rules form the basis for working between subjects in the community. Division of labor is the means through which members in the community work through the object to be achieved, which then results in an outcome. In the heart of the activity system or process, learning occurs through a dialectic or transactional interaction between subject, community, and object (see bi-directional arrows). Such a transactional process is congruent with the social construction or negotiation of knowledge (Hung, 1999). The essence of learning is seen in the transactional process undergirding social constructivism.

Project Work from a Vygotskian Perspective of Activity Theory

Vygotsky (1978, 1981) also posits that mind emerges through interactions with others and the environment, mediated by artifacts, signs, and language. In particular, through a process of internalization of external activity, artifacts affect the kinds of mental processes people develop. In other words, learning proceeds from external action to internal activity. For instance, children transact with the world without initially understanding what they are doing; however, through such a process, they gradually notice patterns in their behavior and come to understand their external activity. With this new understanding of their activity comes the internalization of that activity. Gradually children rely less on the external supports of people and objects in the world to cue their behavior as their behavior becomes directed by internal mental processes. Moreover, a child’s thought processes can go beyond those permitted by the external activity through active manipulating of the external world to support creative ways of thinking. Given the belief that the same processes underlie both cultural and individual development, social interaction is also fundamental to Vygotsky’s theory of child development.

One of the ways children interact with a world they do not understand is by mimicking or modeling mature activity, behaviors, and actions. In other words, with the aid of experts, adults, or more capable peers, children are often able to perform tasks that as individuals they would be incapable of within the stipulated Zone of Proximal Development (ZPD). The ZPD is described as the zone through which a more capable individual can help a less capable learner to
capable individuals engage in the processes of modeling, learners engage in mirroring the actions provided within particular activity contexts (Hung, 1999). Such a process could be perceived as a form of ‘division of labor’ (expert-learner) performed under specific norms or rules of working (modeling-mirroring).

From activity theory’s point of view, thought is also mediated by artifacts created and evolved within a community; hence, ways of thinking within the community are linked with the artifacts. Learners should participate in doing tasks, within the ZPD and mediated by artifacts similar to those of used by practitioners or mature individuals within the community. Learners cannot use the same artifacts as experts because they are at a different developmental level; however, artifacts modeled on expert artifacts and simplified in certain ways can mediate the development of the required skills (Bellamy, 1997). Besides using artifacts in their culture, experts actively change culture through the invention and development of new artifacts. Learners can also be enculturated so that they can participate in this process, giving them the ‘constructivist’ experience of evolving their own interpretive norms through their own cultural designs.

Artifacts could be in the form of presentations, written documents, progress reports, models, pictures, etc. The main point is that learners should be constructing their own artifacts and sharing with their community; that is, modeling after the kind of activities practiced in the ‘real community.’ The (simulated) community of practice provides the context and scaffolding mechanisms where modeling and coaching can take place. Importantly, the learner must be willing to submit to the tasks and actions required of him or her (Hung, 1999). In such situations, beginners move from peripheral participation in an activity to central participation within the community.

Based on the above notions of activity theory, students work together in small groups to solve authentic problems in project collaboration with other students and more capable individuals where interactions and transactions within zones of proximal development can be established. Experts should be available to talk to students and their interactions mediated by technologies such as emails, forums, and knowledge representational tools. These representational tools can include visualization and simulation functions, concept mapping, and other scaffolding mechanisms where transactions of knowledge can be fostered. More capable individuals can act as coaches or facilitators to the group of students, where they also aid in giving students feedback of their progress. Forms of self-evaluation and peer-evaluation methods can also be infused. Much emphasis has been on modeling expert behaviors; however, we are also advocating that learning should also model after activities and practices within real-life communities (the context).

Fundamentally, activity theory provides a framework for project work where learners and experts can work together, establishing shared knowledge, in authentic tasks through the use of appropriate technologies, learning resources, and tools. When learning resources are made available through computer-mediated networks, students have to make wise decisions to use these artifacts to support their own learning. In such contexts, learning is less traditional than in teacher-centered instruction; rather, students look to teachers for direction (Wilson, 1999). Work within these project teams should mirror the kinds of activities, as far as possible, seen in real-life practices. Basically, such efforts are to enculturate learners into activities that ‘real-life communities’ engage in. Through such a transactional process, learners acquire personal ‘robust’ knowledge, producing outcomes of significance.

Design of a Prototype for Web-Based Project Work

In our efforts to promote project work online using Web-based technologies, we have designed an environment in which students would work in teams engaged in solving real-life problems. Such a system would comprise the following activities:

Registration/forming of project teams. This can be facilitated via the Internet, linking participants internationally. Each team could consist of students (locally or internationally), a teacher facilitator, and experts from post-secondary institutions or industries. With the formation of such teams, zones of proximal development can be created, because team members have varying capabilities. The roles and responsibilities of each of the team members must be made clear to everybody involved. This registration stage reflects the mediational process of “division of labor” to be formalized within the activity context.

Project information/procedure scheduling. This stage requires students to engage in planning, brainstorming, literature search, data collection, consolidation, evaluation, and reporting. Timelines, scaffolding procedures, and report-writing templates are provided for their use. They are required to abide by the timelines and to submit progress reports of their work in the form of charts, thinking logs, meetings, and discussion notes. Within this stage, the assessment methods are also included and made transparent to the students. They will be assessed via the overall marking scheme, matrix assessment, peer evaluation, teacher evaluation, and assessment of the written report and oral presentation. We aim that these processes model the kinds of activities in which real communities engage. The above tasks reflect the mediational process of “rules” for the activity context.
INTERDISCIPLINARY PROJECT WORK
A pilot project by the National Institute of Education

PROJECT INTRODUCTION
Title
To study the feasibility of online elections in Singapore

Subject Areas
History, Civic, Mathematics, Technology, Sociology

Introduction
At the end of the project, teams are required to conclude favourably or unfavourably on the feasibility of online elections in Singapore.

Resources
The Singapore Centre for Teaching Thinking

Assessment
Overall Scheme
Matrix
Evaluation
Peer Evaluation
Supervisor
Evaluation
Report & Presentation

Online resources provision. Resources include thinking tools that assist students in problem solving. Web links for the project, and forum and chat facilities for students to communicate among themselves and with teachers and experts. In essence, these tools must facilitate students' thinking and meaning-constructions. By thinking tools, we mean epistemic structures supporting students' thought processes. Epistemic structures assist students to think along certain perspectives of meaning construction. Hence, through the use of tools that allow powerful representations and communications to take place between novices and experts, transaction in learning can be better facilitated. The above resources reflect the mediational process of "tools" in the activity context.

As students, teachers, and experts work together in project work, each with his or her specific functions of problem solving, facilitating, and providing expert advice, students have the opportunity to 'mirror' the processes 'modeled' by more knowledgeable individuals (Hung, 1999). As communication is made through words and graphical representations, thought processes are made visible for 'modeling-mirroring' to occur. Each project work team becomes a small community within the larger community of teams, each working on its project. Through the Internet, these individual teams can communicate and share knowledge. Figure 2 shows a screen capture of the Web-based system developed. The project as shown centers around an authentic task spanning knowledge from different disciplines.

Conclusion
In conclusion, we recognize that project work provides an excellent platform for our students to
improve their thinking abilities and life-long learning traits. Activity theory provides a holistic framework for students to engage in activities authentic to real-life practices. Activity theory admonishes us to focus not only on the design of ‘tools,’ but also on how to craft the ‘division of labor’ to facilitate learning and formulate ‘rules’ for reaching instructional outcomes. The kinds of collaboration between novices and experts and tasks individuals have to be engaged in reflect what real practitioners do in any community. We hope that in the process of engaging in project work, the transactional processes of learning can be fostered.

To reiterate, there has been a lot of work done on the design of tools or technologies for meaningful learning. Unless due consideration is given to the other mediational components of an activity system, our design considerations of the learning context may be incommensurate.

References


