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AUTHOR Orey, Michael A.; Nelson, Wayne A.

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ABSTRACT

The characteristics and elements of situated learning are described, along with some approaches that use this perspective. Situated cognition proposes a radically different explanation of learning that conceives of it largely as a social phenomenon rather than a process occurring within the mind of the individual. Situated learning requires essential actors and participatory relationships beyond those common to current educational practices. Situated cognition suggests that knowledge is a relation between an individual and a social or physical situation. A growing body of evidence suggests that knowledge acquired in specific situations is more powerful and useful than so-called general knowledge. One of the most widely discussed features of situated cognition is the notion of cognitive apprenticeships as a way for learners to become participants in a community of practice. Implementing cognitive apprenticeships or integrating situated learning in any aspect will not be easy. It will require redefinition of instruction and the development of tools and environments that support communication and collaboration among learners and experts. (Contains 30 references.) (SLD)

Title:

Situated Learning and the Limits of Applying the Results of These Data to the Theories of Cognitive Apprenticeships

Authors:

Michael A. Orey
Department of Instructional Technology
The University of Georgia
Athens, GA

Wayne A. Nelson
Department of Educational Leadership
Southern Illinois University at Edwardsville
Edwardsville, IL 62026

In this paper, we try to describe in detail the characteristics and elements of situated learning. We then describe some of the manifestations of instruction that are intended to exploit this perspective. Strengths and weaknesses of these perspectives will be described in the context of the data presented in support of situated learning theories. While providing provocative alternatives to current conceptions of learning, we conclude that it may not be possible to integrate notions of situated learning into instructional design as currently practiced.

Situated Cognition: Alternative Conceptions of Learning

Situated cognition proposes a radically different explanation of learning, conceiving it as a largely social phenomenon. Rather than occurring within the mind of the individual, learning is instead described as a characteristic of many social interactions that take place within a framework of participation (Hanks, 1992). Increasing participation in "communities of practice" has the effect of engaging the whole person, focusing on "ways in which it [learning] is an evolving, continuously renewed set of relations" (Lave & Wenger, 1991; p. 50). Indeed, from the perspective of situated cognition, learning requires a rich repertoire of essential actors and participatory relationships beyond those common to education and training as now practiced. Situated cognition also proposes a different location for knowledge, and a different philosophy of knowledge in the learning process, along with an emphasis on legitimate peripheral participation in social groups that is characteristic of learners in a variety of settings and cultures.

Situated action

Theories of situated cognition take the view that human activity is complex, involving social, physical and cognitive factors. Proponents of these theories believe that rather than acting on symbolic representations of the world that are located in the mind, we are in direct contact with the environment. Cognitive representations only become necessary when normal, situated activity fails (Dreyfus & Dreyfus, 1986; Greeno, 1989; Winograd & Flores, 1986). Suchman (1987) describes two types of activity in which humans engage: ad hoc improvisation during action and representations of action as plans or retrospective accounts. Situated action is not driven by plans, or in other words, humans "do not anticipate alternative courses of action, or their consequences, until <u>some</u> course of action is already underway" (Suchman, 1987, p. 52).

For example, suppose we wanted to build a robot to navigate the rocks, boulders, and craters of Mars. We have two basic approaches. In the first approach, we can build a robot with an "intelligence" based on the computational metaphor of the mind. The robot would utilize video input devices to view the terrain, convert the input into symbols used by the on-board computer to recognize patterns in the terrain, then carefully compute plans about where to move next (e. g., which leg, how far, what angle, etc.). In the second approach, we could build a robot that had "mini-intelligent" legs and arms that could automatically sense the changes in terrain and adjust to the undulations each leg might encounter. Its actions would be situated in the context of walking on Mars, and it would only need to stop and "plan" if it encountered a vertical wall, a canyon or some other obstacle that caused its "mindless" functioning to stop. The outcome of purposeful, goal-directed behavior has seemingly been achieved by each robot, the former using symbolic computation methods, the latter by situated action.

As a more realistic example, consider Lave's (1988) systematic examination of the nature of situated mathematics as a part of the Adult Mathematics Project. One of the most commonly reported anecdotes from her work is the description of a man who is implementing a diet program and trying to cut his intake of food by three-fourths. One of the items he needs to use in a recipe is three-fourths of two-thirds of a cup of cottage cheese. Instead of selecting the appropriate school-based algorithm and performing the necessary calculation to determine the appropriate measurement, the man uses a somewhat "unorthodox" approach. He measures two-thirds cup of cottage cheese, empties the contents of the measuring cup on the counter, shapes the substance into a pie-shaped pile, cuts it into quarters, and removes a quarter section. The man's actions are situated, in the sense that he employs a procedure that is largely based on the context of the situation, even though it reflects some school-based knowledge (e. g., a circle represents the whole, divide the circle into equal fractional portions, etc.). If there were many of these calculations, the man's problem-solving strategies might change to a more efficient approach that incorporates some form of planning -- perhaps he might even choose to use an algorithm. But, this change in strategies would only occur after the man stopped his situated action in order to reflect on the situation so as to develop a more efficient plan of action.

Schon (1983) has extended the notion of situated action to include an important additional characteristic; that practitioners often reflect on their situated action in order to deal with some troublesome phenomenon of the situation. For Schon, knowledge is "ordinarily tacit, implicit in our patterns of action and in our feel for the stuff with which we are dealing. It seems right to say that our knowing is in our actions" (p. 49). As practitioners become more experienced, this tacit knowledge increases in its complexity and usefulness, but all practitioners still experience problems in which it is necessary to cope with divergent situations where their situated actions are not effective in solving the problem. In these cases practitioners employ reflection-in-action to construct new ways of framing the problem so that situated action can resume. Studies of practitioners in a variety of domains, from design to psychotherapy to town planning, reveal practices that alternate between situated action and reflection-in-action. If such behavior is characteristic of practitioners, it may be advantageous to encourage learners to adopt similar behavior when learning to solve problems.

Assumptions about Knowledge

The nature and role of knowledge in the learning process is challenged by situated cognition. Rather than viewing knowledge as internal to the mind, situated cognition suggests that knowledge is a relation between an individual and a social or physical situation. Greeno (1989) explains that such a conceptualization is "..analogous to the concept of motion in physics. The velocity and acceleration of an object in motion are not properties of the object itself, but are properties of a relation between the object and a frame of reference" (p. 286). In fact, the objective nature of knowledge has been questioned by many in the social sciences with some suggesting that there may be no "right" way to represent knowledge or structure content (Wilson & Cole, 1992). The view offered by Suchman (1987) is that the common practices of participants in social situations are the source of an individual's knowledge structures and rules governing her or his behavior. Objectivity is accomplished through "systematic practices, or members' methods for rendering our unique experience and relative circumstances mutually intelligible. The source of mutual intelligibility is not a received conceptual scheme or a set of coercive rules or norms, but those common practices that produce the typifications of which schemes and rules are made" (pp. 57-58).

There is a growing body of evidence, much from the study of learning of mathematics, suggesting that knowledge acquired in specific situations is more powerful and useful than so-called general knowledge that is often decontextualized and represented in abstract structures that cannot be applied in specific situations. This idea manifests itself in the phenomenon that many people's mathematical constructions are independent and quite different from the mathematics that people learn in schools. One of the most often cited studies in this regard is the Carraher, Carraher, and Schliemann (1985) study of children's mathematical abilities in the streets of Brazil. These children were able to perform complex mental arithmetic in the context of street vending in their parents' stands. However, given pencil and paper in the classroom, these same children were unable to perform even the most simple calculations. Further, when the arithmetic problems were stated in terms familiar to the children, they were still unable to perform the calculations. Even though the study may be somewhat flawed due to the mixing of ethnographic methods with quantitative analyses, the results remain compelling.

Saxe (1989) suggested that these children had certain limits in their ability to perform the school-based tasks, specifically that the children in the Carraher, et al., study had little or no school-based mathematical knowledge (orthographic mathematics). Saxe argued that the differences would disappear if the children had more prior knowledge of school-based learning. Working with the Carrahers in Brazil, Saxe carried out a similar study using children who were street sellers, urban children from the same community who were not involved in street selling, and a group of rural children with limited exposure to currency and transactions with currency. The latter two groups were matched with the sellers on age and school background. Performance on the orthographic problems was clearly related to educational background. Those students with less than a third grade level of education correctly solved 40% of the problems, while children with more than a fourth grade level solved close to 90% of the problems correctly. In analyzing strategies, the children with more schooling tended to make use of school-based algorithms in the context of the street calculations. Apparently, it is not that cognition is situated, but that the greater the knowledge of school-based mathematics, the more likely a person will use school-based knowledge in other contexts.

Does the knowledge gained in the street transfer to the school? In the Saxe (1989) study, second and third grade sellers' and non-sellers' performance on school-like computations and word problems revealed that second-grade sellers performed better than the second-grade non-sellers. This result was attributed to the fact that the second-grade sellers used strategies that were very much like those used in selling candy in the street. By the third grade, the non-sellers caught up to the sellers; however, the sellers still used many of the strategies they learned in the street, while the non-sellers continued to use their school-based knowledge. The results suggest that the extent to which mathematical knowledge is situated is much less than that suggested by the Carraher, et al. study. Apparently the better a child can use school-based knowledge, the more it can be used in other situations, and knowledge that children acquire outside of school can be used in school to some extent. The degree to which this knowledge is ultimately useful, however, will certainly be dependent upon the contexts for learning provided in the schools.

Shirley Brice Heath (1983) conducted an extensive ethnography in Appalachia that focused upon three different communities; its purpose was to better understand how learning was valued in the institutions within these communities. After determining the kind of knowledge and abilities that were valued within the three communities, school-based programs were designed to take advantage of cognitive abilities and remediate cognitive weaknesses. The instructional interventions were quite successful, focusing on the knowledge utilized in the community domain and how the knowledge within the school domain could be made to correspond to the community knowledge. In order to help learners to find these correspondences, a variety of translation processes were used. For example, community verbal knowledge largely consisted of opinions, sayings, proverbs, and the like. The corresponding verbal knowledge in school was predominantly written, consisting of facts, scientific principles, scientific methods and the like. Translations would require the specification of gaps between knowledge types and identification of common elements. This explicit activity helped learners see the utility of both forms of knowledge. Furthermore, many of these activities brought the community into the classroom, meaning that many family and community members participated more fully in the education of the children.

Clearly, this method has broader social aspects. The increased involvement of significant others in the schooling process increases the motivation of the learners, helping them to see the importance of schooling. If it is important for a parent to come to class, then the information that is being learned there perhaps has some merit. Given the above evidence, it becomes apparent that knowledge is acquired in both formal and informal ways, and that these types of knowledge can interact through purposeful activities that are designed to take advantage of the strengths of one or the other knowledge types. It may also be concluded that all knowledge is not necessarily situated, as advocated in the radical view of situated cognition. Formal knowledge can be used in an informal context if the formal knowledge is understood well enough. The question is, is school-based knowledge distinct from situated knowledge? The evidence suggests that there is overlap and interaction.

Characteristics of Situated Learning

Learning requires more than just thought and action, or a particular physical or social situation, or just receiving a body of factual knowledge; it also requires participation in the actual practices of the culture. Adopting a relational view of knowledge and situated activity changes the focus of the analysis of learning to characteristics of social participation in communities of practice. Lave and Wenger (1991) suggest that participation is a key element, requiring negotiation of meanings in various situations, with the result that "understanding and experience are in constant interaction" (p. 51-52). As discussed below, a variety of approaches to the design of environments that promote the processes of situated learning have been developed.

Cognitive Apprenticeship or Legitimate Peripheral Participation?

One of the most widely discussed features of situated cognition as it was originally proposed is the notion of cognitive apprenticeships as a means for learners to become participants in communities of practice. As described by Brown and his colleagues (Brown, Collins & Duguid, 1989; Collins, Brown & Newman, 1989), cognitive apprenticeships provide a general framework with four components -- content, methods, sequence, and sociology - for designing learning environments. Content includes domain knowledge, heuristic strategies, control strategies, and learning strategies, all of which are well explicated in the literature on cognitive learning theories and instructional design. Methods refer to teaching methods, including modeling, coaching, scaffolding, fading, articulation, reflection, and exploration. Instructional sequence includes notions such as increasing complexity, increasing diversity, and global before local skills. Sociology, the only category that seems to have emerged directly from theories of situated cognition, includes five aspects: situated learning, culture of expert practice, intrinsic motivation, exploiting cooperation, and exploiting competition. Motivation, cooperative learning and competition have each played a role in the design and development of instructional systems for some time. That leaves only the first two as something to be incorporated into our design models. The second, the culture of expert practice is actually something that should always be examined in instructional design. Part of the analysis phase of design is to determine the tasks to be performed and how they are performed, including the devices that are employed and the skills required to use such devices. The only difference is that Collins, et al. argue for a fairly "rich" analysis that incorporates many subtle aspects of the culture, including all of the various nuances of communication that occur in expert practice. Rather than taking the final aspect, situated learning, to mean that the knowledge ought to be situated within the context in which it exists, Collins, et al. imply that knowledge can be situated if it is acquired in the process of learning-by-doing. If learning involves some activity encompassing the to-be-learned knowledge that requires the active participation of the learner, then according to Collins, et al., this knowledge is situated.

It is curious that the only element of the Collins, et al. model that directly relates to situated cognition is a distinct component. Rather than trying to integrate situated cognition into a model, it is left as a separate component. The use of the term apprenticeship has also been criticized because the characteristics of master-apprentice relationships in many cultures may represent too narrow a view of situated learning. Lave and Wenger (1991) prefer to describe the central concept of situated learning as legitimate peripheral participation, in order to promote a decentered view of learning that shifts analysis away from the notion of "master as locus of authority" to an analysis of "the intricate structuring of a community's learning resources" (p. 94). The notion of legitimate peripheral participation differs from cognitive apprenticeships in several ways, not the least of which is that the terminology does not include the social connotations commonly associated with the word apprenticeship. For Lave Wenger, learners must be "legitimate members of the community, not passive observers, and their activities must be performed in the context of the work of the community. "Peripheral" participation refers to the fact that by their nature as novices, learners cannot be full participants in all community activities, but at the same time they must be recognized as participants in some aspects of the work of the community. There should be time to learn, and to discuss ideas with peers and old-timers. The old-timers should not be threatened by the potential of the newcomer, but should be in a position to offer the best of their knowledge and skill. "Participation" means apprentices (newcomers) should be doing the thing that they are learning to do, not just observing.

Lave and Wenger suggest that legitimate peripheral participation is the mechanism of enculturation for a learner that includes relationships between apprentices and masters, but also includes all of the other participants, skills, artifacts, symbols, and ideas that are part of the culture of practice. As a result, their study of legitimate peripheral participation focuses on that form of social participation which includes learning as a necessary component. Learning as a characteristic of social interaction cannot be extricated from its legitimate context. Unfortunately, legitimate peripheral participation is not an instructional method. Rather, it is a lens for viewing and understanding learning in new ways.

Patterns of Situated Learning

Legitimate peripheral participation serves to help learners develop a holistic view of what the community of practice is about, and what there is to learn within that community. Opportunities for learning are structured by the requirements of work, rather than teacher-student relations. In fact, Lave and Wenger (1991) note that in many situations apprentices learn mostly from other apprentices. For example, among Liberian tailors learning their trade (Lave, in preparation, as cited in Lave & Wenger, 1991), much of the communication of technique comes from more experienced peers. The old-timer (master) mainly serves as a model for the ideal professional in the field performing the daily duties, and only to a lesser degree does the master provide formal instruction. What they also learn is how to talk within the community. The shared practice within a community includes both "talking within" to share information about ongoing activities, and "talking about" through stories that support "communal forms of memory and reflection" (p. 109). The case of the "nondrinking" alcoholics (Cain, in preparation, as cited in Lave & Wenger, 1991) demonstrates that the role of language in situated learning does not just contribute to the development of complex skills. Predominantly, the learning activities employed in the Alcoholics Anonymous organization are based upon language, in the form of public speaking to groups and writing in newsletters. Older members adapt their personal story telling to the experiences of newcomers, while newcomers learn to construct personal stories from the models that are provided.

Lave and Wenger (1991) also suggest that learning in communities of practice is not highly structured and sequenced, but rather "unfolds in opportunities for engagement in practice" (p. 93). There are no rules dictating what should be learned, or when it should be learned. Opportunities to learn are mainly improvised from the situation at hand, following a curriculum that includes the resources of everyday practice. Mayan midwives (Jordan, 1989, as cited in Lave & Wenger, 1991) do not provide any explicit instruction at all. In fact, the midwives report that much of their knowledge comes to them in dreams. The data indicates that they actually learn their profession by observing the practices and participating in increasingly complex practices from a very young age. U.S. Navy quartermasters (Hutchins, in press, as cited in Lave & Wenger, 1991) stated that they preferred apprentices (newcomers) who had not received the traditional classroom instruction prior to coming on-board, because it took more time to correct this erroneous learning than it did to work with someone who knew little or nothing. Also, while there was some "traditional" instructional materials (workbooks) on board, most of the learning occurred in the context of the actual operation of the ship. Newcomers were to perform increasingly more complex tasks in a spiral curriculum that included previously learned tasks. These tasks were performed under the constant guidance of the old-timer, who would correct errors or take over the task if needed. The case of the Liberian tailors (Lave, in preparation, as cited in Lave & Wenger, 1991) again confirms that curriculum can emerge from the practice of formal apprenticeships. The situations involving the Mayan midwives and the Navy quartermasters were not strictly defined as apprenticeships, but the Liberian tailors entered into a formal contract with the old-timer. An interesting attribute of the tailors' learning is that the curriculum is reversed. Rather than beginning with the initial steps in the procedure of making clothes, the apprentices begin at the end, working on finishing touches first in order to observe the quality of workmanship and models for the finished product. In all of the cases cited here, curriculum is situated in practice, and cannot be "considered in isolation, manipulated in arbitrary didactic terms, or analyzed apart from the social relations that shape legitimate peripheral participation" (p. 98).

Structuring Learning (Instruction?) from a Situated View

As mentioned above, the descriptions of learning provided by theories of situated cognition are based upon assumptions about learning that are vastly different from those embodied in current instructional design models. Several general principles have been suggested that can guide instructional designers in the development of strategies to facilitate situated learning. For example, the Cognition and Technology Group at Vanderbilt (1992) suggests that "students need to engage in argumentation and reflection as they try to use and then refine their existing knowledge and attempt to make sense of alternate points of view" (p. 67). They emphasize that instruction should be "anchored" in meaningful contexts that allow situated learning to be simulated in classrooms (Cognition and Technology at Vanderbilt, 1991). In this way, environments can be designed that allow "sustained exploration" of the various aspects of a problem, helping students to "understand the kinds of problems and opportunities that experts in various areas encounter and the knowledge that these experts use as tools" (Cognition and Technology Group at Vanderbilt, 1992, p. 67). This sustained exploration can also be facilitated by technology, as in the approach to developing cognitive flexibility suggested by Spiro and his colleagues (Spiro, Feltovich, Jacobson, & Coulson, 1991; Spiro & Jehng, 1991). In this application, learners examine various cases or scenarios from many perspectives, assisted by the rapid and efficient access to information provided by hypermedia technology. Rieber (1992) echoes these suggestions in discussing guidelines for designing computer-based microworlds. He advocates the design of meaningful contexts that support self-regulated learning, establishing a spiral curriculum, and nurturing incidental learning.

As noted above, one area that will require extensive consideration in designing environments based on principles of situated learning is the amount of control that is provided to the learners. Current models of instructional design tend to assume a great degree of control for the teacher (or the "system") with respect to sequencing, strategies, questioning, etc. Tobin and Dawson (1992) note that this problem leads to a "dysfunctional learning environment" in which learners have "little autonomy, and hence lose interest in the curriculum" (p. 91). Several alternative approaches to teaching have been cited as examples that better support situated learning. One example is Schoenfeld's (1985) approach to mathematics instruction, in which the teacher explicitly models problem-solving strategies to the students, and students are given chances to generate their own problems. Reciprocal teaching (Palinscar & Brown, 1984) is another approach in which control of the learning activities is given to the learners. In this method, small groups of learners assume roles including "teacher", "critic", and "producer" in the process of comprehending written passages. Control of learning activities and communication among learners also can be encouraged with technology, as in the Computer-Supported Intentional Learning Environment (CSILE project described by Scardmalia and Bereiter, 1991). At a school where CSILE has been tested, children of varying grade levels share ideas, criticisms and explanations over a computer network, reflecting characteristics of the legitimate peripheral participation discussed earlier. In these and many other similar cases, the role of the teacher seems to be more like "Yoda" from the "Star Wars" trilogy, rather than "Professor Kingsfield" as depicted in the television series "Paper Chase". Learners are in control, while the teacher serves as a model and facilitator rather than directly controlling the learning process.

Conclusions

After careful consideration of the data cited in support of situated learning, it is evident that integrating the principles of learning suggested by the proponents of the theory into current instructional design practice will not be easy. In fact, we agree with Brown and Duguid (1993) that what is necessary is a complete redefinition of instruction and teaching. There are just too many problems involved in trying to make explicit the knowledge of experts, to abstract that knowledge, and to communicate the knowledge to novice learners. In the end, we are left with the question of whether there can be an instructional theory based on situated cognition, and what the role of technology might be in such a theory. It is apparent that we need to focus efforts on the development of tools and environments that support communication and collaboration among learners and experts, as has been successfully demonstrated in the examples cited above. Beyond that, perhaps Tripp (1993) is correct: we should build and test the artifacts before we formulate the theory.

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