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Author(s)	Peggy Pang and David Hung
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Activity Theory as a Framework for Analyzing CBT and E-Learning Environments

Peggy M. N. Pang
David W. L. Hung

Introduction

In the last two decades, we have seen a proliferation of computer based training or instruction through different forms of information technology (IT) media. These instructional resources include traditional drill and practice applications, tutorials, and simulations. More recently, we have also seen IT used as mind-tools to assist, extend, and complement human cognition. Of late, we have also witnessed the advent of computer-supported collaborative learning environments with tools embedded within these environments supporting shared cognition. The Internet has recently opened up more possibilities for global collaboration. In addition, it has also enabled resources and other forms of learning materials to be delivered at one's own desk in the workplace. While more traditional forms of instructional media, such as CD-ROMs, are characterized in terms of individual self-paced learning, e-learning environments through the Internet open up the possibilities of both individual and social forms of learning.

Instructional designers who have experience designing both computer-based training (CBT) materials using CD-ROMs and e-learning applications in which instruction is delivered using either intranets or the Internet will realize that there are significant differences in these two delivery platforms. This article attempts to describe the differences between traditional CBTs and e-learning environments using the principles of *Activity*

Peggy M. N. Pang is a Master's student at the National Institute of Education in Singapore (e-mail: peggy@icus.net). David W. L. Hung, a Contributing Editor, is with the National Institute of Education's Instructional Science Academic Group (e-mail: wldhung@nie.edu.sg).

Theory as described in the next section. In essence, an e-learning environment developed on the principles of Activity Theory characterizes the workplace because it provides a contextual-community perspective that is lacking in traditional CBT design.

Activity Theory: Contrasting both E-learning and CBT Environments

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 tools and artifacts (Kuutti 1997). An "activity" is undertaken by human actors motivated towards an object (or goal) and mediated by tools and the community. Activities are distinguished from each other according to their objects. It is the transformation of the object into an outcome that motivates the execution of an activity (Hung & Wong, 2000). See Figure 1. In essence, *tools* mediate the processes between subject and object; *rules* mediate the processes between subject and community; and *division of labor* mediates the processes between community and object. In other words, tools are used by subjects to achieve an object; there need to be rules set up between subjects and the other members in the community in order to achieve the goals; and between members of the community, there needs to be a division of labor in order to achieve the object.

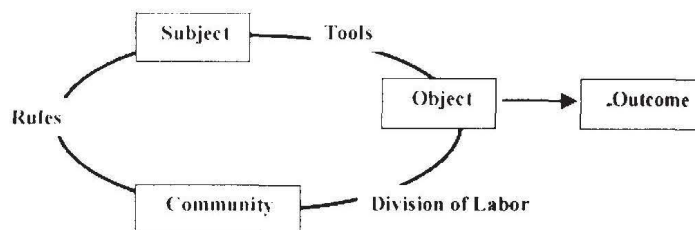


Figure 1. The structure of an activity.

In the design of an e-learning environment, the subject will be the target learners identified for the application. They will be engaged in learning the skills and knowledge (object) with the tools (such as e-mail, notepad, bulletin board) in a community of practice (comprising peer learners, colleagues, expert workers and external subject matter experts). In the process of acquiring the relevant skills and knowledge, there are rules to be learned and adhered to (such as the composition of non-offensive messages), including the

various actors (besides the learners, other main actors are the online instructors, expert workers and external subject matter experts) who must play their part well (division of labor) for the learners to have a meaningful and memorable learning experience.

On the other hand, in a CBT application, the community of practice is commonly limited to peer learners. Since CBTs are usually meant to be self-directed and self-paced modes of instruction, there may not even be a well-defined community of practice. Tools commonly employed in CBTs include a notepad and generic electronic performance support tools such as a calculator or a glossary. Communication tools are not usually used for such environments, since CBTs are primarily self-contained and not networked. In a CBT environment, rules to be designed are restricted mostly to that of navigation. The learners are the main actors. Once the CBT application is developed, the expert workers are not required anymore and learners will learn independently without any online instructors. The fundamental principle undergirding CBTs is to extract experts knowledge and program it into the application.

With a brief explanation of the 'subject' and 'outcome' that are applicable to the design of both CBT and e-learning application, the rest of this article focuses on the considerations for the principles that are more applicable to designing an e-learning environment.

Processes in Activity Theory to Be Considered for E-Learning

Community

Learning is a social act. A workplace is a place where skills and knowledge are applied. It is also a social place, since no one in an organization works in isolation. Thus, it makes sense that workplace learning is social, since the skills and knowledge are learned and applied in an environment of collaboration, coordination and negotiation. Although the acquisition of information may be done individually, knowledge is created from the social context of peers, managers, and customers. Feedback on the appropriateness and effectiveness of their knowledge and skill is commonly received (Brown & Duguid, 2000). Learning occurs most effectively within communities that have developed trust, shared understanding of problems, and a language to communicate solutions. Such learning communities therefore provide a social environment with rich learning resources and opportunities. Thus, in the design of an e-learning environment, learning communities should be identified and capitalized upon.

According to Etienne Wenger (1998), a learning community would comprise the following dimensions:

1. *Language*, including the documents, images, and symbols that employees use to

communicate with each other about their work (such as the terminology that sales representatives use to describe various types of customers).

2. *Tools* that employees use to get the work done (such as sales call forms, order forms, customer lists).
3. *Explicit roles, procedures, and regulations* that define how employees do their work (such as the steps that a sales representative needs to take to fulfil a customer order).
4. *Implicit behaviors and unstated rules of thumb* that make the culture of the workplace unique (such as the "unwritten agreement" that the company's sales representatives will not make negative comments about competitors in front of a customer).

A workplace learning community includes all the formal information that might be conveyed in a classroom course as well as all the social nuances that make information work on a daily basis. What a learning community provides and many formalized education experiences do not is context—that is, real workplace problems involving real relationships and real reactions in real time. Since the Web can be used within a real-time environment, we can use it to create or enhance the informal shared learning that is already happening in the communities in the workplace.

How then do we make use of the concept of 'community' in an e-learning environment? An e-learning environment can include the following ideas:

1. *Collaborative projects* should be included as an essential feature of e-learning. For instance, novice sales representatives can collaborate in producing a sales proposal to sell a new product to a potential client. The regional sales manager is then brought in to give his expert views on the proposals submitted online. Constructive feedback as to what has been done right and what needs to be improved in such work collaboration processes can be given to the learners. Transfer of the skills and knowledge learned will also be facilitated, as the assignment given is not decontextualized and separated from the work environment—preparing a 'winning' sales proposal is one of the key competencies of a successful sales representative.
2. *Through tutoring and mentoring* by experts, novices are brought to a higher level in the zone of development (ZPD). The zone of proximal development defines those functions that have not matured yet but are in the process of maturing and developing. In essence, the ZPD is defined as the distance between the actual development level as determined by independent problem solving and the level of potential as determined through problem solving under

adult guidance or in collaboration with more capable peers (Vygotsky, 1978). According to Vygotsky (1981), collaboration with other humans create zones of proximal development of individuals, enabling them to go beyond their current capacity through the construction of new mediating tools and signs.

3. *Multiple perspectives* can be introduced by including moderated discussions on a workplace problem; for example, the issue of how to improve the morale of the sales representatives. Such discussions provide a good platform for both learners and sales representatives to work together to solve a real problem. Participants will be motivated, since the problem is relevant and they have a personal interest in ensuring that it is appropriately solved.
4. *Learners should be encouraged to continue contributing to the learning of other learners.* For instance, learners are given access to participate in the threaded discussion on the bulletin board even after they have completed the formal e-learning course. The ability to continue to participate and contribute serves as a basis to sustain a community. In the process, comments about the adequacy and relevance of the content and assignments given can be collected and considered for the improvement of the e-learning environment. The knowledge base of the learning community which captures the explicit and tacit knowledge of its members is thus constantly improved and expanded upon.

Object

'Object' is defined as the content knowledge and skills that the learners will act upon or learn in a CBT or in an e-learning environment. Such knowledge that the learners act upon is not synonymous with *information*, as the objective of an instruction is to equip the learner with certain knowledge and skills, not simply to inform. Thus, it is no mean task to plan and design instruction that will bring about effective learning. There are also distinct differences in content design and presentation for CBT and e-learning environments. For instance, with the use of technology, content can be personalized and the community of practice can be capitalized upon in e-learning environments. The following are some factors that the instructional designer has to consider and manage to ensure that the application will result in positive learning and transfer of skills and knowledge to the workplace:

1. *Center of Knowledge and Learning.* Is the content in the environment really adequate and relevant? In the design of CBT, the instructional designer works closely with the instructor or subject matter expert to determine the content to

be learned. The instructor or subject matter expert is therefore the center of knowledge and learning. He or she decides what is to be learned and how it is to be learned. On the other hand, in an e-learning environment, the learner group is connected via either the intranet or Internet. These learners are able to tap the expertise and knowledge of the community of practice as well as searching for the required information and resources on the Internet. The learner group therefore becomes the centre of knowledge and learning, instead of the instructor or Subject Matter Expert (SME).

2. *Motivational Components.* Does the environment engage the learners through novelty, humor, adventure, or some other element? The model of situated cognition is based on the notion that knowledge is contextually situated and is fundamentally influenced by the activity, context, and culture in which it is used (Brown, Collins, & Duguid, 1989). This means that knowledge should not be treated as a self-sufficient 'substance' that is separate and independent of the situations in which it is learned and used. The learners will be more motivated to learn if they are able to see the relevance of what is to be learned. The likelihood of successful transfer of the new learning is also enhanced since the situations presented are authentic. Relative to CBT, e-learning provides much greater scope in providing the activity and context 'in which learning is an integral part of what is learned, instead of being regarded as separable from or ancillary to learning. For instance, content is linked to actual organizational artifacts, such as staff handbooks and databases that capture staff complaints and how they are resolved. CBTs, being self-contained, provide limited access to such artifacts. It is also difficult to update the artifacts if updates and changes need to be made. In essence, e-learning is powerful in bridging the gap between 'knowing what' and 'knowing how' as it attempts to mirror more accurately the workplace structure where training is just-in-time, embedded or situated. In addition, in an e-learning environment, learners are also more motivated to learn as they are empowered to formulate and answer questions by interacting with other learners and the Internet. This is unlike a CBT application, where the learners are directed to answer pre-determined questions.
3. *Use of Media.* Are appropriate media such as video, animation, music, etc., used? In CBT, multimedia features can be capitalized on to a great extent to bring the message across to the

learners. However, note that this is not the case in an e-learning environment. Such multimedia capabilities are limited when developing an e-learning application due primarily to the bandwidth problem. Thus, the more extensive the multimedia feature, the longer it takes to be downloaded and displayed on the user's screen. Therefore, only graphics or multimedia features that are critical to the information content of the page should be included. In order not to frustrate the learners, a good practice is to add text to a link, citing the size and format of the file.

4. *Content Personalization.* Where all the learners are usually presented with the same content in the same sequence in CBT, there can be individualization of content in an e-learning environment, where the learners' profiles are created and managed so that the individual's needs and preferences are matched against a repository of content.
5. *Tone.* An e-learner learns by going through the content, communicating with others using e-mail, and participating in electronic discussions. To make the learner feel that he is not alone in the learning process, a personal and encouraging tone becomes all the more important. Such a personal tone helps to create a conducive learning environment in contrast to a tone that is 'clinical' and condescending.

Division of Labor

As in any community, the members are given different roles and responsibilities so that a common goal can be achieved. Similarly, in an e-learning environment, different roles are played by the community members. For instance, expert workers play the role of tutors and mentors to novices by sharing information and experiences.

Unlike CBT, where the content to be learned is contained in one or more CD-ROMs, e-learners must be active in the learning process in order to acquire the needed skills and knowledge. In an e-learning environment, a learner-centred approach is adopted. Therefore, it is the responsibility of the learners to learn, not the teacher to teach. For instance, instead of passively receiving the prescribed content in CBT, the e-learners are required to participate in or initiate online asynchronous conferences as well as collaborate on projects using a shared work space on the screen (a whiteboard). Thus, acquisition of knowledge and skills also occurs through participation in discussions and sharing of experiences with peer learners, besides learning the prescribed content.

In the design and development of CBT, the responsibility of the subject matter experts (SMEs) is to provide adequate and relevant content to be included

into the CD-ROM. Their job ends once the CD-ROM is developed and delivered for training. On the other hand, in e-learning, SMEs' content knowledge and their understanding of the organizational culture and practices can be further harnessed. For instance, to encourage other expert workers or SMEs to continue contributing to the bulletin board, online instructors may need to provide some form of recognition to these contributors. SMEs can be roped in to help keep the content updated so that learners will have access to new content. One of the faster ways is to link the learners to Web sites that SMEs have created instead of incorporating the new content into the physical Web pages for updating. Thus Web pages are not separate and distilled from the context of the job, as the contents are linked to actual organizational artifacts, such as sales proposals, project management reports, etc. To enable the learners to have a different perspective of a given problem, they may be given the opportunity to query outside experts who have a different solution from internal SMEs.

To reiterate, the essence of CBT is for learners to be engaged in self-paced and self-directed learning, without the need for an instructor. However, in an e-learning environment, instructors play the role of a facilitator. They are required to help learners navigate Web resources, and help them learn collaboratively so as to enable the acquisition of meaningful knowledge and practical skills. Successful e-learning instructors need to be equipped with four critical skills:

1. *Technology competence.* An e-learning instructor must be capable and comfortable using computer hardware and software. For instance, the instructor may open up a discussion, inviting learners' views, using an electronic whiteboard. In addition to conducting a Web-based course, he or she may even be required to maintain and update simple changes.
2. *Proficiency in writing.* Since words and graphics are used in e-learning communication, it is essential that Web-based instructors are able to express themselves effectively and efficiently in writing. Web-based instructors do not have the luxury of using their tone or body language in a Web environment.
3. *Teaching style.* Teaching is no longer a major activity in Web-based instruction. Instead, the e-learning instructor plays the role of a facilitator by helping learners' progress through the course by steering, advising, questioning, and providing constructive feedback. Instead of just pouring information into the heads of the learners as if they are passive receptacles, assignments given should require collaboration where learners are to contact experts or their peers to find information. Part of the role of the e-learning

instructor is to encourage learner interaction—both with the learning materials and peer learners. This means that the instructor must be able to post questions that will be able to stimulate discussion and responses from the learners. Open-ended questions as well as probing questions will encourage discussion as against questions which only require a 'yes' or 'no' answer. In addition, good feedback should be given as it can have a tremendous impact on learners' performance. For instance, constructive and supportive feedback will point the learner on the way to improvement, helping to build self-esteem in the learner, since he or she recognizes what is good in the response given. It is also important that feedback should only focus on behavior, instead of on the learner.

4. *Fluency in Web-based instructional strategies.* This will enable e-learning instructors to navigate confidently through multiple Web-based learning resources.

Rules

As in any community, rules need to be defined so that community members are aware of the way things are done. Rules for project collaboration, mentoring, expressing one's views, and continued contributions from SMEs need to be established. In CBT, it will be quite adequate for the learners to start learning once they know how to move about the lesson and what learning objectives they are expected to achieve at the end of the lesson. For an e-learning environment, the learners need to know more rules of actions. For instance, they are expected to interact in an appropriate manner with fellow learners and the instructor. The e-learning instructors need to provide a syllabus of the content to be learned and to post the schedule of lectures, lessons, and assignment due dates on the Web site. Evaluation criteria and weightings for the various assignments as well as consequences for failing to hand in assignments on time should also be made known to the learners. Since threaded discussions and e-mailing are essential features of Web-based instruction, learners should be aware of how they can participate or behave when engaging in such activities.

Feedback or replies from e-learning instructors must be timely and constructive. Learners need to be assured of assignment submission and the submitted assignments must be evaluated and returned to the learners so that they can proceed to the next lesson. E-learning instructors should also keep to the 'online' schedule posted on the Web. Learners will then be able to seek help or clarifications from the instructor at the allocated time slots.

Tools

After a community is formed in which members are ready to carry out their respective roles and responsibilities (division of labor) within an established framework of rules, tools must then be provided for members to perform their duties. Unlike CBT, an e-learning environment which is able to capitalize on Web technology can provide learners with opportunities for articulation so that tacit knowledge can be made explicit. Examples of such tools include e-mail, bulletin board, Web conferencing, and discussion list. Such tools can be employed to provide a potentially rich social environment that supports and facilitates collaborative learning. For instance, the inclusion of a "Discussion List" facility can categorize the postings by topic and keep a record of threaded messages. This will become a rich knowledge resource for collaborative effort. Learners can also respond when they feel ready, after having reflected on or done further research on the topic. The other advantage of an online discussion is that of a more egalitarian learning environment. Learners who are more reclusive are given equal opportunities to contribute to the discussion which may otherwise be dominated by a few learners found in a traditional classroom discussion. Thus, it can be seen that active participation in an interactive collaborative 'written' environment allows richer learning to occur since learners are required to articulate, negotiate and defend their knowledge. *Through articulation, learners are involved in knowledge construction through a process of sharing, negotiation and reflection.*

In addition to tools for communicative activities, the instructional designer may want to consider the inclusion of electronic performance support tools in the instruction. For instance, in a Web-based instruction on 'Human Resource Policies & Practices', learners should have access to an online version for reference when they analyze and propose solutions to different scenarios. It will be unrealistic to expect the learners to remember the details by heart, since in a real job situation, they will have access to the manual, which is 'knowledge in the world' instead of 'knowledge in the head.'

Relevant Web sites also enable learners to extend their knowledge of the particular subject. An orientation application that familiarizes learners on the navigational features, communication tools, technical requirements, and how to seek technical assistance would definitely help the learners progress smoothly when they embark on the e-learning environment. For instance, learners can be taught how to send an e-mail to the e-learning instructor when they have a query or when they want to communicate with the other learners. In the orientation application, learners are also taught basic netiquette to avoid unnecessary flaming remarks. All learners will therefore start on an equal

Table 1. Comparison between CBT and e-learning design.

Tenets of Activity Theory	Mode of Learning	
	CBT	E-Learning
1. Object	<p>Pre-determined content is transmitted to the learners.</p> <p>Instructor or subject matter expert (SME) is the center of knowledge and learning.</p>	<p>Learners are expected and empowered to go beyond what is presented by being active learners.</p> <p>Learning group is the center of knowledge and learning.</p>
2. Community	<p>Community of practice is limited to peer learners.</p> <p>Limited perspectives are introduced to a workplace problem. Thus, learners do not have access to rich learning resources and opportunities.</p>	<p>Community of practice extends to other expert workers (besides the SMEs) at the workplace, and to those from other organizations.</p> <p>Multiple perspectives are borne upon a workplace issue. Thus, there is a rich social environment with rich learning resources and opportunities.</p>
3. Division of Labor	<p>SME-centered in that the authority for learning is not transferred to the learners.</p> <p>Subject matter experts (SMEs) are responsible for ensuring adequate, relevant and accurate content are included in the CD-ROM.</p> <p>Self-directed and self-paced CBT does not require the intervention of an instructor.</p>	<p>Learner-centered in that learners are responsible for their own learning; not the instructors to teach.</p> <p>SMEs continue to contribute their expert knowledge through participation in bulletin board discussions and even maintaining Web pages.</p> <p>E-learning instructors play the role of facilitators by helping learners learn collaboratively and to navigate Web resources. These instructors must be technologically competent, proficient in writing, able to encourage learner interaction and fluent in Web-based instructional strategies.</p>
4. Rules	<p>Limited set of rules to be learned is primarily related to navigation and assessment criteria.</p>	<p>Rules to be defined for navigation</p> <ul style="list-style-type: none"> • mentoring • project collaboration • bulletin board participation • submission of assignments • assignment criteria

footing when everyone is equipped with the basic knowledge and skills to learn online. They will be able to focus on the content once they start on the e-learning environment, instead of being distracted as they try to figure out the use of the various features and tools provided.

Table 1 compares the application of the Activity Theory components in the design of CBT and e-learning applications.

Conclusion

As seen above, *Activity Theory* provides a practical and holistic approach to the design of e-learning environments. In the design process, learning is viewed as an interdependent system that involves (a) the individual (or subject), (b) tools, (c) a problem space (or object), (d) the community of people who are similarly concerned with the problem, (e) the division of labor between community members, and (f) the rules of

Table 1. Comparison between CBT and e-learning design (cont'd.).

Tenets of Activity Theory	Mode of Learning	
	CBT	E-Learning
5. Tools	<p>There are usually no tools for learners to collaborate since CBT is self-directed and self-paced.</p> <p>Generic electronic performance support tools are provided such as a calculator and a notepad.</p> <p>Problem assignments given may be 'contrived' and somewhat 'decontextualized' as learners have limited access to actual organizational artifacts. Furthermore, content updating to the artifacts may be expensive and slow.</p> <p>A 'Getting Started' page is usually adequate to give learners a good idea of the meaning of the icons used in the CBT application. The icons are more for navigational purposes.</p>	<p>Collaboration tools include:</p> <ul style="list-style-type: none"> • e-mailing • bulletin board • Web conferencing • discussion list <p>Specific electronic performance support tools such as online manuals and references can be linked to the content so that learning is 'situated' and real.</p> <p>Abundant opportunities for learners to solve real workplace problems.</p> <p>An orientation program to familiarize learners, especially new e-learners, is necessary to ensure that they are able to embark on the e-learning application without difficulties. They should be taught about the following:</p> <ul style="list-style-type: none"> • navigational features • communication tools • technical requirements • technical assistance <p>Some hands-on practices are included for e-mailing and bulletin board discussion.</p>

actions. By using this framework, it can be seen that learning is not a decontextualized activity that is separated from work. Rather, learning is a human activity that is deeply embedded in the social matrix of people and artifacts. It is thus situated and framed in the appropriate context. This will definitely enhance the transfer of skills and knowledge acquired to the workplace. □

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