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## FOSTERING COMMUNITIES OF PRACTICE THROUGH LEARNING COMMUNITIES

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### Abstract

This paper discusses the issue of fostering or building learning communities among heads of department (HoD) in IT in Singapore schools. A preliminary study was conducted among 17 HoDs anchoring on the issues of IT MasterPlan II (MP2) in Singapore. The study reveals the issues of concern for these HoD ITs vis-à-vis the impending need to implement the pedagogically inclined stance of MP2. This paper presents a framework of an evolving community of practitioners (CoP) along a simulation, participation, and co-determined interactions continuum. Simulation, participation, and co-determined interactions are three models of learning, which describe how learners are brought through a scaffolded process within a community experience.

The concept of communities, both communities of learners<sup>2</sup> and communities of practice (CoP), has been increasingly gaining attention in the last few years. A community of practice is a sustained social network of individuals who share a common set of core values and knowledge, including a past history, grounded on common practices. As communities are central to the changing and evolving nature of persons acting (situated cognition), we cannot escape the issue of changing phenomena and practice. Hence there is a need to conceive of frameworks that can capture the evolving history of a practice. Many efforts have been made to build communities (in particular, online communities) but many of these efforts fail to recognize the historical and evolving nature of communities.

In this paper, we propose a framework based on three models – simulation, participation, and co-determined interactions – for fostering the evolving nature of learning within the CoP context; we have reconceived the models by conjoining them along a continuum. We introduce the concept of scaffolding along the continuum as a means to foster a community of practitioners.

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<sup>1</sup> On secondment to the Ministry of Education, Singapore

<sup>2</sup> A *learning community* is a collaborative where participants contribute equally, exhibit parity, and focus on continual reflection and inquiry (Hord, 1997). According to *Apple Classrooms of Tomorrow* (1999), a *community of learners* consisting of mentor teachers, faculty, integration experts, and content area specialists provides the best opportunities for pre-service teachers and for K–12 students to learn in environments that include technology in meaningful ways.

## Modelling communities

*Simulation* models (e.g., Schank, Berman, & Macpherson, 1999; Perkins, 1992; Jonassen 2000) in educational technology are in essence learning environments where attempts are made to simulate real world scenarios and practices. These simulation models are also known as practice fields (Senge, 1994). Problem-Based Learning (PBL), for example, is fundamentally a practice field. Originating in the Medical School, Barrows (1986) sought to tailor medical education to be more aligned with the CoP – the real world of hospitals and doctors – which deals with medical cases and problems. The original conceptions of PBL as derived by Barrows (1986) had a strong linkages with the medical community of practice. Project-based science (PBS) is another example where such learning occurs, emphasizing inquiry and social constructivist learning activities. PBS is characterized by: (1) a driving question, (2) investigations, (3) artifact development, (4) collaboration amongst students, teacher, and others in the community, and (5) use of technology tools to support inquiry (Singer, Marx, Krajcik, & Chambers, 2000).

One major problem with any of these simulation models is that they are fundamentally a *simulation*, and are not intended to be the same as the real world. The tension is always in how much complexity is to be introduced for a learner and at which particular stage of the learning experience. The greater the degree of imposed and prescribed variables introduced, the lesser the degree of flexibility given to the learner. Pragmatically, a beginning learner should be introduced to complexity and diversity in a gradual manner. Such an approach has been adopted in the cognitive apprenticeship model (Collins, Brown, and Newman, 1989).

In addition to the simulation model, researchers (e.g., Barab, Squire, & Dueber, 2000) have argued for a *participation* model – that is, instead of bringing the real world into classrooms (i.e., simulation models), students are brought to the real communities of practices (CoPs) to be enculturated in their learning process with central participants of that community (Lave & Wenger, 1991). To a degree, the original conceptions of PBL by Barrows (1986) were a semi-participation model as trainees worked on real cases and patients. It is through enculturation and immersion into the culture of the CoP that these *identity* traits are developed (Polanyi, 1964; Wertsch & Rupert, 1993). As CoPs are formed through the emergent phenomena from evolving reactions and interactions, immersion in the context and culture is imperative. Participation in a CoP involves sharing with others and establishing a sense of intersubjectivity according to the shared beliefs of that community.

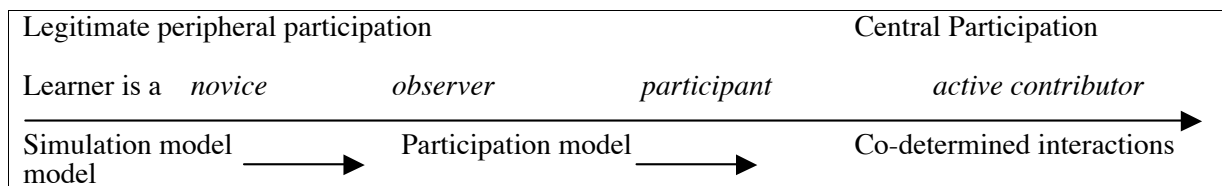
*Co-determined interactions* learning model springs from situations where learners and practitioners are engaged in mutual co-construction efforts. When different participants bring to the learning context skills and knowledge that are of mutual benefit to each other, they are able to co-construct knowledge and meanings. Thus the negotiation or social construction of knowledge between individuals is on a relatively equal plane (with similar or equal authority). The authenticity therefore emerges from the co-evolutionary processes between the practitioners and the learners. The co-determined interactions model extends the notion of situated cognition by emphasizing that knowing and context are irreducible and co-constituted, and thus learning is conceived as fundamentally constitutive of the contextual particularities in which it is nested. In this sense, the co-determined interactions model takes a firm stand on the role of communities of practice as situated contexts through which cognition and the context are always co-evolving in terms of authenticity (Barab, Squire, & Dueber, 2000). This concept differs from Lave and

Wenger’s (1991) notion of legitimate peripheral participation – novices enter into communities and they begin to gradually appropriate skills and a disposition similar to practitioners within that community. Authenticity is *within the context* and emergent with respect to the co-construction efforts between persons and tasks.

### Scaffolding along the Simulation, Participation, and Co-Determined Interactions Continuum

These three approaches need not be discordant but can be seen from the perspective of scaffolding along a continuum. By adopting Lave and Wenger’s (1991) model of legitimate peripheral participation, which is a model grounded on scaffolding and enculturation, we recognize that the above three models can be seen as a CoP learning continuum. With effective scaffolding, we envisage the learner treading from simulation to co-determined interactions. We argue for the need to advance learners through the continuum by appropriating augmented supports through the learning process, yet preserving the construct of authenticity. The concept of scaffolding facilitates the learner within the context of a community moving from legitimate peripheral participation (simulation) to central participation (co-determined interactions) (Lave & Wenger, 1991). In the same vein, as the learner moves along this continuum, the community – which consist of the learners – similarly evolve along this continuum. See Figure 1. The learner progresses from being a novice and finally as an active contributor. These categorizations will be elaborated in the later sections.

**Figure 1. Scaffolding along the CoP continuum**



An example of a learner being scaffolded along such a continuum could be seen from the perspective of a doctor whose training begins at the University where he or she works with non-life *simulations*. In the later years of training, the trainee-doctor begins to contribute alongside qualified doctors in hospital wards, probably engaged in *participation* with doctor-practitioners in daily activities. Subsequently, after graduation, the full-fledged doctor is now ready for *co-determined* interactions with other doctors as they engage in their own medical cases and research into frontiers of medical sciences. Other examples could include pilots under training in flight-simulators, and subsequently as observer-participants in cockpits, and finally as co-pilots in actual flights.

In a similar sense, *scaffolding* is the systemic approach to supporting the learner (Jonassen, 1999), focusing on the task, the environment, the learner, and other instructional persons such as tutors, teachers, etc. That is, scaffolding provides structures and frameworks to support the learning process and students’ performances beyond what is currently possible (Griffin & Cole, 1984; Vygotsky, 1978). A scaffold adapted to the level of the learner ensures success at a task difficult for the child to do on his or her own. Scaffolding envisages a learning structure and

framework for a learner(s) to gradually move along a continuum. These support structures can be conceived as treading within the learning continuum from simulation, to participation, and finally to co-determined interactions (see Figure 1).

Scaffolding usually involves the notion of gradual fading and removal of supports. Tools or resources are initially needed and may gradually be internalized as learners progress in the learning continuum. Again, one needs to differentiate between the supports afforded by scaffolding and those which are used to augment the learner's capabilities. Once the learner is fully immersed in the professional culture of the community, these tools resources can be gradually removed.

In retrospect, the design of simulation-oriented learning environments is complementary to real communities and not a replacement for them. Obviously the real context (non-simulation) with the embedded nuisances would probably be the best because "practice is an effective teacher and the community of practice an ideal learning environment" (Brown & Duguid, p. 127). However, we recognize that it is not always feasible to have full participation with communities of practice from the initial stages of the learning process – it defies the peripheral to central participation concepts of learning within communities (Lave & Wenger, 1991).

To summarize, the scaffolding process can be perceived in the following ways:

- gradual decreased intensity in simulated cases over time and a gradual increase in practice-oriented authenticity through community involvement – from simulation to participation and finally to co-determined interactions.
- exposure of learners from simple to complicated cases (be they simulated or real)
- rotating the roles involved from peripheral to central participation in terms of the degree of responsibility;
- gradual progression towards co-determined interactions having established shared meanings throughout the learning process;
- gradual removal of scaffolding tools, resources, and feedback, and gradual increased employment of real world artifacts (tools), resources, and feedbacks; and
- the gradual and continued adoption of augmented tools and supports from simulation to co-determined interactions over time.

### **Case Study of Heads of Department in Schools**

This case study describes our attempts to foster communities of practice (CoP) among teachers (Heads of Department in ICT) in Singapore schools. There is a strong initiative in Singapore to be learner-centered through the use of technology. The prevailing epistemology in Singapore schools is largely traditional and there has been a growing desire to transform schools towards a CoP-like epistemology of sharing and life-long learning as part of a shift of values to professional development. We had initially appropriated the concept of learning communities from the literature and assumed that these processes could be easily transferred into the local

schools' contexts. We recognized that the Singapore school culture did not fundamentally possess a constructivist-sharing and dialoguing epistemology, and that the process of CoP involvement had to begin from scratch.

The case study group of learners/practitioners are adult practicing teachers who hold to a traditional view of school learning and they have come to the University for in-service training. We gathered the group of Heads of Department of ICT (HoD ICTs) with the intention of fostering among them a CoP whose goals are synonymous with constructivist learner-centered epistemology. Because the purpose of the course is to make them experience the culture and spirit of CoPs – a spirit of sharing – we began scaffolding their learning experiences via the simulation model, exposing them to structures and activities where they, as participants, needed to work together in assignments and tasks with common goals. However, these common goals are in a sense simulations, as they do not reflect the same context as the school through which they come from. At the University, they can possibly pick up the constructivist orientation of learner-centeredness. Within the University, we have sought to foster a sense of community spirit by asking them to engage in tasks where they share resources, common goals, and build up their sense of knowing one another. The following are terms which appear in the protocols: MOE (Ministry of Education), ETD (Educational Technology Division of the MOE), and NIE (National Institute of Education).

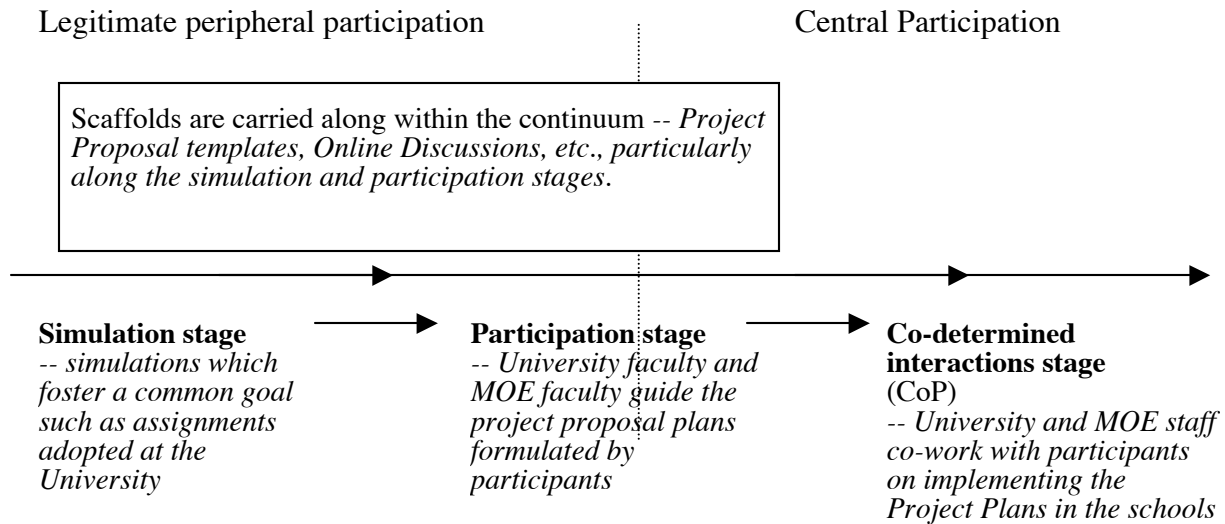
**Participant A:**

After the first session ..., I felt relief. I think I will be able to pick up a lot from my fellow colleagues. They are all so good and most important of all is they are willing to share. I feel at ease with the lecturers and tutors too. The job that they are doing is similar to what the IT HOD is doing in school. Hence they will be able to associate with the kind of pain that we actually are going through when trying to implement new initiatives or programs to the staff of the school. And be able to share with us their experiences.

**Participant B:**

I look forward to our learning together and collectively we can expound, explore and evolve good ideas that will optimize the use of current and limited resources for the “engaged learning” movement. ... The intent to extend the spirit of the course and the camaraderie developed beyond the duration of the DDM is something that will bind the HoDs together and instill pride for playing a special role to lead the school to sustain this educational reform.

**Figure 2. Scaffolding along the continuum**



In the midst of the course (see Figure 2 and Table 1 below), participants are gradually enculturated into the "participation model" as they engage in discussions and project work with their lecturers from the University and practitioners from the Ministry of Education (MOE). At this juncture, after being enculturated with simulation models, participants are ready to engage in conversations with personnel from the Ministry of Education as they discuss possible projects which can be implemented in their respective schools. Here are some protocols which reflect discussions these participants had with personnel from the ministry.

**Participant C:**

Every HoD ICT meeting organized by MOE that I've attended; there is this perpetual question, "What is the role of the HoD ICT?" It keeps expanding as long as there are new IT initiatives, new IT equipment and IT-related equipment. This job is highly stressful, demanding and yet no IT Head has been trained for it.

**Participant D:**

I will email the soft copy to MOE-ETD [Educational Technology Division] persons-in-charge of looking at this area. A few themes that have emerged are: 1) Definition of Roles/Functions of HOD-IT; 2) Definition of Roles/Functions of HOD-IPs (subject heads) for IT ... I guess if roles/functions are clear, the right workload, attitude and aptitude to perform better, to look forward to trainings will follow.

**Participant E:**

On behalf my IT superheroes, I would like to thank you for arranging this morning's session with ETD's director ... his very presence has brought much assurance to us that ETD would continue to help schools in implementing MOE IT MasterPlan [IT MasterPlan of the MOE] agenda. The Chinese saying - "A thousand miles begin with one step" aptly describes our encounter today.

Another scenario arose as follows. When one of the participants presented their plan for implementation of IT in the school, Practitioner A from the Educational Technology Division

(ETD) asked: “what is the objective for the project? Is there an existing problem?” The participant explained that ideas within one particular school are limited and would not capitalize on the Internet. Sharing information across schools also helps the students to see other perspectives. Practitioner A then questioned what strategies would the group want the students to learn? University Professor A, expressed concerned about the scaffolding and the learning task students are required to do. Practitioner B from ETD added that she cannot visualize the product of the project work. What is the end deliverable that is required of the students? University Professor A then suggested that they use inter-school discussions as resources for the end product which is the ‘story’ the students are required to write.

During the participation phase of the scaffolding process, these participations are expected to craft project plans for implementation in the schools. During this phase, participants are not yet ready to enter into full negotiation as at the co-determined interactions phase. We recognized that as far as they were involved in the University course, the participants could be seen as working with a participation model.

When they graduated from the course and begin implementation of their planned projects in schools (real CoPs), they transit from the University to their school or CoPs. HoDs ICT are more ready to progress into co-determined interactions when they are ready with constructivist mindsets. They exhibited reflections of the following nature:

**Participant F:**

Teaching is a process of helping learners construct their own meaning from the experiences provided by the teachers. Meaning is in the mind of the knower and each constructs our own knowledge. It involves personal ownership of the problem. Knowledge acquisition and meaning requires articulation and expression. Meaning-making can also be the result of conversation where we shared with others. ... Of course all argument portrays the advantages of the Constructivist Method, but how can schools in Singapore move on unless there is a systemic change in our school system for e.g. the assessment method used at present, the ranking of schools and the obsession of exam results. Of course, all teachers know that lessons in school must engage children in active participation. All activity and learning must be constructive and intentional. Experiences provided must be authentic and children must learn through collaboration with others. Therefore children cannot learn from technologies. Technologies are used as learning tools to engage children in meaningful learning. Technologies cannot replace the teachers.

**Participant H:**

HOD IT is a change agent. He has to work closely with the IP HoDs to integrate IT into the curriculum. How does he do this? He needs to use the soft approach and convince the teachers the benefits of using IT. IT may not always be the most effective way of teaching to produce better results. Then why use IT? This is one of the challenges I face. Teachers always tell me that there are other proven methods or techniques, which they are sure, can produce better results. Should I then wait for a teacher or HOD to initiative using IT and ask for help? I don't think so. I think I shall work not only with HOD IP but with teachers of the department also.

**Participant I:**

When I was told that all [of us] had to carry out an IT project which should last at least 6 months, I groaned. I was looking for an easy course – just sit and absorb like a sponge! Then when we actually got down to deciding on a project which can be implemented by each member in our group, things got a bit tougher. Our schools are all at different stages of readiness in terms of hardware, infrastructure setup and IT skills. ... So, I



must thank NIE [the University] and ETD [MOE] for coming out with this initiative to help schools. With their backing, the school principals will then realize how important their support is needed for us to do our job. One person alone cannot be responsible for the use of IT tools in engaged learning. Besides having a well-thought out structure, IT Heads need Admin support in freeing us in some ways to do what we should be doing and IT Reps to assist us. I look forward to implementing this project.

Here is a co-determined interactions conversation between several parties – practitioners, University instructors, and MOE personnel. The conversation revolves around the getting students in K-12 schools to engage in productive discourse (within the school as a CoP in co-determined interactions). At this stage, participants are still at the CoP and the learners are observed to be mentees to the University professors (see comments below) and Practitioner B (see comments below).

University Professor A: for such a design, you all could adopt a “debate” among students since the topic deals with controversial issues which students need to understand the arguments about.

Participants: the students may not be capable of a real debate, however, we will not rule out this strategy.

University Professor A: why don't you give students different roles for each forum/group so that students can understand the issues from a valid and realistic perspective.

University Professor B: this will help encourage students to understand divergent views.

Practitioner B: The topic is very content driven, so why move the discourse online instead of having it in the f2f session, which the teachers have been doing for years.

Participants: we would like to capture the students' thoughts and thinking skills through the scaffolds in the online environment. However, we agree that issues given to students must be more controversial so as to provoke thinking.

Practitioner B: You need to ensure the students will be engaged and excited about the project so as to enhance learning. HoDs should not focus on the quality of the results but simply to have faith in the students. HoDs can also take opportunity to learn how to facilitate and moderate student discussions.

Another scenario is when one of the participants returned to her school or CoP and in conversation with her principal. The Participant-HOD was advising her principal of the project implementation plan as worked out in the University or CoP. She, began by sharing (in an online environment) with the rest of the participants her conversation with her principal concerning her project plans, and that her principal was pleased with the project (as developed in the CoP stage). Her principal asked her if she is doing it because of the course (the course taken at the University) she underwent or whether it was for her actual job requirements. Rosy replied honestly that initially it is for the “sake of the course” but subsequently, having gone through the discussion of project work with the other participants, she realized that the project implementation plan was integral to her actual job as a HoD IT. She was able to justify and explain the rationale for the project and to attain the support from her principal. She subsequently convinced her colleagues of the feasibility of the project as she worked with subject heads and others in the school. She expressed that commitment has been given by ETD and the professors from the University.

The above scaffolding process along the continuum is summarized in Figure 2. Within the simulation, participation, and co-determined interactions stages, participants are engaged in

various activities, rules of engagement, rules through which they interact, tools and supports which they adopt in their tasks. The scaffolding processes within the three stages can be seen from the perspective of: Activities, Rules, Roles, Tools, and Supports (AR<sup>2</sup>TS). The processes have been adapted from Wenger, McDermott, and Synder's (2002) framework for fostering CoPs. Table 1 the above processes.

**Table 1. The AR<sup>2</sup>TS processes in scaffolding**

<b>Simulation stage</b>	<b>Participation stage</b>	<b>Co-determined interactions stage</b>
<i>Activities</i> include discussions among participants during class time	<i>Activities</i> include meetings with MOE personnel and the relevant persons with the authority to make decisions	<i>Activities</i> are the stages in project implementation plans to be carried out among teachers and students in the school
<i>Rules</i> include doing a reflection log after every class session	<i>Rules</i> include respecting views and recognizing constraints in the implementations	<i>Rules</i> include MOE support while implementation and documentation of the stages and processes within the implementation
<i>Roles</i> played by participants could involve facilitations, leading in projects, note-taking, coordinating members, etc.	<i>Roles</i> include MOE personnel coaching participants towards projects which lead to learning goals	<i>Roles</i> include MOE personnel assisting participants in soliciting "buy in" of the implementation plans from the school management
<i>Tools</i> include IT mindtools, word-processors, etc.	<i>Tools</i> include project plan templates, official documents from the ministry which facilitate implementations	<i>Tools</i> include all the necessary equipment which would enable project plans to be carried out
<i>Supports</i> include providing advise from instructors, documents which provide information and resources.	<i>Supports</i> include advise from MOE personnel which promote what is feasible and otherwise.	<i>Supports</i> include MOE and school management support in the project implementations.

Scaffolding requires tools and supports which enable the learner to progress and these supports should fade away when they have served their function. In this case, we have adopted the use of supports such as online discussions, reflection logs, and project plan templates. These tools and supports which were adopted while in the University course fade away (or no longer used) as the participants progress along the simulation to co-determined interactions continuum. However, new supports and tools are created as participants proceed into the co-determined interactions phase of the scaffolding process. These tools and supports are tools and artifacts specifically designed and used within the CoP.

## Discussion

We have described a framework where a community of participants or learners are scaffolded towards a situation where they can possibly become central members of a CoP, having adopted Lave and Wenger’s (1991) concept of legitimate peripheral participation. The evolving nature of the learning process can be seen from the perspective of increasing task authenticity and deepening practitioner (CoP) involvement (see Figure 3). In Figure 3, we have divided the participation stage into 2 parts: the simulation-participation and participation-co-determined interactions stages. The simulation-participation process is inclined towards simulation with the gradual introduction of simulated-experts such as pre-programmed intelligent agents. The participation-co-determined interactions process is inclined towards participation in CoPs. Here learners begin to enter into actual CoPs.

**Figure 3. Degree of authenticity versus degree of facilitation**

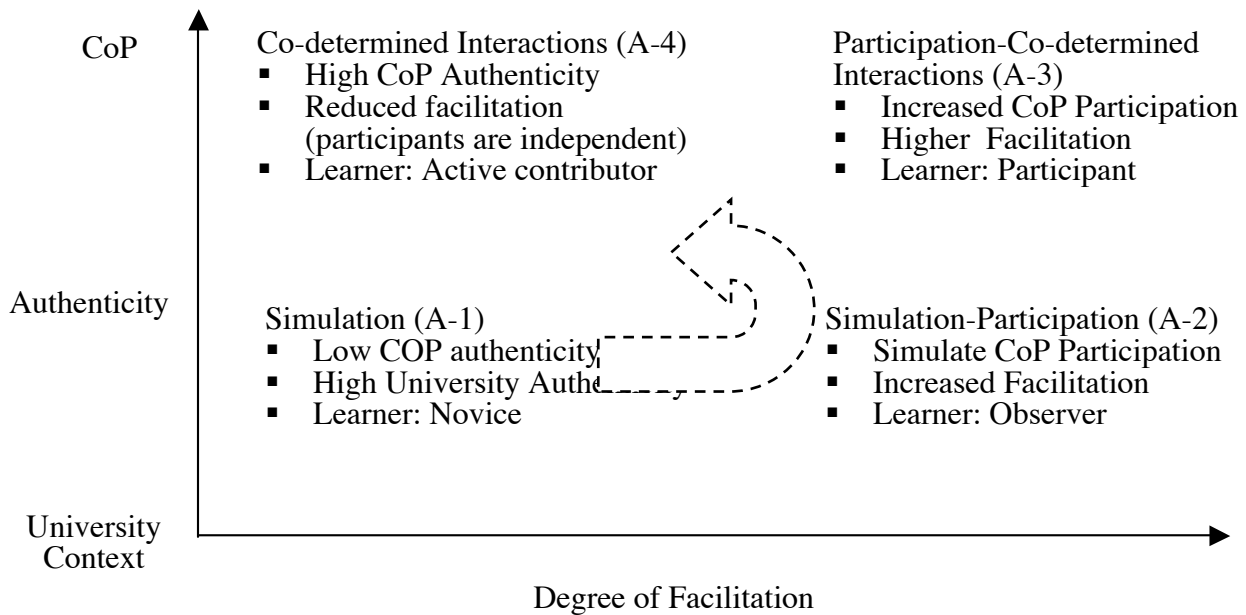


Figure 3 depicts the various stages of the scaffolding process and how task authenticity is increased when learning threads from the simulation to co-determined interactions stages. We make the assumption here that task authenticity is highest at actual CoPs. Similarly, the involvement of practitioners from CoPs in the learning process increases accordingly. Table 2 further elaborates on the evolving process.

**Table 2. Readiness of learners for CoP participation**

<b>Simulation (A-1)</b>	<b>Participation (bridge between university and CoP) – A-2 &amp; A-3</b>	<b>Co-determined interactions (A-4)</b>
Learners are <i>unable</i> or <i>not ready</i> to interact at tasks which practitioners at CoPs are engaged in.	Learners are <i>somewhat ready</i> but not fully equipped with the relevant knowledge and skills.	Learners become mature and <i>ready</i> to co-construct knowledge and skills with practitioners from CoPs.
Strategies adopted at this stage include directing and facilitating	Strategies include persuading learners and creating the buy-in of	Strategies include sustaining relationships between learners and

<b>Simulation (A-1)</b>	<b>Participation (bridge between university and CoP) – A-2 &amp; A-3</b>	<b>Co-determined interactions (A-4)</b>
learners with the approach knowledge and skills.	CoPs as a model for learning.	practitioners.

Following Figure 3, we want to thread the learner from A-1 to A-2, A-3, and finally to A-4 (“A” signifying Authenticity) as depicted by the threaded dotted line.

At the simulation phase (A-1), the characteristics are:

1. High simulation-university authenticity, e.g., the authenticity of a problem-based learning task carried out at the university, but low CoP authenticity;
2. Because the learner has not been “bought in”, we start with a relatively higher level of instruction (lower facilitation) such as giving clear guidance and content knowledge; and
3. The learner is currently still “a novice”.

At the simulation-participation phase (A-2), the characteristics are as follows:

1. It is the transition from simulation to participation stages;
2. The learner is now expected to be less dependent on instruction;
3. The task is designed to be less difficult so that the learner can handle the complexity and authenticity;
4. Participation is involved where experts are simulated persons (e.g., in goal-based scenarios)
5. Begin to increase facilitation; and
6. Learner has progressed from novice to observer, understanding the task at hand and the conceptual knowledge needed.

At the participation-co-determined interactions phase (A-3), the characteristics are as follows:

1. It is the transition from participation to co-determined interactions;
2. The authentic task is still kept at a manageable level – not at the full authenticity of CoP-tasks;
3. The level of real practitioner participation is increased;
4. Higher levels of facilitation is needed as compared with A-2; and
5. Learner has progressed from “observer” to “participant” of CoP.

At the co-determined interactions phase (A-4):

1. It is now the actual CoP stage;
2. Reduced facilitation is needed as learner is now within the CoP.
3. High degree of CoP authenticity is now required – i.e., the actual CoP task; and
4. Learner is active contributor, or a central member of the CoP.

The learner from A-1 to A-4 is depicted as progressive within the continuum – from *novice*, to *observer*, followed by *participant*, and finally to being an *active contributor*. These processes are our characterizations reflecting some sort of a progression which follows Lave and Wenger’s (1991) model of legitimate peripheral participation where learners are scaffolded towards central participation within the CoP’s framework.

At the different stages of the evolving process, different strategies are adopted to foster the community where learning occurs. At the simulation stage, these strategies include directing and facilitating learners concerning the value of CoPs and the related beliefs of sharing and dialoguing. At the participation stage, learners need to be persuaded of the benefits and “buy-in” is to be encouraged. At the co-determined interactions stage, learners become practicing peers and colleagues with CoP-practitioners and these relationships need to be harnessed and sustained.

In the above sections, we have described a framework where learners or participants are fostered in the process of learning into a CoP through the simulation, participation, and co-determined interactions models. Although these three models are differing ways of enculturation and learning, we have also found the scaffolding process to be a useful framework where a CoP is evolved and probably sustained. The issue is: how much scaffolding should be engineered versus allowing the community to evolve naturally. In other words, is scaffolding too prescriptive?

Proscription is an alternative to prescription. A proscriptive approach is more transparent than a prescriptive approach in that what it forbids is made visible while in a prescriptive approach what is forbidden is invisible (Bopry, 1999). A proscriptive design facilitates creativity because it merely sets up some constraints or parameters, but does not rigidly determine how the goal is to be achieved. In other words, prescription does not support creative activity nearly as well as proscription does. A proscriptive design sets minimal parameters to an environment so that creative processes on the part of the learner can be manifested. An example of prescription is the “U-Turn” sign in some countries. In prescriptive design, cars can make a U-Turn only when there is a prescribed sign indicating to do so. In other words, you turn only when there is a “U-Turn” sign, that is, only when you are told. In other systems such as the United States, cars can U-Turn anywhere unless there is a sign that spells “No U-Turn”. Such a proscriptive design (making a U-Turn unless otherwise specified) encourages participants “to do anything possible” unless otherwise told; whereas a prescriptive design spells out “what can only be done”, leaving little room for alternatives.

PBL environments can become more proscriptive by allowing learners to set problems. Activity in constructivist learning environments can be more student-driven (bottom-up rather than top-down). If we accept that there are a number of alternative routes to the same end, proscription facilitates discovery of the scope of these alternatives. A prescription such as a simulation model is an orienting device. Instead of “mirroring nature” (a positivist view), knowledge is as a “path laid down by walking” (Bopry, 1999, p. 11). Such a position focuses on creating joint understandings through language where individual meaning constructions are validated with varying perspectives of others. The specification of ‘reality’ depends on an agreement between two parties that a given experience is real. Understanding is understood to be personal, and not necessarily shared. From such a perspective, all instruction is deterministic and thus not

congruent to organisms co-evolving meanings *in situ* and with multiple meanings possibly emerging.

While learners do enter into shared worlds of meaning with others ... this interaction is not instructional. Instead, educators orient or point learners in a desired direction. Language is a tool that is used to orient others. Within the enactive-constructivist framework, symbol systems are coordinators of behavior, not conveyers of meaning. (Bopry, 1999, p. 18)

In other words, we are recommending or suggesting in our proposed framework that scaffolding along the simulation, participation, and co-determined interactions direction is just a path, but learners need to do the *walking*. There should be enough flexibility in the pathway for learners to evolve in a proscriptive fashion. In this proscriptive manner, learners construct and evolve meanings which are authentic to themselves, although the degree of authenticity is highest at the co-determined interactions stage. Table 3 reflects some of our thoughts on proscriptive and prescriptive environments and the activities which learners would be engaged in within the context of our learning continuum.

**Table 3. Prescriptive and Proscriptive Characterizations**

	<i>Prescriptive</i>	—————▶	<i>Proscriptive</i>
<i>Learning continuum</i>	Simulation	Participation	Co-determined interactions
<i>Type of knowledge</i>	Learning establish knowledge	Constructing established knowledge	New emerging knowledge
<i>Type of system</i>	Narrowly defined systems	Bridge between narrow and broad systems	Broad systems with much room for flexibility
<i>Type of problem</i>	Narrow prescriptive problems, with some degree of ill-structuredness	Ill-structured problems, but perhaps simplified	Ill-structured problems directly related to the real world demands
<i>Type of thinking</i>	Problem solving, Assimilating, Analyzing	Problem solving, Evaluating, Synthesizing	Problem finding, Problem solving, Creating, Innovating
<i>Type of learner</i>	Non-mature learners	More mature learners	Mature contributors – CoP
<i>Type of context</i>	Working within school-university contexts	Working at some dimensions of the CoP	Working at the edge of the CoP on R&D
<i>Type of identity</i>	Student or school-culture identity	Semi school-CoP identity, but dominantly schooling	CoP-culture identity

In Table 3, we attempt to characterize the simulation to co-determined interactions continuum against various classifications – from type of knowledge to type of context. A general trend in the increasing complexity of skills and thinking is involved. In addition, the co-determined

interactions end is proscriptive in the sense of being more less-defined or ill-structured where new frontiers of knowledge are being discovered.

One of the main arguments of situated cognition against the schooling is the problem of identity formulations or the lack of authenticity in schools. Schools create a culture of 'students' while CoPs create practitioners with perspectives and ways of seeing such as scientific thinking. With the scaffolding process as proposed, opportunities for partnerships with CoPs become an intentional process at the co-determined interactions phase, albeit a staged process; and thus this issue of identity formation may be facilitated by the bridging of identities. In other words, over the course of a school involvement, this inter-bridging of CoP involvement (at the participation phase) would develop greater overlaps between 'student-identities' and 'practitioner-identities'. The transition between 'being a student' and 'being a practitioner' would be minimized based on our conjectures of the scaffolding model.

The essence of the efforts is in developing the appropriate identities in our learners. Such a focus brings the learners or persons into predominance. The scaffolding process is aimed at bringing the learners to their maximum potentials. Vygotsky has in times past mentioned that in the educative process, the learner is central and all the art of the teacher is placed to maximize that potential.

### **Conclusion**

In our framework, learners are scaffolded towards real-life projects/problems in a gradual and staged manner. At each stage of the scaffolding process, an evolving process of interactions between students, instructors, problems, and the supports given must be a dynamically negotiated interaction. This dynamism would answer to Barab, Squire, and Dueber's (2000) concerns for co-evolutionary authenticity (which cannot be prescribed). From the learner's perspective, he or she is engaged in co-constructing meanings relating to an authentic project (i.e., the project implementation proposals which participants have to conceive) with the aid of tools and supports. Such a process prepares the learner for more challenging co-determined interactions in the future. In essence the issue of 'buy in' is measured by the degree of learner involvement and autonomy in meaning construction.

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