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The PQRS of Scaffolding the negotiation of meanings

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Introduction

Recently, educational researchers and practitioners have considered the potential of social constructivist principles to learning and instruction (Bredo, 1994; Brown, Collins, & Duguid, 1989; Hung, 1998; Jost, 1995; Prawat, 1996; Roschelle, 1989, 1992). Social constructivism suggests that learning is the mediation of different perspectives through the use of language (Lave & Wenger, 1991). There is a current need to understand how social constructivism can be effectively implemented in the school and classroom settings.

Based on our preliminary implementation of social constructivist approaches in instruction (among twenty pre-service undergraduate trainee teachers), we conceptualized a framework where students were engaged in Generating, Negotiating, Organizing, Situating of meanings, whereas teachers were primarily Instructing and Scaffolding the learning involved. We referred to this social constructivistic framework as **GNOS-IS** (Hung, Chen, & Cheung, 1998). Our observations suggested that through the GNOS-IS processes, students were able to construct shared meanings relevant to the learning and instructional objectives to be achieved.

As a follow-up of that study, we focused on the *Scaffold* process of the GNOS-IS by identifying useful scaffolding strategies teachers can use within social constructivistic classroom settings. The aims of this follow-up study are (a) to reflect on how we scaffold students' meaning negotiation and (b) to identify effective ways in scaffolding.

Scaffolding within the ZPD

Vygotsky (1978) described a form of learning from intermental to intramental levels as learning within the *Zone of Proximal Development* or ZPD (Vygotsky, 1978). Vygotsky defined the ZPD as the distance between the actual development level, as determined by the ability to engage in problem solving independently, and the level of potential development, as determined through problem solving under adult guidance. The activities within the ZPD are characterized by the child growing · into dependency upon the adult, and gradually through the process of dependency, learns to grow out of such a dependency. The ZPD, in other words, captures those functions and abilities that have not yet matured, that are in the process of maturing, that can be accomplished with assistance.

We suggest three aspects within the ZPD that individual students can elevate their ability from the "actual development level" to the "potential development level." According to our understanding, students' developmental level can be further demarcated into three C's: Content, Cognition, and Communication competency levels. Figure 1 below represents the three C's within the ZPD of an individual student (hypothetical case). *Content* also connotes the skills required at performing a problem task.

Potential Development Levels according to CCC

Content   Communication

Cognition

Zone of Proximal Development

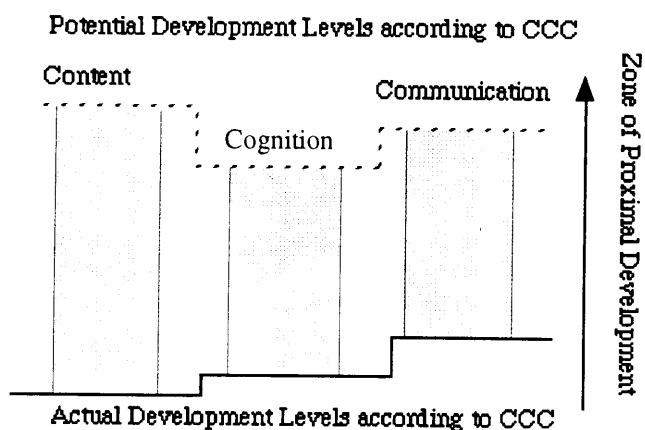Actual Development Levels according to CCC

Figure 1. Content, Cognition, and Communication within the ZPD

These three aspects are congruent to Vygotskian research where notions such as language, cognition, and conceptual development are learning processes within the ZPD. For example, Snow's (1984) research shows a relationship between the extent of adult-child interactivity and the language (communication) development of children. Through the process of externalizations and refining of the language (relevant to the content) used, students would be more fluent in the communication of their thought processes. We know from Vygotsky's research that language is one of the factors for actualizing learning within the ZPD (Vygotsky, 1978). In many respects, students often realize whether they understand the concepts or otherwise through the process of externalizing their thought processes in appropriate language (Hung, Chen, & Cheung, 1998).

Children's conceptual (content) development can be enhanced by the parent's provision of advanced concepts in conversation (Adams, 1987). Students' level of knowledge and understanding can be enhanced through proper scaffolding from teachers or more knowledgeable peers and adults (Tharp & Gallimore, 1988). Work has also been done on cognitive (cognition) change within the ZPD where novices appropriate from experts skills and thought processes (Newman, Griffin, & Cole, 1989). Through means such as the situating and applying of content knowledge, students would also be engaged in cognitive activities such as classifying, categorizing, interpreting, making comparisons, etc. In this regard, their cognitive and metacognitive abilities can also be elevated (Hung, Chen, & Cheung, 1998).

To sum up, we recognize that students entering into guided participation with the more capable individual (teacher or instructor) can begin at different levels of content expertise, cognitive or thinking ability, and communication competency in regard to the language relevant to the domain of problem. In the case of our study, 'content' denotes conceptual development (including skills), 'communication' represents language ability, and 'cognition' relates to cognitive change. In this regard, Vygotskian research has provided a theoretical foundation for learning within ZPD, including the key dimensions of what is learned within the ZPD. However, there is a need to identify practical and effective strategies teachers can apply within the ZPD, and also a need to distil when teachers can operationalize these strategies.

Context of study

Twenty students from the year two undergraduate course at the National Institute of Education (Singapore) were engaged in our study. The authors of this paper served as instructors for the course (not all three authors/instructors were present for every lesson). In our course, the students meet for computer laboratory tutorials two hours per week for a total duration of nine weeks. The focus of this paper reports on how teachers scaffold the students' discussions on the appropriate use of metaphors and interactivity in multimedia projects.

Results of the study

The results of the study is organized around four processes, which we have identified as Pointing, Questioning, Resolving, and Summarizing (PQRS).

Pointing

As we considered the discussions that were taking place, we occasionally contributed our thoughts and assessment of the project in comparison with others in order to illustrate the concepts that we were trying to convey across to the students. At a later point, after our 'pointing,' we were delighted that students were able to recognize that the function of metaphors should be more integrated with the pedagogical, rather than just utilizing a context to force fit a number of content areas.

Questioning

We questioned students' assumptions and used rhetorical questions to surface potential issues related to multimedia project design. From the *questioning* approach, we helped students to uncover hidden assumptions and helped them to relate to pedagogical considerations. For example, we used a rhetorical question relating to the appropriateness of the font and size, even though we intrinsically agreed with the students' choice or selection. Such questioning serves to surface the design issues we intended to convey to the students. If these questions were not asked, students may make decisions based on their intuition rather than on grounded understanding of the rationale underlying the design.

Resolving

We particularly want to highlight that the teacher's role is crucial in resolving differences in opinion. For example, the teacher resolves the issue of interactivity being too linear as in the above project. After we (the instructors) intervened to resolve the conflicts in opinion, we helped them to recognize that they were actually arguing for two entirely different issues or perspectives. The student presenter (SP) focused on the metaphor matching the content, whereas the others argued that the metaphor lacked interactivity.

Summarizing

By summarizing, we mean that we paraphrase students' opinions to help them externalize their thought processes and that we progressively distil or summarize the concepts learned in order to scaffold students' understanding. For example, at the end of each class discussion, we summarized the main instructional concepts shared and negotiated. Interestingly, almost all the instructional design concepts derived through shared knowledge were similar to those found in professional textbooks on instructional design. Usually, through the process of summarizing, we would be able to concretize the essence of the discussion using appropriate language within the context of the issue at hand. Moreover, by summarizing, we were also able to clarify unclear ideas and issues raised in the discussion. Through such a process, the teacher models the use of appropriate language (for example, the use of the term 'focus' or 'focal point') for argumentation of the task at hand. We later observed that students were able to appropriate the language we used in their discussion. The shared design principles described below are examples of statements jointly constructed and summarized by both students and instructors. The essence of the points made below reflects an appropriate use of language in instructional design.

In short, from the protocols depicting effective scaffolding processes, we recognized that the scaffold process include four effective strategies. They are: *pointing* (P) or directing students in appropriate directions, *questioning* (Q) students for their understanding (hinting different points of view), *resolving* (R) differences and conflicts in opinions, and *summarizing* (S) students' opinions by assisting their externalization of thought processes and distilling important lessons or points. We denoted the above processes as the PQRS of scaffolding for the negotiation of meanings.

Discussion & Conclusion

Based on the results of our study, we also tried to identify relationships between PQRS and CCC (Content, Cognition, and Communication). Table 1 below denotes such a relationship.

Table 1

Relationship between PQRS and CCC

Teacher's action	Pointing Focus the discussion directly	Questioning Focus the discussion rhetorically	Resolving Identify the crux of the issue	Summarizing Clarify the crux of the issue	Criteria for strengths of support
Content	*	*	**	**	whether 'closure' of learning is facilitated by the teachers' action
Cognition	*	**	**	*	whether students are required to appraise the teachers' action
Communication	**	**	*	*	whether students are required to respond to teachers' action using language

*support   **strongly support

In respect to students' elevation of *content*, we found that the teacher's role of *resolving* and *summarizing* could bring forth a reasonable 'closure' of students' learning at the group and individual levels respectively. Hence, these two processes strongly support the elevation of students' content knowledge. In the event that the teacher can resolve the impasse of group discussions, students would probably benefit with more understanding of the issue or content (if students were able to accept the teacher's contribution). In this regard, students achieve a 'closure' of understanding at the group level. Moreover, if individual students are able to accept the teachers' summary of issues, content knowledge also reaches some form of 'closure' at the personal level. For example, when individuals cannot clearly identify issues in content, they may undergo a state of 'disequilibrium' having experienced assimilation and accommodation (using Piaget's terms). However, if the teacher can summarize the issue at hand, such a process may result in the students' achieving a closure in understanding. *Pointing* and *questioning*, on the other hand, open up opportunities for learning rather than closure in understanding. These two processes may or may not lead to the elevation of content knowledge.

In relation to students' elevation of *cognition* (see Table 1), we found the teachers' role of *resolving* and *questioning* significant for elevating students' group and individual cognitive levels respectively. In terms of resolution by the teacher, students (as a group) would have to go through a process of accepting or rejecting the contribution set forth by the teacher. Students would also have to think through issues and questions raised by the teacher, especially if the question is posed to a particular student. Hence, we hypothesize that questioning and resolving would strongly enhance students' cognitive abilities. As for *pointing* and *summarizing*, the teachers' contribution could be an incidence of transmitting information of which students would have to determine if they could 'receive' the information. Hence, the degree of elevation of cognition may not be comparably significant.

In terms of *communication*, we found the teachers' role of *pointing* and *questioning* significant for elevating students' group and individual communication levels respectively. When teachers *point* and *question* students, often a reaction is needed from the students. The teacher's role in *resolving* and *summarizing* would serve as 'modeling' the use of more precise language to scaffold students' communication ability. However, the support from the resolving and summarizing processes contributing to students' elevation of communicative abilities in reference to the language used in the content area may not be obviously significant. Here, resolving and summarizing are the teacher's action and sometimes may not require the students' response. For pointing, in addition to observing teachers' model communicative processes, students are required to follow the direction stipulated by the teacher, for example, focusing on a certain language category pertaining to the content. Similarly, in questioning, students would have the opportunity to practice their use of language, and hence, elevating the communication ability.

In summary, we suggest that all PQRS processes support students' learning within the ZPD of individual students. The strengths how PQRS supports content, cognition, and communication are based on (a) whether 'closure' of learning is facilitated by the teachers' action, (b) whether students are required to appraise the teachers' action, and (c) whether students are required to respond to teachers' action using language, respectively.

We have provided in this paper a *scaffold*, a meta-scaffolding process, for teachers and educators to scaffold students in the ZPD. Our original motivations for such a paper is mooted by our instincts that the teacher is always a fundamental and key resource despite the shift towards student-centered learning. Scaffolding is an art — providing students with 'just enough' guidance to motivate them to

continually construct knowledge (with others) and to learn. In this paper, we have written a modest prelude to a 'scaffolding opera.' We invite 'artists' from various fields to join us in refining, enriching, and extending such an opera with endeavors to 'socially construct' a masterpiece of passion and impact.

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