SCAFFOLDING LEARNING USING WORKSHEETS AT REPUBLIC POLYTECHNIC

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ABSTRACT

In Republic Polytechnic (RP), we developed a unique Problem-Based Learning system known as the One-Day One-Problem Approach ™. At the beginning of a day, students will be presented with a problem. They will work in teams and with guidance by the side from the facilitator, come up with a presentation of their solution by the end of the day. Students are expected to engage in self-directed and collaborative learning. Knowledge is constructed collectively by the class as oppose to being transmitted by the facilitator.

The student cohort consists of local students with at least O'Levels or ITE qualifications and foreign students of similar standards. As with all polytechnics in Singapore, they need to pass Mathematics, Science and English to be enrolled into RP. Most of them are exposed to rote learning predominantly. Many of them find it hard to connect with the underlying ideas and concepts introduced in the problems and require support from the facilitator to bridge the gap in their knowledge.

Hence, one of the challenges of Republic Polytechnic (RP) in implementing our brand of Problem Based Learning (RP-PBL ™) is the need for scaffolding. In order to ensure that student's learning is enhanced, an accompanying worksheet for each problem is given to students. The worksheet serves as a scaffolding that

- Mimics the inquiry path of an expert. It contains a series of questions that an expert will ask when solving the same problem and/or
- Uses a series of questions that will prompt the learner to think more deeply into the underlying concepts. These questions usually revolve around a totally different context.

The assumption underlying instructional scaffolding is that there is a cognitive distance between what learners know and can do on their own, and what they are currently capable of doing with the assistance of a more knowledgeable person. Lev Vygotsky (1978) called this area the Zone of Proximal Development (ZPD). It is defined as the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers.

Scaffolding is a process of teacher-student interaction within the student's ZPD that serves the same role physical scaffolding serves for a builder. (Wood et al. 1976):

- It helps ensure the child's success,
- It extends the child's competence into new territory, and
- It can be taken away as the child becomes more responsible.

The metaphor of scaffolding translates to a model of learning through incremental assistance, with the prototypical interaction. The interactions create new meanings outside the heads of the two interacting people through the creation of a shared meaning, or intersubjectivity (Newman, Griffin, & Cole, 1989; Rogoff; 1990). These external meanings and interpersonal process then become reconstructed internally, or appropriated.

But scaffolding has to be seen as a complex collaborative process, in contrast to the traditional view of a teacher sequencing small steps for the student's ultimate attainment of new knowledge and skills. The teacher transmit social knowledge through scaffolding, but the personal knowledge through a dynamic teaching/learning interplay that draws the child into a more mature, yet still understandable, model of a problem (Rogoff, 1990). A key feature of the interaction is that the scaffolder provides just enough support for the learner to make progress on his or her own.

The conception that knowledge is constructed by the learners during scaffolding extends Vygotskian concepts into the realm of Piagetian theory (Hatano, 1993). The learners' search for meaning and significance are critical parts of their ZPDs. (Moll & Whitmore, 1993). Yet to acknowledge that knowledge is individually constructed is not to ignore that this process is facilitated by interactions with other people – both horizontal relationships with equal-ability peers and vertical interactions between expert and novice (Hatano, 1993). This blend of Vygotskian and Piagetian theories is known as social constructivism (Cobb, 1995; Asoko, Leach, Mortimer, & Scott, 1994). This perspective views scaffolding interchanges as constructive all along the way, with meanings continually being created inside the heads of the speakers, rather than being created between them and then internalized.

Brush and Saye (2002) divided scaffolding into two types – Soft and Hard Scaffolding. Soft scaffolding refers to dynamic, situation-specific aid provided by a teacher or peer to help with the learning process. Such scaffolding requires teachers to continuously diagnose the understanding of learners and provide timely support based on student responses. They are generally provided "on-the-fly" where the teachers monitors the progress students are making while engaged in a learning activity and intervenes when support or guidance is needed.

Hard Scaffolding is defined as static supports that can be anticipated and planned in advance based upon typical student difficulties with a task. These support structures can be embedded with a task. In RP's context, worksheets can be seen as a form of hard scaffolding.

This research aims to examine what qualities make up an effective worksheet in the social constructivist framework of the RP-PBL™ process. It will include an empirical study based on expert views as well as classroom outcomes.

METHODOLOGY

A set of criteria of effective scaffolding will be extrapolated from literature and presented to a group of experts in the RP-PBL™.

They will rank and refine the criteria in relation with the role of worksheets in the RP-PBL™ process. These criteria are translated into observable actions to be used to gauge effectiveness of worksheets in a class.

Different worksheets will be presented to the experts to judge based on those criteria and rating is tabulated for each worksheet. At the same time, outcome from different classes will be recorded and use to gauge the success of the worksheet in practice. The measurement of success of the worksheet in practice will be determined by 3 aspects – facilitators' rating of the worksheet based on the same criteria, the quiz scores attained by the students and student's feedback on the effectiveness of the worksheet.

We will compare the ratings and look for conforming and contradicting situations. These situations are likely to offer us a good idea of what makes up an effective worksheet.

The specific areas that we can explore from the data are -

1. Worksheets that start with students' prior knowledge generally help them to learn more deeply. In alignment with constructivism, we believe that students can better understand a new idea when they can connect what they are learning with what they already know.

2. Worksheets that are instructional steps towards the solution tend to undermine students independent thinking. I believe that this is so because this can take away the students need to exercise reasoning and developed their own problem solving strategy.

3. Long worksheets are not suitable in the RP daily context. This is because students are expected to come up with their own solution to the problem by the end of one day. Long worksheets can potentially distract them from the problem.

4. Worksheets with analogies help students link with the concept introduced in the problem. This is because analogies are usually situations that students are familiar with and that can serve as a learning platform for the students to build up their understanding of a particular concept or idea.

5. It is not necessary to restrict the questions in the worksheet to the context of the problem for the students to gain a deep understanding of the problem. This is because it challenges the students to think about how the idea introduced in the worksheet can be applied to the problem.

The findings to these questions will help us to develop better worksheets for students.

KEYWORDS

Scaffolding, Worksheets, Problem-Based Learning, Inquiry Path and Social Constructivism