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Deeper Learning by Putting Students in Charge of the Problem Lifecycle

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ABSTRACT

Participatory Learning actively engages students in every stage of the problem lifecycle (including crafting problems for peers, providing solutions, peer grading, and disputes involving self-assessment). This brief motivates and describes the emerging Participatory Learning approach. The discussion then focuses on several issues concerning motivating students, guiding them in conducting the various problem lifecycle tasks, and evaluating participation and learning.

Keywords: participatory learning, active participation, peer assessment, student empowerment

PL FRAMEWORK

PL (Participatory Learning) is an emerging constructivist (Piaget, 1928; Vygotsky, 1978) approach, deepening learning through active participation by students in every problem lifecycle stage for assignments, quizzes and other course activities. Researchers have studied, and many instructors utilize individual PL stages. PL *uniquely* combines these stages into a comprehensive framework for deeper learning. PL stages include (see Figure 1):

1. Each student creates a problem ((De Jesus, Teixeira-Dias, & Watts, 2003; Foos, Mora, & Tkacz, 1994; Hargreaves, 1997; Hutchinson, Wells, & others, 2013; Palmer & Devitt, 2006); similar to inquiry- or problem-based learning (Barrett, Moore, & others, 2010; Hmelo-Silver, 2004; Koschmann, Kelson, Feltovich, & Barrows, 1996; Polman, 2000))
2. Instructor optionally edits the problem (ensures quality)
3. Another student solves the problem
4. Two students grade the solution, including the problem creator (peer assessment (Cho & Schunn, 2003; Hersam, Luna, & Light, 2004; E. Z. F. Liu, Lin, & Yuan, 2002; J. Lu & Law, 2012; Richards, Adsit, & Ford, 2012; Sadler & Good, 2006; Topping, 1998; Wiswall & Srogi, 1995; Yu, 2011))
5. If grades diverge, another student resolves the grade
6. Optionally, the problem solver can dispute the grade with justification (self assessment (Klenowski, 1995; E. Z.-F. Liu, Lin, Chiu, & Yuan, 2001))
7. Instructor resolves disputes (ensures quality)
8. Students can read everything peers have done (learning by example (Cho & Schunn, 2003; Van Gog & Rummel, 2010))

All stages are anonymous to minimize potential bias (R. Lu & Bol, 2007) and provide a more welcoming environment so students can constructively critique others (Yu & Liu, 2009)(Chen, 2010). Instructors provide instructions and rubrics for stages as appropriate.

Actively engaging students in every lifecycle stage empowers them to take ownership of their own learning, increases satisfaction and persistence in learning (Joo, Lim, & Kim, 2011) and motivates students (Guthrie, 2004; Holocher-Ertl, Kunzmann, Müller, Rivera-Pelayo, & Schmidt, 2013; Jones, 2009; Sircar & Tandon, 1999) to achieve deeper or higher learning outcomes (Anderson, Krathwohl, & Bloom, 2001; Bloom, Englehart, Furst, & Hill, 1956; Felder & Brent, 2004). For example, when designing problems, students must organize and synthesize their ideas and learn to recognize the domain's important concepts, resulting in "deep" learning(Hargreaves 1997)(Entwistle 2000; Keane, Keane, and Blicblau 2014). Through rubrics, instructors make expectations and evaluation criteria explicit, which also facilitates feedback and self-assessment, further promoting learning (Jonsson & Svingby, 2007).

We recently developed a software prototype on the Web that implements and facilitates the PL framework for both on-campus and e-learning environments, focuses participants on the task at hand, and streamlines management of courses and assignments for instructors (including automatically allocating students to tasks).

PRIOR PL RESEARCH

Initial PL research focused on exam problems, before developing the software prototype to streamline and guide the process (thus initially requiring much instructor overhead) (Shen, Bieber, & Hiltz, 2005; Shen, Hiltz, & Bieber, 2008; Wu, Hiltz, & Bieber, 2010). These prior studies are based on the widespread Technology Acceptance Model (TAM) (Davis, 1989)—the most widely used model in Information Systems (Lee, Kozar, & Larsen, 2003)—and its extension, the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003) for learning supported by an online infrastructure. This model focused on perceived learning and acceptance of the approach, although not actual learning. Results were very encouraging. Frequency distributions of survey results for our three major prior research model constructs (in italics) showed:

- 59.5% agreed or strongly agreed that they experienced *Perceived Enjoyment* (5 point Likert scale, construct measured with 3 questions, N > 220),
- 65.6% experienced high levels of *Perceived Learning* (7 questions), and
- 60.8% *Recommended PL* for future classes (1 question).

We also conducted other data, reliability and validity assessments, yielding generally favorable results (Wu et al., 2010). This encouraged us to develop the supporting prototype, and to focus future PL research towards potential widespread use to deepen learning, and investigate several very interesting issues.

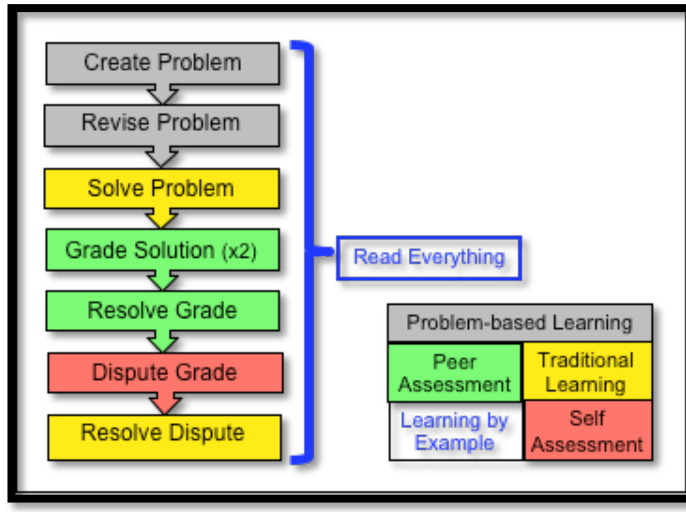

Figure 1. Participatory Learning (PL) Framework (color-coded by types of learning).

ISSUES EMERGING WITH PL

Motivation and Trust Issues

- In many traditional problems, only the solution is evaluated (graded). Which other lifecycle tasks could be evaluated, such as the quality of the problem created or the quality of the grading process. Would evaluating these cause students to take their tasks more seriously, trust other students to put in a more good-faith effort, and learn more deeply?
- Does anonymity foster trust when students solve each other's problems and evaluating peers?
- Do students develop interest in subjects that they may otherwise find uninteresting or overly challenging because they understand these subjects more deeply through participatory learning or because it engages them and causes them to take more ownership of the subject? Would PL encourage articulation or students to continue on for higher levels of education?

Guidance Issues

- Which types of guidelines and rubrics will help students conduct and learn from each type of problem lifecycle task? Would students take more ownership of the process if instructors involved them in developing the overall problem structure, guidelines and rubrics?

- How can we help students make better arguments when solving problems and justifying evaluations (grading)?
- What software features (scaffolds) would most effectively support active participation and learning in each problem lifecycle stage?

Issues Surrounding the PL Framework and Evaluating its Effectiveness

- Which active participation tasks and other aspects most deepen learning and engender participant acceptance?
- Which subject areas and types of problems would most benefit from participatory learning? Would it work effectively with writing assignments, science labs, computer programming, etc.?
- Which aspects and tasks work best when done by individuals and which would also foster deeper learning with groups?
- Which educational levels could effectively take advantage of participatory learning (primary, secondary, post-secondary, adult education, training and development)?
- Would it be an effective approach for MOOCs? Would it be an effective approach for hackathons and other forms of informal learning?
- Could participatory learning be used as an authentic assessment approach?
- To what extent do students gain interpersonal and workforce skills from different aspects of participatory learning?
- How do instructors ensure that all students (and instructors) do their tasks on-time, so other students waiting on their input are not delayed? What processes should be put in place to facilitate reallocating students to tasks if students do not do their tasks in a timely manner or even drop the course, leaving tasks abandoned?

Participatory Learning creates learning opportunities, increases student motivation for and enjoyment of learning, and has the potential to deepen learning through active participation in the entire problem lifecycle for assignments, quizzes and other kinds of activities. We look forward to working with teachers and researchers to experiment with and refine the approach.

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