Integrating Problem-Based Learning and Research Skill Development: An Example from a Master's Teacher Leader Course

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Abstract

This paper presents an exploratory analysis of a course that integrated Problem-Based Learning (PBL) and the Optimising Problem Solving (OPS) version of the Research Skills Development (RSD) model. Data were drawn from course assignments and end-of-course evaluations of 86 students who participated in four separate sessions from fall 2016 to summer 2017. This leadership master's course was designed for working teachers who built problem-to-solution projects based on their actual school experiences. Descriptive analyses found that the PBL and OPS frameworks aligned not only conceptually, but in the steps of the problem-to-solution process. Most valuable, however, was the application of the OPS framework in the student evaluations of the course. Findings suggest that PBL and OPS successfully integrated to scaffold authentic learning and provided a means to gauge course outcomes.

Introduction

The conceptual model (as illustrated in the Models of Engaged Learning & Teaching or MELT pentagon), delineation of the facets of research, and especially the progressive levels from highly directed to increasingly autonomous learning, fit well the teaching of practitioner educators. When I began teaching a master's leadership course to in-service teachers, I realized how applicable the RSD framework, and especially its close sister the Optimising Problem Solving (OPS) model, was to the problem-based

research project completed by these teachers. As a result, I began to explore not only how these different research-based learning models fit together, but perhaps more importantly, how frameworks could specifically be used as tools to measure course outcomes and student learning. This paper presents early findings of that investigation.

Background

Research-Based Learning

MELT and similar models present generalized pedagogical frameworks for designing inquiry activities and scaffolding research-based learning. The Research Skill Development (RSD) framework (Willison & O'Regan, 2007) is one of several research-based learning (RBL) conceptual models that is organized around a progression of exercises that leads students toward ever greater capacity and autonomy. Specified frameworks offer matrices to evaluate student progress (Venning & Buisman-Pijlman, 2011). Inquiry learning, however, is not a 'holy grail' or sufficient to ensure effective teaching. It has been pointed out that empirical evidence of effectiveness for all forms of research-based learning is, at best, emerging (Willison, n.d.).

Problem-based learning (PBL) is described as experiential learning focused around investigation and resolution of messy, real-world problems (IMSA, 2014). Learning using this approach is roughly organized in three stages. The first stage requires students to understand the problem by defining, describing, and clearly stating it. Then, learners must complete exploratory research, gather data, and generate possible solutions to the problem. In the third stage, students must select the resolution that best fits the situation, and present a case supporting their conclusions. It is the problem that provides the impetus from which the learner structures the investigation, selects appropriate resources, and is motivated to develop solutions. Fundamentally constructivist in nature, PBL forces students to plan, reflect on, and regulate their strategies and tasks, resulting in deeper learning (Strobel & van Barneveld, 2009).

Learner Guidance

The inquiry approach is often more effective when a reasonable degree of structure and assignments that constrain the complexity of the inquiry process are used (Lazonder & Harmsen, 2016). Key types of guidance have been identified in the literature. Process constraints is a mechanism by which inquiry is organized into smaller components or more manageable subtasks. Status overview is a summarization or visualization task completed by the learner as a means to review, remember, and better build to the next stage.

Teachers as Leaders

Teachers are now considered essential actors in improving, re-culturing, and transforming state-supported schools (Hall & Hord, 2015). Teachers with advanced degrees need skills to take on a widening range of professional activities, largely due to reform and Intensification of accountability (Ryan & Feller, 2009). Especially at the master's level, required leadership training (and certifications) focus on evidence-based decision making by engaging others outside the classroom for program review, planning, and professional development. Even young and inexperienced teachers are now asked to be efficacious in shaping improvement. Research suggests that increased training can reduce teacher stress and increase individual sense of purpose and empowerment to take on these diverse demands.

Course Description

Problem to Solution Process

Taught to working teachers seeking rank advancement and a graduate degree, the course sought to apply theories of change and leadership, use an inquiry learning approach, and build research skills. Entitled *Leading Achievement Change*, the course was offered entirely online to preschool through high school teachers who were geographically dispersed, in short (six or eight weeks) sessions. A progressive problem-to-solution process consisted of seven assignments, each with readings, lectures, research, and completion of a section of a paper that culminated in a complete problem-to-solution research report and one logic model diagramming the problem, and another for the solution. The seven steps/assignments from problem identification to solution creation are listed in Table 1.

Analyses and Findings

Data came from course assignments, student work, and a course evaluation given to class participants in four separate course sessions from fall 2016 through summer 2017. These datasets allowed for exploratory research that (a) compared PBL and OPS models; used student evaluations (b) to statistically gauge perceptions of engagement, understanding and mastery; and (c) for qualitative analysis of student response to problem solving learning strategies. It was anticipated that these findings would assist in measuring students' learning and course outcomes.

Alignment of PBL and OPS Models

The OPS facets of research were aligned to the problem-to-solution assignments to check continuity of process and alignment between designs. Early assignments focused on identifying and clearly defining the problem by gathering data and considering school practice, climate, and concerns. The problem logic model is both a generative process and a graphical representation. For purposes of this analysis, it was placed with 'Generate & Evaluate', but also represents information used to plan the solutions as typical for the 'Organise & Manage' facet. Several course assignments were located under the 'Analyse & Synthesise' facet. These include a review of literature, study of theories of change, and the culminating draft and final problem-to-solution report, which included a second logic model to specify and graphically represent the proposed solution. Overall, alignment of the PBL project and OPS model appears strong, as presented in Table 1.

End-of-Course Survey Findings

From four courses, a total of 86 student responses to 26 end-of-class evaluation questions were used to align course components with the OPS framework. Class participants responded using a Likert-type scale from 1-5 where 1 was strongly disagree and 5 was strongly agree. The survey demonstrated strong internal consistency with a Cronbach's level of .97, which is high and well over the .80 acceptable for social research (Creswell, 2012). Table 2 shows the mean and standard deviation of each question, as well as the alpha levels for each sub-scale. Overall, responses averaged above three indicating a strong level of agreement with each item. However, varied responses show inconsistent student growth and

possible need for course modification for at least some groups of students. The findings do suggest strong alignment between course activities and the OPS framework.

Open-Ended Responses

A different tact was taken in the analysis of open ended retrospective responses (N=77) from students when asked to complete this half-sentence: "the single most valuable thing I learned in the course is." Many students appreciated the step-by-step approach:

> *How to follow a logical process on how to identify current needs in my school and research-based solution on how to effectively address these issues.*
> *How to break apart a problem and dig deep to find solutions.*
> *The correct steps needed to evaluate a problem and create a solution.*
> *How to work through a problem in small steps rather than tackling it in one giant step.*

Many students also valued that problem-solving required communication and participation with others:

> *I learned how to read people's levels of concern…*
> *I can help bring about change in a cooperative manner.*
> *Create a community of support.*
> *The importance of communication and collaboration with colleagues.*

Still others appreciated better understanding how research fit into the problem-solving process:

> *Instead of rushing in, it's best to research problems carefully….*
> *To review what the literature says before making a change so I know my plan has been effective before.*

Most heartening, perhaps were that many responses suggested that the ultimate goal of the course was to some extent realized. These students showed increased confidence for leadership and agency within their school:

The single most valuable thing I learned in this course is that I have the power to work with my peers and colleagues to make our school and work environment better…
That anyone can develop a plan to implement small changes that can positively impact students.
The amount of experience I have does not necessarily correlate with my leading abilities as long as I have right tools for change.

Conclusions

Preliminary findings indicate that problem-based learning, the Optimising Problem Solving model, and working with the facets of research can ensure that students are given tools and techniques for (a) developing research skills, (b) generating best practices, (c) and growing capacities as agents for change and improvement in their schools (Bourner, Bowden, & Laing, 2000). Overall, it appears that authentic learning helped deepen clinical problem solving by leading class members to dissect the problem and devise a change plan of action. There seems to be substantive evidence that research skills and other problem-solving abilities through a progressive and generative process do help young practitioners develop their own sense of self-efficacy that translates into professional competencies.

Table 1

Alignment of OPS model facets of research by course assignments

Problem Definition & Specification
#1 ID school-based problem
Find & Reflect
#2 Provide evidence of problem (school data, policies, other data)
Generate & Evaluate
#2 Context of problem (Others stages of concern, school climate, etc)
Organise & Manage
#3 Problem Logic Model & Write Up (Refined details of actions and outcomes)
Analyse & Synthesise
#4 Review of Literature (Research possible solutions)
#5 Theories of Change (within school communications; professional development & other training/resources; theories of change & process steps for success)
Communicate & Apply
#6 Draft Solutions Change Plan/Solution Logic Model (Solution logic model & write up)
#7 Final Report & Solutions Change Plan

Table 2

Descriptive statistics of survey items

	Cronbach's alpha	Mean	SD
Find & Reflect	**0.79**		
Helped me understand the problem better.		3.91	0.79
Forced me to rethink what the problem was.		4.05	0.77
Generate & Evaluate	**0.80**		
Helped me understand school practices.		3.94	0.79
Helped me understand difference between policies & practices.		3.92	0.71
Organise & Manage	**0.83**		
Helped me understand different ways to measure student progress.		3.87	0.70
Now more carefully consider short term measures of student progress.		4.03	0.66
Helped me measure small changes in student performance.		3.88	0.70
Analyse & Synthesise	**0.92**		
I now ask more questions about educational programs/practices.		3.75	0.79
I question established ways of doing things more.		3.59	0.85
I better understand how to work with people for change.		3.82	0.82
I better understand others' motivations and concerns about change.		3.84	0.77
I am more considerate of others' perspectives.		3.86	0.73
Communicate & Apply	**0.89**		
Made me want to take on more of a leadership role in my school.		3.71	0.90
Helped me lead others.		3.76	0.81
More confident about leadership roles		3.67	0.94
I understand how to implement change in schools.		3.88	0.75
I learned how to better implement change in my school.		3.87	0.81

I learned how to plan for change.	3.99	0.75
I understand leadership better.	3.91	0.81
I am sure what to do (to implement change)	3.37	0.93
I want to more clearly understand the goals of educational programs/practices.	3.81	0.76

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