Investigating Science Teachers' Professional Growth in Self-Regulated Learning Through Professional Development: An Extreme Case Analysis

Anastasia Kitsantas, Timothy J. Cleary, Erin Peters-Burton, Angela Lui, Kim McLeod, Jacqueline Slemp, Xiaorong Zhang

George Mason University & Rutgers University

PRESENTED AT:

INTRODUCTION

Self-Regulated Learning in the Classroom

- Self-regulated learning (SRL) is a goal-directed process that refers to the degree to which students are metacognitively, motivationally, and behaviorally active participants in their own learning processes (Zimmerman, 1989).

- SRL skills correlate significantly with students' motivation and academic achievement (Cleary et al., 2017; Cooper & Corpus, 2009; Dignath & Büttner, 2008)

- Teachers generally express positive perceptions about utilizing SRL strategies in their classrooms; however, many are not familiar with specific SRL processes or how to successfully implement these concepts in a classroom setting (Lau, 2012; Pauli et al., 2007)

SRL Professional Development and Coaching

- Existing SRL professional development (PD) involves distinctions in duration of training: While some SRL PD programs utilize a longer-term, multi-component format (e.g., Perry et al., 2007), others can last several weeks (Peters-Burton & Botov, 2017) or be as brief as a couple of hours (e.g., Allshouse, 2016). Although there is variability in SRL training experiences and PD programming, research supports the overall effectiveness in supporting teachers' SRL learning.

- Some research has linked teacher SRL knowledge and skills with teachers' ability to conceptualize or implement SRL principles in their lesson plans or instruction (Buzza & Allinote, 2013; Dignath & Büttner, 2018; Dignath-van Ewijk & van der Werf, 2012)

- Some other research has also examined teacher self-efficacy for using SRL strategies in their classroom after the PD program (e.g., Allshouse, 2016).

Research Questions

1. To what extent do high school science teachers differ from pretest to posttest in their familiarity and efficacy beliefs in applying SRL following an SRL PD workshop?

2. In what ways do the experiences and perspectives of teachers who are proficient and emerging in SRL vary regarding applying SRL principles to science lesson plans?

METHOD

A two-phase explanatory sequential mixed methods design was used in this study: quantitative data were collected in Phase 1 with all 19 teachers before and following a PD SRL workshop; Interviews were conducted with six teachers in Phase 2.

Participants

- 19 in-service secondary science teachers from a suburban public school district in the Mid-Atlantic region of the US participated in this study.

- Among these 19 teachers, three were identified as emerging and three as proficient based on their knowledge and application of SRL.

Data Collection

Quantitative Data Sources

- Teacher familiarity of SRL: was measured using 10 items using a 3-point Likert scale items (pre-test: $\alpha = .96$; post-test: $\alpha = .92$).

- Teacher efficacy for applying SRL with high and low performing students: was assessed through 10 items on a scale ranging from 0 to 100 (pre-test: $\alpha=.97$ for lower; $\alpha=.95$ for upper; post-test: $\alpha=.98$ for lower; $\alpha=.91$ for upper).

Qualitative Data Sources

- Teachers' SRL knowledge: one open-ended item that asked them to describe their conceptual understanding of SRL.

- Teachers' SRL application: vignette-based application question about a struggling science student who was lacking a variety of SRL strategies.

- Teachers' implementation experiences: Semi-structured interviews with teachers to understand their experience in incorporating SRL into their lesson plans.

METHOD AND RESULTS

Method (continued)

Professional Development Program and Procedures

The PD consisted of a one-week SRL Summer Institute designed to help teachers understand the components of SRL and apply SRL principles in their classrooms through lectures and activities (see Figure 1 below for detailed activities of PD). Both the quantitative measures and the open-ended questions were administered before and after the PD. Interviews about teachers' incorporation of SRL into their lesson plans were administered six months after the PD.

Figure 1

PD Program and Activities
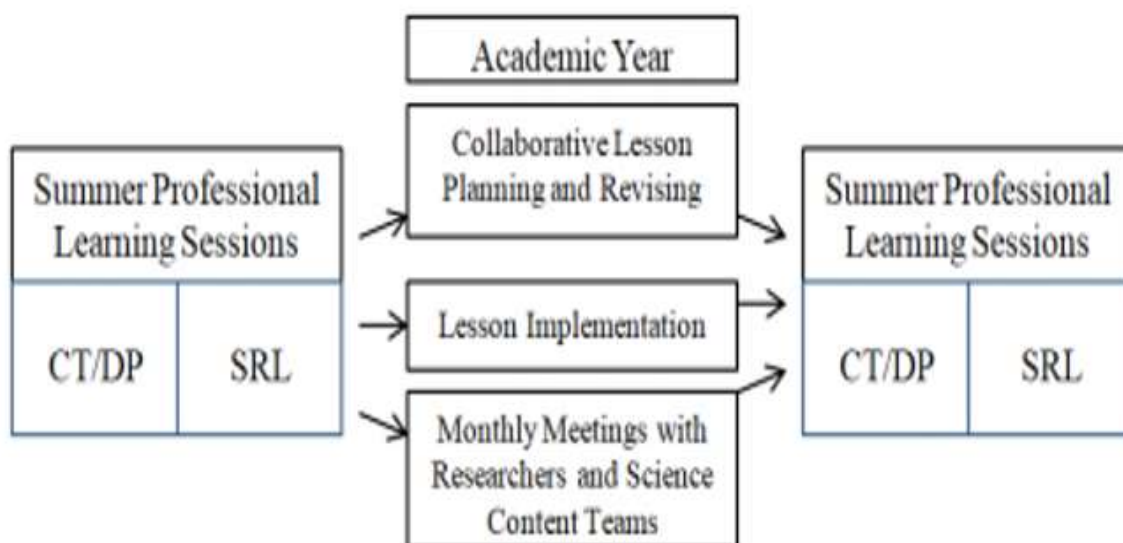
Data Analysis

- Teachers' knowledge and application were coded by two trained graduate students in quantity and quality dimensions using a previously-developed rubric (Zhang et al., 2020).
- Paired sample t-tests and Wilcoxon Signed-Ranks tests were used to assess pretest-posttest changes across teacher familiarity, self-efficacy, and knowledge and application.
- Interview transcripts were collectively coded by three, trained graduate students using an emerging codebook. A thematic analysis approach (Braun & Clarke, 2006) was further used to identify themes from coded segments.

Results

Teachers' Efficacy Beliefs and Perceptions of Familiarity with SRL

Descriptive analyses showed that both proficient and emerging teachers' familiarity with SRL and efficacy beliefs for applying SRL with their most at-risk and most advanced students increased after the PD (see Table 1 and Table 2).

Table 1

Pre-Post Changes of All Teachers' Efficacy, Familiarity, Knowledge, and Application of SRL

	$M_1(SD_1)$	$M_2(SD_2)$	T/Z value	Effect Size
Self-Efficacy Lower	44.56(12.54)	68.66(13.31)	5.52**	1.38
Self-Efficacy Upper	77.97(11.07)	90.47(5.37)	4.27**	1.07
Familiarity	2.20(.55)	2.66(.41)	3.26**	.79
KnowledgeFrequency	1.61(1.91)	4.44(2.81)	3.65**	.86
KnowledgeQuality	--	--	2.80**	.49
ApplicationFrequency	3.69(2.12)	6.50(2.45)	6.14**	1.54
ApplicationQuality	--	--	2.81**	.50

RESULTS: OUR SIX EXTREME CASES

Efficacy Beliefs and Perceptions of Familiarity with SRL

Table 2

Extreme-Case Teachers' Efficacy for Applying SRL and Familiarity of SRL

Extreme Cases	Proficient			Emerging		
Name	Rob	Andre	Lauren	Kristen	Maria	Lily
Subject	Chemistry	Physics	Biology	Biology	Physics	Biology
Teaching Experience	7	4	5	25	14	4
PreSELower	44	44	38	43	65	50
PreSEUpper	71	83	63	84	86	94
PostSELower	77	69	82	55	58	87
PostSEUpper	89	95	96	85	83	100
PreFamiliarity	2.8	1	1.8	2	1.2	3
PostFamiliarity	2.8	2.7	2.5	1.6	2.4	3

Note. PreSELower = pre-PD teacher efficacy for applying SRL with the low-performing students. PreSEUpper = pre-PD teacher efficacy for applying SRL with the high-performing students. PostSELower = post-PD teacher efficacy for applying SRL with the low-performing students post-PD. PostSEUpper = post-PD teacher efficacy for applying SRL with the high-performing students. PreFamiliarity = pre-PD teacher familiarity of SRL. PostFamiliarity=post-PD teacher familiarity of SRL.

Experiences and Perspectives of Application of SRL

Theme 1: Attitudes toward SRL.

- Teachers proficient in SRL reported positive perceptions about implementing SRL, and were convinced of the benefits of SRL.
  - **Experience with students' positive outcome convinced them of the value of SRL.**
  - **Positive perceptions about SRL and cultivated a culture of SRL in their classrooms that aligned with their values.**
- Teachers emerging in their SRL skills were interested but tentative in implementing SRL.
  - **Dismissive** of SRL and its inclusion in their instruction
  - **Hoped for an easy "switch" to quickly and easily integrate it.**

Theme 2: Targeted SRL Skills.

Teachers were given a maximum amount of freedom in lesson planning and integrating SRL.

- Teachers proficient in SRL skills
  - targeted specific SRL skills for classroom implementation,
  - expressed the importance of **SRL's cyclical nature**, and
  - described the infusion of SRL as a process for engaging students in a cycle of learning (plan, monitor, and reflect).
- Teachers emerging in SRL skills
  - were able to name a wide variety of SRL processes and skills they may have tried, but
  - could not speak to specific examples of their infusion, simply naming terms which translated into **breadth, not depth**.

Theme 3: Barriers Faced by Teachers.

Generally, both teachers proficient and emerging in SRL struggled with the application of SRL, but they spoke about this difficulty differently.

- Teachers proficient in SRL did not have a problem-free experience in infusing SRL, but they did seem to be more aware and comfortable with where they struggled.
- Teachers emerging in SRL had difficulties with application, but also named a wide variety of external factors (e.g. parents, student motivation) they felt prohibited the infusion of SRL.

DISCUSSION

Overall, teachers benefited from the PD as they reported higher levels of efficacy and familiarity with SRL after the PD.

In terms of the extreme case analyses, two major findings emerged:

- Proficient teachers infusing SRL into their science lessons were those who were more self-regulated in thinking about their PD experience and the infusion process.
- Emerging teachers were more likely to resist implementing SRL for various reasons, but proficient teachers felt comfortable with the unknowns of SRL infusion.

These findings have important implications for the implementation of PD programs.

- Science teachers need to build a solid knowledge base of SRL concepts and application to effectively implement SRL in their classrooms.
- PD programs aiming at improving teachers' knowledge and application of SRL should consider elements promoting teachers' beliefs about SRL to optimize the effect of the PD.
- PD programs related to teachers' application of SRL should include specific examples in the relevant context to model teachers' implementation of SRL in their classrooms. However, context and settings have to be carefully considered in generalizing the conclusions of this study (Yin, 2003).

ABSTRACT

This study examined how high school science teachers' experience, beliefs, and perspectives regarding applying Self-Regulated Learning (SRL) principles to science lesson plans vary based on their level of SRL knowledge and application skills. Six extreme cases (SRL proficient, emerging) were identified from 20 teachers participating in a Professional Development (PD) program. Teachers' efficacy for applying SRL and familiarity of SRL were measured before and after the PD and an interview was conducted to understand their experience in incorporating SRL into their lesson plans. Results showed that teacher efficacy and familiarity of SRL increased across all teachers. However, proficient teachers in SRL held a more positive perspective toward the implementation of SRL than emerging teachers. Implications for teacher training are discussed.