Exploring Preservice Teachers' Pedagogical Reasoning: A pilot study

Stephen Keast & Lucy Anders

Monash University, Clayton, Melbourne, Victoria, 3800, Australia

Abstract

In contemporary times policy makers are calling for preservice teachers to be 'classroom ready' at the end of their education. Previous research investigating the pedagogical reasoning of expert teachers suggests that making explicit pedagogical reasoning can assist a teacher in communicating aspects of their often tacit practice and improve their understanding of teaching. This pilot study sought to investigate whether preservice teachers would relate to pedagogical reasoning. It found that the entire sample reported valuing the potential benefits in aiming to interrogate their pedagogical reasoning and the pedagogical reasoning of their mentors on placement. This suggests that a larger study exploring the pedagogical reasoning of preservice teachers is feasible and appropriate to address the political demands on the future generation of teachers.

Keywords: Pedagogical Reasoning; Preservice Teachers; Shulman; Pinball Reasoning

Corresponding author e-mail address: keast@monash.edu

Introduction

There have been many concerns over the effectiveness of preservice science teacher education particularly in contemporary times of rapidly changing technologies, increasing student diversity and pressing global problems. Teaching is a complex interaction between many factors that are difficult for the novice to navigate. This paper seeks to report a pilot study adapted from a larger Australian Research Council (ARC) funded project (Project: DP140104025), conducted to investigate the relevance of our research with preservice teachers (PSTs). The larger study seeks to build on previous research focused on the Pedagogical Reasoning of Expert Science Teachers (PREST) (Mitchell, Keast, Panizzon, & Mitchell, 2016; Keast, Mitchell, Panizzon, Loughran, Tham, & Rutherford, In Press), extending understanding from expert teachers to preservice and beginning teachers. Teacher education has been under review in many western countries including Australia, with calls for PSTs on their exit from courses to be classroom ready. The Teacher Education Ministerial Advisory Group (TEMAG, 2014) collaborated with stakeholders and made 38 recommendations to achieve improvements in both the content and delivery of initial teacher education courses in Australia (TEMAG, 2015). The recommendations include greater emphasis on science in primary and secondary teacher education, and better alignment with the Australian Professional Standards for Teachers (APST) (AITSL, 2014) in preservice programs. The APST elaborate a contemporary understanding of what teachers are able to do at different points in their career, but are silent on 'how' and are non-specific about 'why'. Being an effective teacher in a contemporary sense requires more ingenuity, agency and critical awareness than ever before. However, Rovegno and Dolly (2006) suggest that PSTs are rarely given agency in teacher education because the current paradigm is that an expert panel of teachers dictate their wisdom to PSTs. This is in contrast to the recent ACER review of teacher education in Australia, which identified that well-designed programs have "an inquiry approach that connects theory and practice, including regular use of case methods, analyses of teaching, and learning, and teacher research applying learning to real problems of practice and developing teachers as reflective practitioners" (Ingvarson et al., 2014, p. 39).

Pedagogical reasoning (PR) is the enactment and integration of all aspects of teacher knowledge as a teacher seeks to make the content pedagogically powerful for students (Shulman, 1987). Pedagogical Reasoning has been under-researched since Shulman (1987) first termed the idea of Pedagogical Reasoning and Action (PRA), while there has been considerable research into other frames that Shulman (1986) raised such as Pedagogical Content Knowledge (PCK). Keast et al, (In Press) have reconceptualised Shulman's 6-stage, mostly linear process of PRA by considering the first three stages, comprehension, transformation and instruction as PR and the later three stages, evaluation, reflection and new comprehensions as teacher reflective practice. There has been numerous studies on teacher reflection and reflective practice that in our work on PR we consider to be the thinking teachers do in planning lessons or groups of lessons before entering the classroom. The outcome for teachers during this thinking is to build pedagogically powerful lessons.

From previous research, the larger team has demonstrated how PR can improve expert teachers' understanding, planning, delivery and reflection of their practice (Keast, Mitchell, Panizzon, Loughran, & Tham, 2015). A framework of (five) focal concepts (Big Ideas, Student Engagement, Quality Learning and Quality Learners, Contextual Constraints and Opportunities, and Personal and Professional Identity) (see Mitchell et al, 2016 for explanation of the focal concepts) and the knowledge of expert science teachers' PR from the PREST study has the potential to scaffold PSTs' classroom readiness by supporting deliberation on the 'how' and 'why' of the APST. Of the five focal concepts proposed, the first four are used during planning while conversations are mediated by the fifth focal concept. By asking PSTs to consider the reasoning behind their choices, and question the practice they observe on placements, we hypothesise that they will be better placed to give examples of their achievement of the 'graduate' standards. We also posit that PR will help build professional agency in the PSTs.

Three research questions guide the larger study:

1. Does PR and our framework of focal concepts resonate with preservice teachers in ways that they find useful?

2. How can PR be used by graduate teachers to frame their practice against professional standards?

3. What elements of the Focal Concepts of the framework in our PR model are retained by teachers after full registration?

PR has the potential to scaffold pre-service and beginning teachers' pedagogical practices against APST as a monitoring tool to improve their teaching. Monitoring teaching practice and better understanding why they teach, has the potential to vastly improve the student learning outcomes in beginning teacher's classes. We argue that teacher readiness is more than just being ready to teach today's students. PSTs of today also have to be the teacher leaders of tomorrow. Being able to articulate, analyse and interrogate PR has proved to be an empowering route to leadership in the PREST study. If we can do that with beginning teachers they should be able to build leadership capacity quicker.

Background

Reconceptualising Pedagogical Reasoning

As mentioned above, we consider only the first three stages of Shulman's model to be PR, with the following three falling under reflective practice. The framework we use to analyse teacher's PR has come from the empirical data of a select group of elementary and secondary expert science teachers. We use the term expert rather than experienced, as the teachers that researched with us had been involved for several years in professional learning programs that supported them to articulate and reflect on their practice in sophisticated ways (see Keast et al., In Press, for further details). As teachers discussed their planning their commentary 'pinballed' between our focal concepts. We have termed this rapid and non-linear bouncing between foci, 'Pinball Reasoning'. Pinball Reasoning, while sounding chaotic and erratic, is not. It is the progressive building of understanding of the content, the pedagogy and the learning intentions. Expert teachers clearly have a sophisticated highly interconnected knowledge of teaching based around students, content, learning, activities, their school environment and culture, and professional expectations that interact as teachers working in small teams discuss lesson planning. In fact the type of teacher dialogue we have observed with expert teachers we refer to as interrogating professional practice. It is when teachers interrogate each other's practice that their values and tacit knowledge of practice become explicit.

Preservice Teachers versus Expert Teachers

It is clear that PSTs do not have the experience or wealth of knowledge that expert teachers have. So research such as this paper refers to, that investigates ways PSTs can make sense of their experiences within teacher education (in whatever form it takes) add to our understanding of developing better science teachers. Typically courses in teacher education focus on content knowledge (Ginns & Watters, 1995; Hoban, McDonald, & Ferry, 2009), pedagogy (Keast & Bragg, 2003; Keast, Cooper, Berry, Loughran, & Hoban, 2010) and PCK (Berry, Friedrichsen, & Loughran, 2015; Mavhunga & Rollnick, 2013) as means to learning about teaching. Morine-Derschimer and Kent (1999) for example investigated PSTs developing knowledge of teaching. Their model gave reference to how PST gain pedagogical knowledge.

Figure 1: Categories contributing to Pedagogical Knowledge (Morine-Dershimer & Kent, 1999, p. 23)
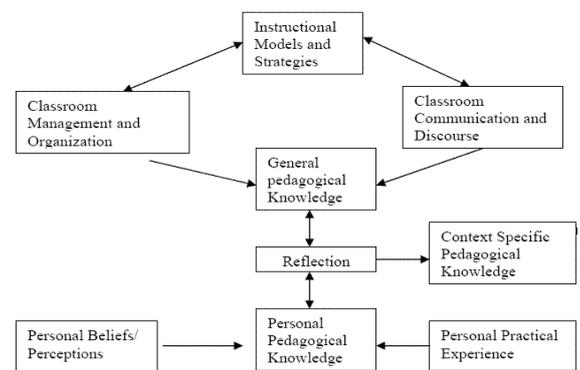
Compared to the work in the present study other frameworks do not account for PST's thinking and meaning making of such notions of teaching and learning in terms of a complex set of interconnected factors. Typical of other research, it presents PST's planning for teaching as linear and progressive. Our work with expert teachers in fact demonstrates the rapid fire interconnected nature of teacher's pinball reasoning. It is our hypothesis that PSTs will relate to the notions of PR in our model and view these as helpful to their learning about teaching when lesson planning is seen as process of interrogating practice as much as the linear approach of choosing appropriate and interesting activities.

Methodology

Pilot Study

A pilot study was conducted in 2015 consisting of a lecture and tutorial about PR given to 4th year students at Monash University in Australia in a multi-domain core unit of the Bachelor of Education. The team had approval from the Monash University Human Research Ethics committee to conduct this research, Ethics approval number CF14/29 – 2014000009. This pilot study focused on RQ1, since if preservice teachers found the concept confusing or not useful the larger research project would need to be reviewed and changed. The lecture presented the focal concepts and gave an analysis of a transcript of a planning conversation from the PREST study. At the end of the lecture students completed an exit slip and volunteers submitted these for data analysis. They were asked three questions:

1. What does Pedagogical Reasoning mean for you?

2. Do the foci sound reasonable as things you would consider when planning a lesson?

3. From the lecture did PR sound like something that would help you understand your teaching?

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Completion of the exit slips was voluntary and anonymous, so as not to prejudice the results.

Following the lecture a tutorial class was given where the PSTs were invited to do their own analysis of a pre-recorded planning conversation between two expert teachers, in a jigsaw-style activity where each member of the group focused on one of the focal concepts. The group then discussed what they heard in the tape and whether they heard examples of the focal concepts being discussed. They were then given the opportunity in pairs to have their own planning conversation where they worked to interrogate the topic and activities, in an effort to discuss their pedagogical reasoning. At the end of the tutorials, two groups were asked to fill in another exit slip. They were asked the following questions:

1. After analysing the PR of two teachers, what purpose do you see for the foci?

2. Is one foci better (or worse) than the others in understanding your PR?

3. In discussing planning, did you pinball about the foci?

The responses were then collated using Microsoft Excel and pattern coding was employed to categorise the responses according to degree of positivity. Basic statistics were used to measure the rate of agreeance with the statements.

Results and discussion

Response from Lecture

Firstly it should be noted that in this course lectures are videotaped and attendance is not compulsory. The lecture was conducted on a Monday morning the first week after students completed professional experience in schools. As a result many students choose not to attend the actual lecture with the intention of watching the lecture on line. Hence only 35 (of the 128 cohort) attended this lecture, with 28 submitting exit slips. Some example responses for each question given after the lecture can be found in Table 1.

Table 1: Sample responses for each of the lecture exit slip questions

Question One: What does Pedagogical Reasoning mean for you?	Question Two: Do the foci sound reasonable as things you would consider when planning a lesson?	Question Three: From the lecture did PR sound like something that would help you understand your teaching?
How teachers make the content pedagogically powerful for the students [PST 23]	Hearing the foci explicitly labelled and defined I thought back to placement and how I observed it all in planning meetings and how they impacted the design of lessons [PST 12]	It is definitely something that will continue to improve my teaching and understanding of why [PST 11]
Interrogating practice working out the deeper purposes and meanings of what the teacher is doing [PST 11]	Big Ideas I usually treat as key concepts, which is a layer down. Engagement is always on my mind, I think that most management is done pre-emptively and comes from planning [PST 15]	It sounds fundamental. I've always felt that I should be able to explain my 'content reasoning' (justification of content) to students. I see no reason that it should be otherwise for pedagogy. It's a fairly common phrase 'you cannot be sure you know something until you explain it to someone else'. I believe this phrase is true [PST 21]
It refers to my reason for choosing certain activities that will most appropriately help students' learning of specific content. It takes into consideration the specific class, space and context of the lesson [PST 10]	The reasoning IS often tacit however analysis of the foci can help new teachers develop better pedagogy [PST 26]	Definitely! I'm excited to use it in my portfolio as it will enhance my explanations and I feel it will put me ahead of my peers having a deeper reasoning for my teaching. Thank you! [PST 16]

Surprisingly for us all the preservice teachers reported meanings for PR that were useful for understanding aspects of their teaching in response to Question 1. Particular key terms from the lecture had resonated with different students, and the examples in Table 1 while not exhaustive are indicative of the range of responses including: pedagogically powerful, interrogating practice, and PCK. In this way PSTs were incorporating the new knowledge of PR within the important concepts they identified with from the course. In terms of our research it appeared at least initially from the data that PR made sense to PSTs and could be assimilated into their knowledge system of learning to teach.

For question 2 (Do the foci sound reasonable as things you would consider when planning a lesson?), 100% of respondents said yes (n=28). This was both surprising and comforting, since the foci has emerged from our work with expert science teachers, and yet they resonated with PSTs from a cross section of teaching specialisms. Most (n=24) PSTs went on to elaborate the ways they thought the focal concepts would be useful. Table 1 includes indicative comments that were received from the 24 PSTs who thus responded. Some PSTs recognised on reflection how the foci had been used unknowingly by teachers at the school during planning meetings as reflected by PST 12 in Table 1. It reinforced that the frame would be useful for PSTs to understanding the thinking of teachers who made explicit their PR. The preservice teachers demonstrated those aspects of PR they could identify as useful and worth investigating further. PST 15 in Table 1 connected with Big Ideas and student engagement. It was pleasing to see that PST 15 made the further connection between these ideas of PR and classroom management issues, recognising that most management issues can be planned for pre-emptively. Understanding that cognitively engaged as well as affectively engaged students are less likely to cause behavioural problems. In this way PR was a useful frame to focus on issues that PSTs are often concerned with, e.g. students' engagement with the content and behaviour management. PST 26 demonstrated quite an insight when responding, that making her tacit knowledge of practice explicit during planning would assist her pedagogical development. These comments are the ways the authors envisioned PR could be useful and helpful for PSTs to better understand their practice.

For question 3, 27 responded positively and the single negative comment was *If I taught science* [PST 6]. For this PST, she could not make the transition of ideas to her own context since the examples from the PREST study were all science based. The positive responses demonstrated that preservice teaches were seeking a way to frame their practice, many had ideas about their developing pedagogy and the PR framework gave them labels and space to categorise and understand their thinking. Interestingly PST 16 recognised value in using PR in her Portfolio assessment task and that this would give her an advantage in job interviews (our PSTs demonstrate their practice in interviews using the professional portfolios they create for this unit, that demonstrate evidence of their practice against the APST).

Responses from Tutorials

Some difference in responses of the PSTs from either tutorial were evident in the data. Most of the PSTs who were in the tutorial straight after the lecture also attended the lecture (n=10 attended the lecture, n=12 submitted exit forms, n=20 attended class) and benefited from the knowledge gained in the lecture. Many of the PSTs in the afternoon tutorial did not attend the lecture (n=11 did not attend lecture, n=14 submitted exit forms, n=19 attended class) and as a result found it more difficult to understand the process and foci because they hadn't witnessed the extended explanations. The second tutorial was considerably harder for us to teach as we needed to repeat much of what was in the lecture and re-explain concepts we covered in tutorial one. Regardless, many PSTs resonated with our framework of pedagogical reasoning. Table 2 below contains comments indicative of the respondents.

Table 2: Sample responses for each of the tutorial exit slip questions

Question One: After analysing the PR of two teachers what purpose do you see for the four foci?	Question Two: Is one foci better (or worse) than the others in understanding your PR?	Question Three: In discussing planning, did you pinball about the foci?
As a teacher to understand my own practice, to obtain another's view, to reflect on pedagogical reasoning and to make sure it is student based rather than my own. [PST 4 class 1]	I think they all work together in unison. Need all for them to work. [PST 12 class 2]	Yes! They all link together yet stand alone. "Oh that's a good technique to engage students, but it also is turning a constraint into an opportunity". Outdoor ed teacher using the bad weather that was stopping an activity as a learning opportunity. [PST 13 class 2]
Big ideas are useful for directing learning. Student engagement is vital for promoting learning. Quality learning ensures planning is directed towards good learning for students. Considering restrictions and opportunities are good for considering new ways of teaching. [PST 10 class 1]	Quality learning and learners helps to look at how the lesson is succeeding in helping students to learn the content [PST 5 class 2]	No, because we were reflecting practice and we told the story in a sequence. [PST 6 class 1]
Helps teachers in developing and understanding the purpose of their pedagogy and why it was picked to use for a specific lesson or group of students. [PST 7 class 2]	I think they're all equal and are interrelated. They are all dependent on each other and need the others to exist. [PST 7 class 1]	Yes. It happened organically so there wasn't an order to it where we talked about one after the other. [PST 6 class 2]
A process of internal reasoning to keep planning focused on effective student learning [PST 11 class 2]	Student engagement relies on implementation. A fantastic tool delivered poorly can be very disengaging. [PST 2 class 1]	Somewhat, my partner probed me with questions and I explained my choices and then she asked me what I would do differently. [PST 7 class 1]

The PSTs all resonated with the foci and were able to see worthwhile purposes for themselves and the teachers on the recordings. There were no negative comments or lack of purpose in the 26 responses received. Like PST 10 in class 1 above, several PSTs commented on the usefulness of the foci and the purposes they observed for each. For others it was about making the purposes of teaching explicit as PST 7 from class 2 remarks above. Foremost in some PSTs thinking was the student learning as reflected in the comments of PST 11 from class 2 and PST 4 from class 1.

For question 2, *Is one foci better (or worse) than the others in understanding your PR?* approximately half the PSTs saw the interconnectedness of the foci. These PSTs were able to view the focal concepts as parts of the PR process and not individual items to be ticked off a checklist. PST 7 from class 1 commented on the interrelated nature of the focal concepts as did PST 12 in class 2. Both of these PSTs recognised that you need each of them and they should not be thought of in isolation. The notion that some of the PSTs so readily identified that the focal concepts were interconnected was confirmation for us that these ideas were of assistance to rethink their teaching practice. Other PSTs focused on one of these focal concepts, for PST 5 in class 2 above it was quality learning and quality learners. While for PST 2 in class 1 it was student engagement. These two foci were more often represented in the results than big ideas or contextual constraints and opportunities.

For question 3, *In discussing planning, did you pinball about the foci?* the majority of PSTs responded in similar ways to PSTs 13, 6 and 7 above

that in discussing their planning they pinballed between the first four focal concepts. Contrasting this, several groups (like PST 6 in class 1) reported that they did not pinball about the foci. In the case reported here, PST 6 responded that each group member gave a reflective account of their own experience and the conversation was linear. It was surprising for us that PST 7 in class 1 reported that her classroom partner probed her reasoning. This was the type of interrogation of practice we observed in expert teachers.

Discussion

We were excited by the results and the way the PSTs generally related to our framework of PR and the focal concepts. Applying a framework developed from expert teacher's knowledge to novice teachers is fraught with danger as PSTs are often too focused on the individual items rather than seeing teaching as a complex interplay between interconnected parts. We have observed lesson planning in teacher education to be conducted in this way. Three main points stood out for us and these will be discussed next.

As PST 6 in class 1 stated above, when reflecting on practice the reasoning is linear rather than pinballing as we have observed in pedagogical reasoning. Shulman's 6 stages of PRA (Shulman, 1987) have been reconceptualised by our team since we have found that a teacher's thinking in stages one to three is different than for stages four to six. There is already a well-established research literature on reflective practice (Korthagen, 1993; Loughran, 2002; Richardson, 1992; Schön, 1983; Zeichner & Liston, 1996) so it was sensible for our team to separate this from the pedagogical reasoning teachers do before entering the classroom. Pedagogical reasoning is made explicit when teachers work together in small teams to interrogate their professional wisdom. What wasn't clear to us was whether PSTs would be able to make sense of this framework and see it as intelligible, plausible and fruitful (Posner et al., 1982). While not conclusive at this stage given this is a pilot study it is reassuring for the larger study.

This pilot study was conducted immediately after PSTs returned from their final teaching placement in the course with only a few weeks left in their final semester. At this time they have transitioned, identifying more as teachers and less as students. Some of the PSTs have critical incidents from placement firmly in their front of mind. We hypothesise that this has influenced some of the PSTs in their comments on importance of the focal concepts. While most PSTs recognised the interconnected nature of the focal concepts and that they were not meant to be viewed individually, others focused on some as more important than others. The question was deliberately phrased in this way to identify if there were any focal concepts that resonated more than others. The results indicate that Quality Learning and Engagement were slightly more relatable, however this was small and less than 30%. This issue emerged unexpectedly from the pilot study. In the future we will endeavour to include a more rigorous method of data collection in the larger study to investigate the reasons for this. Being the first week after teaching placement, meant there were many absences from the course as PSTs often used this week to catch up on days missed during placement. The numbers in the lecture and tutorials were low. It was initially thought that this would be an ideal time in the unit to capture PSTs' PR as it would be still fresh in their thinking. Due to the low attendance this will be reconsidered for the larger study.

The nature of expert teacher's knowledge of teaching, pedagogy and learning amassed over a significant period time is incomparable to the novice PST. A major concern for the ongoing project was, would PST see the benefits of this model in their planning and would it be enough to change their practice. While too early to be definitive about this, it was encouraging to see the way the PST engaged with the focal concepts and responded to the exit slips. PST 7 from class 1 and her partner engaged in probing each other's practice that aligned with the interrogation of practice that our PREST expert teachers viewed as valuable. Given their knowledge base, PSTs questioning each other's understanding of the content as they plan lessons will enhance their developing pedagogical reasoning. While encouraging in the pilot study, this needs further investigation.

Finally, this study has shown that our framework for pedagogical reasoning does resonate and is feasible for enhancing PSTs understanding of teaching. We recognise the limitations given the number of PSTs involved in this study and rudimentary data collection. However, within the limitations it is exciting for the upcoming larger study.

Conclusion

Clearly the PST related to the PR framework as it was presented. They readily engaged with the ideas and were able to integrate aspects of PR into their current thinking about their teaching practice. It is our contention that developing PR in PSTs is important since it gives an insight into the complexity of teaching and the many competing notions within lesson planning. The focal concepts offer a framework that directs what they should be paying attention to in their construction and implementation of lessons. Future research is based on whether the PR framework can be adopted by preservice and newly graduated teachers to implement with lesson planning and inform their developing understanding of practice. Time will tell.

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