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Examining Changes in Pre-service Teachers' Beliefs of Pedagogy

Lynn Sheridan, University of Wollongong

Abstract: Pre-service teachers enter teacher education with beliefs about teaching and ideas on pedagogical approaches. This research focuses on monitoring the pedagogical beliefs of a cohort of pre-service teachers' pre-existing pedagogical beliefs on important/relevant pedagogy for secondary teaching and how these beliefs changed over the course of their degree. Data were collected from a cohort via a survey at the beginning and end of the year of the study. The cohort comprised pre-service teachers from each year of the four-year degree. This research found that pedagogical beliefs changed over the duration of the course. This finding indicates that there are educational opportunities when pre-service teachers are most receptive to building new teaching practices. The implication of this research is that pedagogical teaching in teacher education can be improved by a better understanding of how pedagogy beliefs evolve over the duration of the course.

Keywords: pre-service teacher, pedagogical beliefs, teacher education

Introduction

The preparation of pre-service teachers is viewed as crucial to the quality of the teacher workforce both by national accreditation bodies and Universities (AITSL, 2014; Roberts-Hull, Jensen, & Cooper, 2015). In particular, supporting the development of pre-service teachers' pedagogical beliefs is considered to be central to improving teachers' professional practices (Endacott & Sturtz, 2015; Penso & Shoham, 2010; Paakkari, Tynjala, Torppa, Villber & Kannas, 2015; Rossum & Hammer, 2010; Vosniadou, Vamvakoussi & Skopelitis, 2008).

According to Paakkari et al., (2014) teacher experiences in "real" schools is necessary for expanding teachers' pedagogical repertoire yet, classroom practice alone is not enough to for pre-service teachers' to transform their "complex, advanced and sophisticated pedagogical beliefs into true actions in their future work" (p. 19). The process of changing pedagogical beliefs and understanding how beliefs change, as the pre-service teachers progress through their degree, will assist teacher educators in supporting pre-service teachers' learning.

According to key theorists, pedagogical views are shaped by own experiences and align closely with beliefs about knowledge, how students learn and how teachers teach (Fajet, Bello, Leftwich, Mesler, & Shaver, 2005; Ryan, Carrington, Selva, & Heally, 2009). Current literature has focused on teacher development and pedagogy (Burn, Hagger & Mutton, 2003; Endacott & Sturtz, 2015; Garrits, 2010; Gholami & Husa, 2010; Gillies & Boyle, 2008; Paakkari et al., 2014; Paris, Polson-Genge & Shanks, 2010) but there is limited consensus on the pedagogical beliefs of pre-service teachers and how these beliefs change as they progress through a teacher education course. Most studies have investigated specific subject pedagogy (Paakkari et al., 2014; Starkey, 2010) or the pedagogical processes of experienced teachers (Endacott & Sturtz, 2015; Howard & Clarence, 2011). For example, the Paakkari et al., (2014)

research in Finland examined the development and alignment of concepts of pedagogy in health education, suggesting that pre-service teachers “did not develop more complex, comprehensive, sophisticated or advanced strategies” (p.18), prior to entry into work. While Endacott and Sturtz (2014) research focused specifically on experienced teachers’ pedagogical reasoning in history, suggesting that only a fraction of the pedagogical reasoning needed was adopted and that “a critical introspective stance towards pedagogical reasoning was warranted” (p.15), to ensure students in history classrooms have enduring understandings.

This research focuses on monitoring the pedagogical beliefs of a cohort of pre-service teachers’, their pre-existing pedagogical beliefs on important/relevant pedagogy for secondary teaching and how these beliefs changed over the course of their degree. This understanding is essential for teacher educators as it provides opportunity to influence and build on pre-service teachers’ pedagogical beliefs with potential to improve their teaching approaches and classroom effectiveness.

Pedagogical Beliefs

Research by Waring and Evans (2015) suggest there is much confusion, uncertainty and contestation over what pedagogy actually is, stating that “pedagogy is likely to mean different things to different people, with teachers, researchers and policy makers approaching the notion from very different perspectives and conceptual standings” (p. 27). While the Leach and Moon (2008) research presents pedagogy as a “dynamic process informed by theories, beliefs and dialogue, only realised in the daily interactions of learnings and teachers in real settings” (p. 6). These views of pedagogy inform the definition of pedagogical beliefs in this study. Pedagogical beliefs are the complex views of teachers’ knowledge, skills and abilities, used in the reasoning, managing and ways of responding to the interactions of teaching and learning (Loughran, 2013, p. 135). Numerous researchers elaborate on the aspects of changing pedagogical beliefs (Endacott & Sturtz, 2015; Paakkari et al., 2015; Rossum & Hammer, 2010; Vosniadou et al., 2008; Wubbels, 1992).

According to constructivists’ theory and current research in this area, pre-service beliefs are often difficult to change (Bates, 2005; Committee for Teacher Education, 2005; Darling-Hammond, 2006; Joram & Gabrielle, 1998; Korthagen, Loughran & Russell, 2006; Ryan et al., 2009). Pre-service teachers’ pedagogical beliefs are shaped by their personal belief systems (Burn, Hagger & Mutton, 2003), with their concepts of effective teaching influenced by these beliefs (Pajares, 1992; Schon, 1987). Research by Thomson, Turner & Nietfeld, (2012) identified a variety of complex beliefs among pre-service teachers, narrow pedagogy understandings and difficulties with articulating pedagogical teaching goals. Studies in identity work with physical education teachers by Wrench and Garrett, (2012) revealed that particular pedagogical practices are adopted from their own experiences and influenced by technical rationality, performance pedagogies and shaped by learning from core education subjects. In constructing new beliefs, the pre-service teacher must link theory to practice within existing preconceptions (Wubbels, 1992), allow opportunities for critical reflection (Endacott & Sturtz, 2015) and a deeper analysis of pedagogical reasoning (Vosniadou et al., 2008). Wrench and Garrett (2012) indicated that the pre-service teachers “make strategic decisions” (p. 12), when teaching that supported their own pedagogical interests.

Influencing Pedagogical Beliefs

This research aligns with Loughran’s (2006) view that the pre-service teacher learns to construct meaning of teaching from personal experiences that have been brought to their teaching in a systematic and conscious way. Changing pedagogical beliefs is a complex

process, it requires an understanding of the purpose, content knowledge and strong foundation in subject pedagogy to enable connections and influence teaching (Paakkari et al., 2015; Endacott & Sturtz, 2014; Rossum & Hammer, 2010). In order to influence personal beliefs the pre-service teachers' construct of how to teach must be challenged, however pre-service teachers are often reluctant to adopt alternative teaching concepts unless they have experienced failure and will often continue to hold on to pre-existing beliefs at the end of teacher training (Korthagen et al., 2006; Joram & Gabriele 1998; Paakari et al., 2015; Ryan et al., 2009; Wan, Nicholas & Williams, 2010). Changes in pedagogical beliefs may occur when the pre-service teacher experiences conflict between their ideal of pedagogy and the realities of teaching practice within the classroom (Mahlios, Massengill-Shaw & Barry, 2010; Tarman, 2012.)

Current studies by Biesta, Priestley and Robinson (2014) on teacher beliefs, suggest that good and meaningful teaching is always informed by past experiences, including personal and professional biographies. They suggest that teachers' beliefs and values are enacted in the here-and-now and influenced by culture and context (p. 626). Teacher education and in particular practice teaching opportunities can either reinforce or challenge pedagogical beliefs, providing the opportunity for pre-service teachers to create new versions of firmly held truths, referred to as a process of reframing (Schon, 1987). Teacher education coursework provides the opportunity to engage in this process and the understandings needed to reason through and enact a "complete act of pedagogy" (Shulman, 1987 p.19). Research in this area is grounded in the principles of productive pedagogy outlined by Gore, Griffiths and Ladwig (2006) and Bransford, Brown and Cocking's (2000) research into how people learn and the design of the learning environment. Learning and organisational theorists propose that people learn best through active involvement, and through thinking about and becoming articulate about what they have learnt (Bransford et al., 2000). The thinking of pre-service teachers is important because it helps guide their teaching preparation.

The pre-service teachers' views on pedagogy are influenced by their pre-course beliefs, their course of study and the quality of their professional experiences, combining to give a different result for each pre-service teacher. According to Shulman (1987), a key theorist in the study of pedagogical beliefs, changing teaching requires "an act of reason, continuing with a process of reasoning, culminating in performance of imparting, eliciting, involving or enticing and is then thought about some more until the process can begin again" (p.13).

Understandings of pedagogical beliefs in teaching are supported by theoretical frameworks such as: Schwab's (1978, cited in Sung and Yang, 2012), substantive and syntactical knowledge; and Shulman's (1987) pedagogical reasoning and action. Current research suggests that to know a subject and select appropriate pedagogy teachers must have substantive content knowledge in order to make sense of learning and guide inquiry in the field (Sung & Yang, 2012; Starkey, 2010). This syntactical knowledge forms the underlying structure of subject matter and the epistemological beliefs that the pre-service teacher acquires in their coursework. Research undertaken by Garritz (2010) highlights the importance of science teachers' pedagogical aptitudes – the teachers' interests, attitudes and emotions on pedagogical choice and the emotional investment that the pre-service teachers place on beliefs that underlie their choice of pedagogy (Gholami & Husa, 2010). They referred to choice of pedagogy as teachers' practical knowledge, knowledge that is converted to suit the situational demands of the classroom, viewed as "time bound and situation specific" (p.1527). It is suggested that disciplinary background, the type of coursework undertaken and practicum experiences have substantive bearing on the pre-service teachers' pedagogical beliefs (Endacott & Sturtz, 2015; Haser & Dogan, 2012; Paakkari et al., 2015; Westhoff & Polman, 2007) and the potential to influence the pre-service teachers' pedagogical beliefs (Korthagen, Kessels, Koster, Lagerwerf, & Wubbles, 2008).

Influencing pedagogical beliefs relies upon multiple, interdependent factors such as, the quality of the teaching degree, the practicum, the classroom practices and the characteristics of mentors (Darling-Hammond Fickel, Koppich, Macdonald, Merseth & Ruscoe 2006; Drew & Mackie, 2011; Gillies & Boyle, 2008; Mayer, 2006; NCATE, 2010; Parhar & Sensoy, 2011). In addition, adopting new pedagogy requires confidence, intuition, imagination and improvisation (Darling-Hammond et al., 2006). There is a link between pre-service teacher confidence and the ability to expand pedagogical beliefs (Committee for Teacher Education, 2005), which presents a further challenge for teacher education in moving the focus from the teacher's personality and subject matter to pedagogical knowledge and expertise. However, it is suggested that the pre-service teachers' characteristics are malleable, indicating that teacher education programs can be tailored to promote specific pedagogical approaches (Dunn & Rakes, 2010; Wan et al., 2010).

There are difficulties involved with encouraging pre-service teachers to adopt alternative pedagogies due to the often complex and fragmented agendas in teacher education (Bates, 2005; Darling-Hammond, 2006). Best practice pedagogy such as; student-centred pedagogy (Gillies & Boyle, 2008), active and collaborative learning (Drew & Mackie, 2011) and culturally relevant pedagogy (Parhar & Sensoy, 2011) are often viewed as complex to acquire and difficult to learn. In order for pre-service teachers to engage in comprehensive and sophisticated pedagogy, teacher education must support them in creating links between existing personal beliefs and the practical experience they encounter in teaching (Paakkari et al., 2015). This involves a process of reasoning, imparting, eliciting and active engagement in order for the pre-service teacher to elucidate subject matter through effective pedagogical means (Shulman & Shulman, 2004).

According to Darling-Hammond (2006), "to advance knowledge about teaching, to spread good practice, and to enhance equity for children, it is essential that teacher educators and policy makers ensure strong preparation for the teacher" (p.312). The Endacott and Sturtz (2015) research supports this view and advocates for an iterative, reflective approach for pre-service teachers to develop critical pedagogical beliefs. Other researchers suggest a depth of pedagogical content knowledge as most important for enabling connections, influencing pedagogical practices and developing reflection and meta-cognitive skills (Starkey, 2010; Lofstroma & Pom-Valickis 2013).

Researchers have recognised the importance of the professional experience in influencing pedagogical beliefs. The choice and level of pedagogical expertise a pre-service teacher is able to acquire is directly influenced by the quality of that experience, the teaching context and the pre-service teachers' ability to fully engage in reflective processes (Lee, 2005; Penso & Shoham, 2010). Learning needs to be authentic within the school/classroom context, have links to relevant coursework, have exposure to varied classes and be supported by experienced teachers (Darling-Hammond et al., 2006; Paakkari et al., 2015; Rossum & Hamer, 2010; Ryan et al., 2009). The practicum experience provides the pre-service teacher with the opportunity to make connections and build confidence with pedagogy (Darling-Hammond et al., 2006; Starkey, 2010). Le Cormu and Ewing (2008) believe this occurs in reflective practicums, where there is opportunity for active participation, and personal control over learning, which enhances the pre-service teachers' professional agency. Awareness of individual student needs helps the pre-service teacher to become open to change, it involves critical reflection and sense making as a basis for pedagogical beliefs (Korthagen, 2004; NCATE, 2010; Swennen, Lunenberg, & Korthanagen, 2008; Paakkari et al., 2015; Swennen et al., 2008; Ryan et al., 2009).

Central to teacher education is understanding, how pre-service teachers learn to teach, their views about teaching and how these views are implemented (Atkinson, 2010). The purpose of this research was to investigate pedagogical beliefs over the course of a degree in

order to identify the specific beliefs that the pre-service teacher participants brought into their study, their beliefs of good teaching and how these beliefs were shaped and changed over the course. More specifically, the research question that guided this study was:

What are the pedagogical beliefs of the pre-service teachers as a cohort in terms of their initial beliefs and how did these change over the course of a degree?

Method of Study

The aim of this research was to explore the pedagogical beliefs viewed as the most important/relevant pedagogy for good teaching from a whole cohort, across each year of an undergraduate secondary teaching degree. In one year group data were collected from each year of the degree, at the beginning and end of each academic year. A survey instrument was developed to collect quantitative data from participants in all four years of the degree, during the one-year data collection period. This research acknowledges the subjectivity of the researcher, as both a researcher and teacher educator. In particular it recognises the way the research practices are based on personal and content-specific experience in the field identified by (Macfarlane, 2009). It is important to recognise that research practices and assumptions are based on personal and context-specific experiences. This influences how research is conducted and the learnings from the research process and accepts that is a valuable outcome of the research process.

Participants

This research involved a group of Australian undergraduate secondary Personal Development, Health and Physical Education (PDHPE) pre-service teachers ($n = 167$). The research group was chosen as they represented a large cohort of secondary teachers, all were required to have a second subject area, and were generally viewed by the University and the school community as highly academic and capable future teachers. Many students from this program obtained teaching positions on graduation. The majority of participants (85%) were identified as coming from an English speaking background. Gender breakdown was male (45.7%) and female (54.3%).

Survey Instrument Development

The Sequential Exploratory Design Method of Creswell, Planto, Gutmann and Hanson (2003) was used to develop the survey instrument to track, over the course, the pre-service teachers' beliefs about valued teacher qualities. The two-phase design method uses the results of a qualitative data collection through focus groups to develop quantitative questions for the survey instrument. The qualitative exploration of valued teacher qualities of the pre-service teacher in the focus groups involved open questioning, from a subset of the participants in each year of the program. This model was selected because an exploration was needed in developing a measurement instrument most suited to the specific study group. It provided the researcher with authentic, rich qualitative statements. Data was thematically analysed to guide the development of questions and the appropriate response scale for the quantitative survey instrument (Creswell & Plano Clark, 2007). The research used quotations, themes and categories to generate survey questions. To overcome bias and to ensure reliability the instrument was trialled using a combination of staff and students ($n = 20$). Some of the survey

questions were based on credible instruments used in other published studies (i.e. Loughran, 2007). The instrument was reviewed by a statistician, ethics approval was obtained and all participants were de-identified. Data were collected from a subset of the participants in each year of the degree. Focus group work enabled pre-service teachers to use their voice to openly discuss the attributes of a good teacher and valued teacher pedagogy. A process of content analysis was used to identify relevant themes and categories (Sarantakos, 2005, p.345). The second phase used these themes and categories in conjunction with validated questions from the literature to guide the design of the survey instrument questions. A process of coding and establishing interrelated broad categories of conceptual ideas guided the scope and style of the survey. The instrument used both questions with Likert scales and open questions requiring a written response (see Appendix I - Question 6).

Data Collection and Analysis

The survey instrument was distributed to each year cohort in the four-year degree, total population ($n=167$). A snapshot approach, with surveys distributed at the beginning and end of the academic year, was used to collect data.

Statistical analysis involved descriptive statistics and inferential statistics. Datasets were statistically analysed using SPSS (Version 18) software. To ensure credibility a large sample size was used and rigorous procedures followed for developing and validating the instrument. Statistically significant or strong predictors were used as the basis for interpretations. A factor analysis was conducted for the largest response at Time 1 (beginning of the year in each year of study). Principle component analysis (PCA) with orthogonal (varimax) rotation was used and a six-factor solution emerged on forty one (41) items from the survey distributed at the beginning of the academic year). One hundred and eleven (111) responses were available after incomplete returns and outliers were detected and deleted from the analysis.

The six-factor orthogonal solution was selected because this solution was consistent with the theoretical underpinnings of this research and had the clearest structure. The six-factor solution accounted for 49.5% of the variance in the original items, a higher variance than the four, five or seven factor solutions. Overall, variables were well defined by the factor solution as 83% of the items had a communality value of 0.40 or above. Inspection of the rotated component matrix revealed moderate to high loadings for each item on at least one factor. Overall, 93% of items loaded onto one factor were greater than 0.40.¹

This research sought to explore the understandings from the viewpoint of a whole cohort of pre-service teachers' on what they believed were important pedagogical beliefs and practices for secondary teaching. The interactions of the researcher with the data require acknowledging the reality of people's experiences, which are constructed realities. The information then collected by the researcher becomes a reconstruction of reality and certainly not objective reality (Sarantakos, 2005). Three of the six factors that emerged from the factor analysis focused on pedagogy. The two main categories concerned with pedagogy: views on pedagogical approaches: student and resource-centred and views on pedagogical professional

¹ Space does not permit an elaboration of all 6 factors from the factor analysis in this paper. Other factors will be discussed in detail in future publications. The four factors not being discussed include: content knowledge, professional and interpersonal, teacher knowledge, textbooks and activity sheets.

practice. The third pedagogical factor was views on the use of textbooks and activity sheets. There were limited items to this factor so it was not studied further.

For participants, pedagogical approaches included instructional techniques, student-centred strategies or resource-centred strategies such as: group work, practical work, demonstrations and teacher direct discussions. Pedagogical professional practices included routines, policies, procedures and practices influencing selection of teaching strategies.

Demographic testing against the six factors included a one-way analysis of variance (ANOVA) with the purpose of detecting differences in-group means. A t-test was used to determine whether there were significant differences between two sets of scores. Following-on from the factor analysis pre- and post-testing (beginning and end of each year) was conducted against the factors.

Findings

To address the research question, findings identified pre-service teachers' initial pedagogical beliefs as a cohort in term of importance/relevance to secondary teaching and how these changed over the duration of the degree. Findings identified pedagogical changes for this group across each year and over the four years of the degree. Both statistical and descriptive testing were used to analyse the data.

In the factor analysis two pedagogical factors were identified as valued pedagogical teacher qualities: Pedagogical approaches (PA) – Factor 1, comprising student-centred instructional approaches and pedagogical professional practices (PPP) – Factor 2, comprising the structure of the interactions surrounding the pedagogy. Items included in each of these factors are shown below (see Table 1). There are additional factors identified in the original factor analysis, which have not been used in this paper.

Additional statistical testing included pre and post testing and correlation testing against demographics including; age, gender, situation prior (i.e. previous work or study) and existing qualifications. Pre and post testing compared changes in participant's responses from beginning to the end of the year in each of the four years. Correlations looked for relationships both, positive or negative between factors.

Descriptive statistical testing was conducted on specific data sets such as views on pedagogical practices and approaches) (refer to Appendix I – Q6 of survey). This extended the understanding of specific pedagogical choices, which were being made both across the whole course cohort and in specific years of study.

	Factor 1	Factor 2
view on instructional techniques—models, tactile aids	.725	
view on instructional techniques—discussion	.694	
view on instructional techniques—problem-solving techniques	.693	
view on instructional techniques—group work	.621	
view on instructional techniques—student-centred approach	.589	
view on instructional techniques—demonstration and modelling	.545	
view on instructional techniques—IT-computers, power point internet, smart board	.529	
view on instructional techniques—video/DVD	.524	
uses interpersonal communication to maintain appropriate student behaviour	.428	
view on instructional techniques—verbal questioning techniques	.404	
uses routines and rules to maintain appropriate student behaviour		.719

consider students' needs when planning the uses of time space materials and equipment in teaching	.619
use school policy and procedures to maintain appropriate student behaviour	.616
intrinsically knows what to consider when planning the use of time space materials and equipment	.448
considers resources and time available when planning learning	.390
uses expert knowledge or skills to maintain appropriate student behaviour	.367

Table 1 Factor analysis – Factor 1 (PA) and Factors 2 (PPP)

Two factors emerged from the data set at Time 1 (beginning of the year in each year of study), with a factor solution of 83% of the items. For Factor 1, pedagogical approaches were defined as instructional approaches for example discussions and problem solving. These teaching approaches were student-centred pedagogy for example; group work, practical work, demonstrations, and teacher directed discussions. For Factor 2, pedagogical professional practices, were defined as the structure of the interactions for example routines, policies, procedures and practices (see Table 1).

Statistical Findings

Demographic testing against the factors

Each of the participants were identified by a number with individuals participants being matched at Time 1 (T1) (beginning of academic year) to Time 2 (T2) (end of academic year) in each year of the course. A t-test was used to identify whether there was significant mean differences between the two sets of scores by comparing mean according to gender, age, situation prior and existing qualifications. Significance was identified in age and existing qualifications (see Table 2).

Demographic Influence	Views on	Mean	Significance
Age			
18-24 years	PA	18.4182	t(136)=2.38p=0.019
25-29 years	PA	16.8519	
18-24 years	PPP	10.3130	t(1430=3.53,p<0.01
25-29 years	PPP	8.9310	
Existing Qualifications			
Group 1(no Qual.)	PPP	10.64	F(1,146)=4.71,p=0.032
Group 2 (Qual.)	PPP	9.85	

Table 2 Differences in participants' views of pedagogy at T1 and T2 according to age and qualifications

The results show that on average, the 18-24 year age group identified PA of higher importance than did the 25-29 year age group. Those participants who identified as having existing qualifications viewed PPP as being of higher importance than PA.

Correlations between factors

A bivariate correlations test using Pearson's product-moment correlations was conducted to determine correlations between factors. The bivariate correlation test was undertaken between pairs identified in the factor analysis to confirm significance as either a positive (high/high or low/low) correlation or negative (high/low or low/high) correlation (see Table 3).

The value indicates the strength of the relationship. High or low scores for *professional pedagogical practices* are associated with high or low scores for *pedagogical approaches*. A negative correlation exists for the relationship between *content knowledge* and the pedagogy factors, this indicated a change of importance between content and pedagogy.

Factors	Correlation
Pedagogical approaches and pedagogical professional practice	Positive ($r = 0.456, p < 0.01$)
Pedagogical approaches and content knowledge	Negative ($r = -0.317, p < 0.01$)
Pedagogical professional practice and content knowledge	($r = -0.390, p < 0.01$)

Table 3 Positive and Negative Correlations between Pedagogy Factors Identified in the Survey

Test for significance from Time 1 to Time 2 over the 4 years

A comparison of the mean of each factor over the four years, identified a significant mean difference for views on *content knowledge* ($F(3, 144) = 2.69, p < 0.05$) and *views on the use of pedagogical approaches* ($F(3, 137) = 2.76, p < 0.05$). This suggests that pre-service teachers' beliefs on the importance of pedagogy increased over the four years while content knowledge becoming of lesser importance.

Significance was identified in both categories of pedagogy (PA & PPP) from Time 1 to Time 2, across Years 1 to 4. The pre-service teachers views on (PA) were most important at T1, decreasing at T2, indicating that pedagogical reasoning was occurring, beliefs were being influenced and reconstructed over the course of each year (see Table 4).

Time	Views on	Mean	Significance
1 (pre-test)	Pedagogical approaches	T1 -16.72 T2 -15.35	$t(58) = 2.67, p = 0.01$

Table 4 Participants views on pedagogical approaches

Overall significant mean difference was identified for (PA) over the four years. Pre-service teachers in Years 1 and 4 identified (PA) as being significantly more important than did pre-service teachers in Year 2 and Year 3 (see Table 5).

Factor	One-way ANOVA	P = Mean difference divided by standard error
Views on the use of pedagogical approaches	T1, F (3, 137) = 2.76, p < 0.05	Year 1 and Year 4 p = 2.48

Table 5 One-way ANOVA results for views on the use of pedagogical approaches

Descriptive Statistics

Comparison of pedagogical approaches

Descriptive statistics were obtained from Question 6 of the survey instrument. Question 6a asked participants to indicate their level of agreement on the importance of specific instructional techniques, while Question 6b asked participants to rank their preferred pedagogical approaches (see Appendix I–Q6 survey).

Pre-service teachers' preference for particular pedagogical approaches changed from Year 1 to Year 4, with the different years each selecting a different category of pedagogy. There were six pedagogical approaches identified as important at both T1 and T2. These six important pedagogical approaches identified with small percentage changes from T1 to T2. It is interesting to note that no specific pedagogical approaches were identified as significant for Year 4 (see Table 6).

Pedagogical approaches most relevant/important	Time 1 Years 1-4 total	% T1	Yearly Freq. T1	Time 2 Years 1-4 (total)	% T2	Yearly Freq. T2	% diff.	χ^2	P
Uses high interest lessons- interactive student interest high	1 (52)	23.1	12	1 (32)	15.6	5	-7.5	0.774	ns
	2 (35)	20.0	7	2 (18)	11.1	2	+8.9	0.711	ns
	3 (28)	50	14	3 (12)	8.3	1	-41.7	4.17	<0.05
	4 (29)	18.2	6	4 (14)	31.3	4	+15.1	0.827	ns
Uses a range of teaching strategies	1	21.2	11	1	18.8	6	3.4%	.091	ns
	2	22.9	8	2	22.2	4	0.7%	.004	ns
	3	7.1	2	3	50.0	6	+42.9	31.1	ns
	4	30.3	9	4	12.5	2	+17.8	1.18	ns
Plans lesson that are relevant to the students	1	17.3	9	1	9.4	3	-7.9	1.16	ns
	2	8.6	3	2	22.2	4	+13.6	8.51	<0.01
	3	14.3	3	3	8.3	1	-6	.301	ns
	4	9.1	3	4	18.8	3	+9.7	2.36	ns
Adopts teaching to students learning styles	1	11.5	6	1	25.0	8	+13.5	5.07	<0.05
	2	8.6	3	2	11.1	2	+2.5	.131	ns
	3	3.6	1	3	8.3	1	+11.9	.747	ns
	4	15.2	4	4	0.0	<1	-15.2	2.13	ns
Adapts teaching to their environment/context e.g. caters for special needs	1	0.0	<1	1	6.3	2	+6.3	0.0	ns
	2	11.4	4	2	11.1	2	-0.3	.001	ns
	3	3.6	1	3	0.0	<1	-3.6	.432	ns
	4	9.1	2	4	6.3	<1	+2.8	1.27	ns
A student centred approach	1	3.8	2	1	0.0	<1	-3.8	1.22	ns
	2	11.4	4	2	5.6	1	-5.8	0.540	ns
	3	7.1	2	3	8.3	1	+1.2	0.026	ns
	4	0.0	<1	4	12.5	2	+12.5	0.0	ns

Table 6 Comparison of common pedagogical approaches at Time 1 and Time 2, Years 1-4

A chi-square test was conducted to identify the overall distribution of the ranked first choice across all four years at T1 and T2. The results of the chi-square test identified common pedagogical approaches in all years with some variations occurring from T1 to T2.

A chi-square was used to test the overall significance across the whole dataset at T1 and T2 that is if certain qualities ranked consistently more important/relevant than others.

Time 1 $\chi^2(30, N = 148) = 39.29, p = 0.119$

Time 2 $\chi^2(30, N = 78) = 29.92, p = 0.575$

To test for significance across Years 1–4, a chi-square test was conducted: A χ^2 test – $\chi^2 (O - E)^2 \div E$

Significance was identified in the following pedagogical approaches: uses high-interest lessons—interactive, student interest high Year 3 $p < 0.05$; plans lessons that are relevant to students Year 2 $p < 0.01$; and adapts teaching to their environment/context (for example, caters for special needs) Year 1 $p < 0.05$.

Out of the six preferred pedagogy approaches, four were identified at both T1 and T2: uses a range of teaching strategies; uses high interest lessons; plans lessons that are relevant to students and adapts teaching to student learning styles. The importance of the four common approaches varied across the four years. Significance was identified in three out of the four common pedagogical approaches in Years 1, 2 and 3 (see Table 7).

Pedagogical approaches	Year	Significance
Uses high-interest lessons	3	$p > 0.05$
Uses a range of teaching strategies	3 & 4	T1 Year 3 50% T2 Year 4 31.3%
Plans lessons that are relevant to students	2	$p > 0.01$
Adapts teaching to students learning styles	1	$p > 0.05$

*Note: Not significant however high % recorded from T1 Year 3 to T2 Year 4

Table 7 Common pedagogical approaches across Years 1 to 4

Limitations

There are limitations to this research. Firstly, the research was limited to a single undergraduate cohort of teachers at one Australian university. Secondly, no comparative research was done with other teacher education courses to determine if differences in beliefs were related to the choice of degree or teaching areas. Thirdly, the data was collected pre and post for each year across the course's four years during a one-year period, a snap shot data collection approach, rather than a longitudinal study with the one cohort over four years. Finally, the identified beliefs are those of the cohort as a group rather than individuals, which offers the advantage of understanding a cohort's belief system yet, it limits the opportunity to delve deeply into individual beliefs.

Discussion

The literature outlined below supports the findings of the research question. As evidenced in many studies pre-service teachers' pedagogical beliefs and the challenges of changing these beliefs are viewed as complex, influenced by personal belief systems and experiences (Biesta et al., 2015; Burn, Hagger & Mutton, 2003; Ryan et al., 2009; Wubbles, 1992; Korthagen et al., 2006; Pajares, 1992). Additionally, research has shown that the pre-

service teachers' pedagogical practices develop when learning links practical classroom experiences involving critical reflection and includes understanding of the subject's pedagogical knowledge (Endacott & Sturtz, 2015; Lee, 2005; Penso & Shoham, 2010; Vamvakoussi & Skopelitit, 2008; Rossum & Hammer, 2010). Seminal theoretical frameworks and current research in this area support the process of influencing pedagogical beliefs, (Garritz's, 2010; Gholami & Husa, 2010; Paakkari et al., 2015; Schwab, 1978; Shulman & Shulman, 2004; Shulman, 1987; Starkey, 2010; Sung & Yang, 2012; Westhoff & Polman, 2007).

With regard to the research question; *how do pre-service teachers' beliefs on pedagogy as a cohort change over the duration of their degree*, this research showed that changes occurred from the pre-service teachers' initial constructed views on valued pedagogy over the four years of the degree. This research expands on earlier findings by Paakkari et al (2015) who found, with a much smaller group (n=20); only a minority of the pre-service teachers did advance their pedagogical concepts, with the major advancement occurring post degree. This research found changes occurred for a majority of the pre-service teachers in the course. This research looked at pre-service teachers' pedagogical beliefs more broadly and looked at each year of the study in contrast to Paakari et al., (2015).

The pre-service teachers in this research on entering the course had firmly held ideas on effective pedagogy based on their own storylines, socio-cultural histories and experiences. Biesta et al., (2015) research supports this stating that, "teaching is dependent upon the personal qualities, beliefs and values," (p.636). Their research also holds that their beliefs from, "the past, orientation towards the future and engagements with the present", (p. 626), play an important role in the choice of pedagogical practices. Many of the participants' initial views on pedagogy remained important and were considered an essential component of their pedagogical content knowledge. Research confirms that substantive content knowledge is influential in the selection of pedagogy (Sung & Yang, 2013; Starkey, 2010).

The participant's age group was also influential on beliefs and potential for changes in beliefs, with participants in the younger age group, 18-24 years, viewing choice of pedagogical approaches (PA) as more important than the 25-29 age group. For the older age group, many with existing qualifications and work experiences, particularly in sport and coaching, pedagogical professional practice (PPP) was viewed as more important than pedagogical approach (PA). Research supports the view that pedagogical understandings are built within existing preconceptions (Wubbles, 1992), shaped by personal belief systems (Burn et al., 2003) and influenced through links to previous study and work (Korthagen et al., 2008). This research confirms there were differences in beliefs based on age and prior experiences.

For this group of pre-service teachers it is proposed their beliefs were strongly influenced by their experiences with the subject content in their teaching areas, particularly as the first two years where content was viewed as being important in laying the foundation on which pedagogy could be built (see Appendix II- course structure). Pedagogical approaches became more important, particularly during professional experience where there was a need for the pre-service teacher to demonstrate their ability to link content and pedagogy in the classroom. Biesta et al., (2015) research refers to this practice as the prevalence of teachers' beliefs with a strong orientation towards the here-and-now. Changing beliefs is recognised as complex, yet strong subject foundations and clear purpose is seen as enabling connections (Paakkari et al., 2015; Endacott & Strutz, 2014; Rossumun & Hammer, 2010).

Teaching opportunities reinforced or challenged the pre-service teachers' pedagogical beliefs, providing opportunity for the pre-service teachers to reframe (Schon, 1987) their pedagogical beliefs. Connections between coursework and practice reinforced previously held beliefs or learnt principles of productive pedagogy according to Gore, Griffiths and Ladwig (2006). The pre-service teachers it is suggested were active, in trying out and thinking through

their pedagogical ideas. As they progressed through the course they made connections to their understanding and beliefs of how students learn, to what they were experiencing in the classroom. Bransford et al., (2000) research, into how students learn, suggests that making connections is essential in expanding pedagogical understandings. Research by Wrench and Garrett (2012) referred to this as making strategic decisions that support pedagogical self-interests.

Overall the participants saw the two different forms of pedagogy as separate, yet interrelated when identifying *pedagogical approaches* (PA) and *pedagogical professional practices* (PPP). Follow up tests for correlations showed that for the participants there existed a strong relationship between these two forms, both on entry and throughout their degree. This finding suggested participants' beliefs were complex, teaching was viewed as more than just teaching approaches and they were considering the structures of the interactions that surround the choice of individual strategies e.g. routines, policies, practices. These beliefs, it is proposed, were reinforced through subject methodology coursework and through professional practice experience.

Most evident was that participants were changing their views suggesting they were actively engaged in critical reflective thinking about their teaching approaches and effective teaching as they progressed through the four years of the degree. Significant mean difference was identified for PA over the four years of the course for all participants. Current research stresses the important role of critical reflection in expanding and changing beliefs (Endacott & Strutz, 2015).

Changes in beliefs in each year provided an insight into the possible malleability of pre-service teachers' beliefs described in research by Dunn and Rakes, (2010) and Wan et al., (2010). This research found that in Year 1, the importance of adapting teaching to student's learning styles was most important for the pre service teacher. First year pre-service teachers wanted their own lecturers to cater for *their* learning needs. The importance of this belief was confirmed on reflection of their own classroom practices in later years. With progression through the course the pre-service teachers expanded and changed their choice of teaching approaches, particularly in Years 2 and 3. This period it can be suggested was an important time for changing beliefs and hinted at the influence of pedagogy coursework and practicum experiences. The pre-service teachers' pedagogical choices indicated that they were becoming more sophisticated where their pedagogy included such items as; the needs of the individuals, the use high interest lessons, the use of a range of teaching strategies and planning lessons that are relevant. They were active in, making judgement, improvising and using pedagogical reasoning in selecting and using a specific teaching pedagogy. This process is well documented in research (Korthagen, 2004; Paakkari et al., 2015; Swennen et al., 2008).

The selection of different pedagogical approaches reflects the changing requirements of the degree and indicated that the pre-service teachers were open to change. This indicated that they were making connections, building expertise and gaining confidence with their teaching practices. In Year 1, pedagogy was viewed as the unknown, yet-to-be-learnt requirement for successful teaching. By Years 2 and 3, the majority of pedagogical learning, it is suggested, had occurred and consequently beliefs had changed. Wrench and Garrett, (2012) research supports the view that changes in pedagogical beliefs are shaped and developed through university learning. At this time in the degree, the emphasis was on planning, the curriculum and the beginning of the professional experience placements, bringing with it new understandings on how and what to teach. Research suggests that this process involves viewing pedagogical decision-making as distinct from merely learning subject content (Endacott & Sturtz; Paakkari et al., 2015; Shulman 1987; Shulman & Shulman, 2004).

By Year 3, subject methodology, professional experience and special needs were bringing different challenges for teaching practice and implied influence in moving pre-service

teachers from a position where teaching was viewed as their own performance. Teaching was becoming about their students' learning and was highlighting the tension between the ideal teaching practice and reality of the classroom experience. This was leading to changes in pedagogical beliefs (Mahlios et al., 2010; Tarman, 2012). By Year 4, it is suggested, they had gained sufficient confidence, experience and knowledge of pedagogical practices and subject specific pedagogy to be able to critically reflect on the most effective practices. Shulman, (1987, p. 19), refers to this as "a complete act of pedagogy" involving a continuous process of reasoning. Year 4, was marked by consolidation, driven by the requirement to teach independently in the final professional experience. The pre-service teachers had at this time an extensive repertoire of approaches and it is suggested were less likely to change their beliefs on pedagogy. By this time they had confidence, intuition and were able to use imagination and improvisation in making pedagogical decisions (Darling-Hammond et al., 2006). Fourth year pre-service teachers were considering the needs of the students, the subject, and the school context and their own performance as a teacher. Golami & Husa, (2010) refer to this as practical knowledge, most suited to the demands of specific classroom contexts. Thomson, Turner & Nietfeld, (2012) research refers to this as the narrowing down of pedagogical understandings.

It is proposed that the professional experience was instrumental in building confidence and influencing possible changes in pedagogical beliefs for the participants. The value and influence of professional experience is well documented in research and supports this view (Darling-Hammond et al., 2006; Korthagen, 2004; Rossum & Hammer, 2010; Ryan et al., 2009). The pre-service teachers were possibly using the professional experience to link existing preconceptions with new understandings of pedagogy.

In this course professional experience started in Year 2 and by Year 3 participants had begun to see their role as a teacher of students rather than the earlier belief that they were a teacher of content. They now wanted their lessons to be relevant to students and wanted to give lessons that offered high interest and engaged the students' interest. Wrench and Garrett (2012) noted in their study that pedagogical practices are adopted from personal experiences and influenced by technical rationality and performance pedagogy. This research's data highlighted Years 2 and 3 as an important "window of opportunity" for experimentation and influence on pedagogical beliefs, a period when the pre-service teachers were most receptive to changing beliefs.

For the pre-service teachers constructing new pedagogical understandings and/or altering existing views required both teaching successes and failures with pedagogy. The Korthagen et al., (2006), research suggests this is necessary in order for pre-service teachers to adopt alternatives. As one 4th Year pre-service teacher stated when asked, after a challenging final practicum – What do you believe were important teaching pedagogical practices to have as a teacher? She commented: "show an interest, respect opinions, talk and listen...speak to them not at them, speak their language, laugh with them and be empathetic." Kemis (2005) research refers to this as the reasoning behind selecting certain teaching approaches, "the what works" notion. They were actively constructing meaning from experiences (Dunn & Rakes, 2010; Darling-Hammond et al., 2006; Rossum & Hammer, 2010; Ryan et al., 2009).

It is suggested that the exposure to professional experience, particularly when linked with specific coursework e.g. special needs, behaviour management and method courses, can influence the pre-service teacher's pedagogical beliefs. Certainly, the first-hand experience enabled the pre-service teacher to gain substantive knowledge of teaching practice in their disciplines, supported their enquiry and development of pedagogical understandings and has been noted in Sung and Yang's (2012) research. The participants' exposure to the realities of the classroom created connections and challenges between their existing beliefs and new pedagogical beliefs. Le Cornu and Ewing (2008) research stresses the importance of the

reflective practicum in enhancing the pre-service teachers control over learning and subsequent increase in professional agency. The pre-service teachers, it is suggested, were starting to question the how and why of teaching, to shift the emphasis away from content knowledge and personal performance to pedagogical practices that supports individual students. According to Wrench and Garrett (2012) critical discussions in core education subjects help to alter pedagogical perceptions, when exposed to classroom realities. Sung and Yang (2012), refers to this as acquiring “the tools of inquiry within a discipline” (p.79). It was the structure of learning, the opportunity for real world teaching along with exposure to challenges to personal pedagogy, that most influenced the construction of new versions of the “truth” in terms of pedagogical beliefs.

Implications

Although data was derived from only one degree, the implications of these findings are that teacher education programs do play an important role in influencing and supporting the development of pre-service teachers’ beliefs. To capitalise on this, teacher educators need an understanding of what pre-service teachers bring into their study, as well as the optimum time to introduce new beliefs or challenge existing beliefs. For example, in order to develop a range of teaching approaches pre-service teachers need to be given time and opportunity to experiment with new pedagogy ideas. The optimum time for this is in Years 2 and 3 of the degree. Another finding was that courses such as, “catering for diverse student needs”, are better placed in Year 4 when pre-service teachers had gained confidence with their pedagogical practices.

For the pre-service teachers there was a continuum of practice involving the repositioning and reconstruction of beliefs of teaching and the linking of new beliefs to existing frameworks at key periods in a course. The role of the practicum was influential in this regard for the mentor teachers. This has implications for the timing of practicum placements, the choice of school, the experiences of the mentor, the range of opportunities available to the pre-service teacher to practice their teaching and the role of coursework in supporting this process. A significant finding was that a window of opportunity for influence, occurred in Years 2 and 3 of the program. This period could be further utilised to reinforce pedagogical learning and views through reflection and closer links to coursework, especially subject methodology.

This research signals the need for further exploration of pre-service teachers’ developing beliefs and the views they bring to teacher education. It is crucial to develop a broader understanding of the factors that influence the pre-service teachers’ beliefs about pedagogy. This is particularly important in supporting reflection during and post the practicum experience and in reinforcing or challenging pre-conceived beliefs about teaching and learning. Core education subjects such as, special needs, sociology and aboriginal education are important in shaping future teachers’ beliefs, yet they are often taught and viewed as separate from the practice of teaching. Closer ties are required between education subjects and the enactment of practice in these areas to expand beliefs and improve teaching and learning practices. The findings did suggest that the pre-service teachers have the capacity to change beliefs. Some beliefs however did not change and were constrained by pre-existing belief structures for example the existing beliefs of their school mentors and/or the educators within the program.

When sufficiently sophisticated and nuanced understandings of the pre-service teachers’ beliefs are developed, teacher education can move to better meet the needs of pre-service teachers and prepare them as good beginning teachers. The research showed changing beliefs of pre-service teachers as they progressed through their degree and has implications for

course structure, design and pedagogical support in teacher education. For example, there is an optimum time when subjects such as special needs, sociology or subject methodology should be introduced, which subjects are better in the foundational years and which subjects are best placed in Year 4. Similarly, in the design of subject course work, there will be an optimum time to introduce broad belief subjects that support pedagogical practices and understandings.

Future study is recommended to investigate individual belief systems so as to further enhance our understanding of how teaching coursework contributes to pedagogical beliefs. Understanding how best to support the pre-service teachers' pedagogical development in teacher education is central to producing quality teachers and improving student outcomes.

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Appendix I

Section 6. Your view on instructional techniques (pedagogical practice)

This part of the survey asks you about your views on pedagogy (teaching practice). In particular, it asks you about the strategies and approaches that you believe are most relevant/important to secondary teaching.

6a. Based on your experiences so far and observations how important (if at all) do you believe the following strategies are in teaching secondary students.

Beside each of the statements presented below, please indicate your level of agreement on **the importance** of the following instructional techniques for secondary teachers? Please tick one box in each row.

It's important for a teacher to

(1) strongly agree (2) agree (3) uncertain (4) disagree (5) strongly disagree

Instructional Techniques

1. Use a reference or textbooks
2. Use activity sheets
3. Use direct teaching (teacher talks to class)
4. Use group work
5. Use models, tactile aids
6. Use demonstration and modelling
7. Use discussion
8. Use IT (computers, power point, internet, smart board etc.)
9. Use videos, DVD's
10. Use verbal questioning techniques
11. Use problem-solving strategies
12. Use student-centred approaches

6b. Rank the following pedagogical approaches in order of importance: **One (1)** being the **most important** and **twelve (12)** being the **least important**. Please number the box from 1–12.

Approaches

1. Uses a range of teaching strategies
2. Uses high-interest lessons—interactive, student interest high
3. Adapts teaching to students' learning styles
4. Links curriculum/syllabus to teaching
5. Monitors students understanding during instruction
6. Communicates purpose/outcomes of the lessons
7. Encourages students to take responsibilities for their learning
8. Show students that you are a learner e.g. makes use of student expertise
9. A student-centred approach
10. Adapts teaching to their environment/context e.g. caters for special needs
11. Plans lessons that are relevant to students

Appendix II

Sample Course Structure (Secondary Undergraduate PDHPE including 2nd Teaching Area)

Year of degree	Semester 1 (subjects)	Semester 2 (subjects)
Year 1	Education Psychology Health Education 1 Sports Skills 1 Sport Science 1	Indigenous Education Health Education 2 Sports Skills 2 Sport Science 2
Year 2	Behaviour Management Sports Skills 3 Practicum 1 *2 nd Teaching Area	ICT Sports Skills 4 Sport Science 3 *2 nd Teaching Area
Year 3	Subject Methodology Health Education 3 Practicum 2 *2 nd Teaching Area	Subject Methodology Sports Skills 5 Practicum 3 Special Needs
Year 4	Subject Methodology Internship	*2 nd Teaching Area Curriculum Studies Elective

* PDHPE pre-service teachers were required to have a second teacher area e.g. mathematics, History, English, Languages, Design and Technology