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Abstract: Twenty-five preservice graduate teacher education students at the Queensland University of Technology, Brisbane, Australia were asked to describe their epistemological beliefs (beliefs about knowing, learning and teaching) at the end of their year-long course. The discussions were semi-structured and analysed from a predominantly grounded theory perspective. A number of categories of core beliefs about knowing emerged which reflected a continuum of beliefs. From naïve to more sophisticated, there was an increasing focus on truth that was constructed and reasoned with a corresponding decrease in focus on truth as absolute and received. There was also some consistency noted between core beliefs about knowing and peripheral beliefs about learning and teaching for a number of students.

Format: Round table

Biography: Joanne Brownlee is a lecturer in the School of Early Childhood at the Queensland University of Technology. She recently completed her doctoral studies that investigated the nature of epistemological beliefs in preservice teachers. Her current research is focussed on the relationship between early childhood teachers' epistemological beliefs and their practice long day care.

# Students learning to teach: Conversing with students about their epistemological beliefs

## Background

This paper is a report on the beliefs about knowing, learning and teaching held by student teachers and the relationships between such beliefs. Core beliefs about knowing are considered to play an important role in influencing the development of knowledge and other beliefs because they are central values or theories that are functionally connected to most other beliefs and knowledge (Hofer & Pintrich, 1997). Hofer and Pintrich argued that beliefs about the nature of knowledge (certainty and simplicity of knowledge) and the nature of knowing (source of knowledge and justification for knowing)

. . . should be considered the core of an individual's theory, while the other beliefs about learning, teaching and intelligence may be related to the core dimensions but are peripheral to an individual's theory. . . (p. 119).

Therefore epistemological beliefs, in the context of this paper, refer holistically to core beliefs about knowing and peripheral beliefs about learning and teaching.

Personal epistemological belief systems range from dualistic beliefs in the existence of absolute truths to relativistic beliefs that knowledge is tentative, personal and relative to various contexts. One of the most influential researchers in the area of epistemological beliefs was William Perry (1970). Perry noticed that Harvard liberal arts students moved through several positions starting from a dualistic view that truths exist and can be transmitted from an authority to multiplism where personal opinions and ultimate truths are accepted because all truths are not yet established by authorities. In this latter position, individuals begin to rely less on authorities for absolute truths. However, a dualism still exists because personal opinions and truths are still considered to be 'right' or 'wrong'. The next position, relativism subordinate, constitutes a major shift in epistemological thinking because now individuals consider that knowledge is actively and personally constructed, although this occurs in some contexts only and opinions need to be supported with evidence. Absolute truths can no longer exist because truth is considered to be relative to individuals' personal interpretations of experiences. The next position, relativism, constitutes a view that knowledge is actively and personally constructed in all contexts. The final positions of commitment still reflect relativistic thinking. However, particular beliefs are more valued than others and are committed to in a flexible manner. These positions are represented in Table 1.

Baxter Magolda (1993) also described stages similar to those reported by Perry (1970). See Table 1 for this comparison. In longitudinal research with more than 100 college students, individuals were interviewed yearly using open-ended questions and asked to complete short answer responses to the Measure of Epistemological Reflections (MER) (Baxter Magolda, 1994). Within each of the positions, Baxter Magolda (1988) described ways of knowing that differ for both genders. Relational modes of knowing, which are open, flexible, connected and responsive, are considered more typical of women's ways of knowing (Noddings, 1991). Conversely, the impersonal or objective mode of knowing is often characterised by the use of logical, algorithmic procedures that result in separateness and abstraction (Baxter Magolda, 1993). The positions or beliefs about knowing are described as absolute (similar to Perry's dualism), transitional (similar

to Perry's multiplism), independent (similar to Perry's relativism) and contextual (similar to Perry's commitment positions).

**Table 1: Summary of stages in the epistemological schemes of Perry and Baxter Magolda**

Perry (1970, 1981)	Baxter Magolda (1993)
Dualism <i>(knowledge certain; authorities have answers)</i>	Absolute knowing <i>(knowledge certain)</i>
Multiplism <i>(some authorities are right, others wrong opinions appropriate until truth discovered)</i>	Transitional knowing <i>(uncertainty some areas of knowing)</i>
Relativism subordinate <i>(value opinions supported by evidence in some contexts only)</i>	Independent knowing <i>(all knowledge uncertain)</i>
Relativism <i>(relativism is a feature of all learning)</i>	Contextual knowing <i>(combines impersonal &amp; relational modes of knowing)</i>
Commitment <i>(recognises need for commitment in one's beliefs)</i>	

Both Perry's and Baxter Magolda's epistemological schemes are descriptions of adult epistemological beliefs along a continuum from naïve to sophisticated beliefs. The term naïve is used in this paper to refer to individuals who have a tendency to believe that truth is certain, absolute and able to be transferred by an authority. The use of the term sophisticated refers to those beliefs that truth is relative, changing, and actively constructed by the individual (Kardash & Scholes, 1996).

It might be expected that individuals who have more sophisticated beliefs about knowing, that is that individuals construct truths, would also conceive of the peripheral beliefs about learning and teaching in a similar manner. This means that they may be likely to conceive of learning and teaching from a constructivist perspective. Constructivism refers to a particular set of beliefs about knowing and learning that understanding exists only for the individual who actively creates such beliefs. Therefore, regardless of whether constructivism is viewed from a social or personal perspective, individuals actively transform the new information in some way so that it becomes linked to their prior knowledge. Conversely, individuals who have more naïve beliefs that focus on truth as absolute and categorical might be expected to conceive of learning and teaching from a more reproductive perspective in which individuals receive and acquire information rather than construct personal meaning. These assumptions emerged from the notion that beliefs about learning and teaching, along with all knowledge and beliefs, may be influenced by core beliefs about knowing (Bem, 1970; Hofer & Pintrich, 1997; Posner et al., 1982; Rokeach, 1968; Sutton et al., 1996).

Apart from influencing beliefs about teaching and learning, epistemological beliefs also influence problem solving (Kitchener, 1983). For well-defined, simple problems described as puzzles, the use of metacognitive strategies is sufficient (Kitchener, 1983). Metacognition refers to reflection on how one goes about learning so that one may develop better knowledge and regulation of oneself as a learner (Brown, 1987).

Ill-defined problems that reflect real world dilemmas may require epistemic cognitive processes or meta-metacognitive processes to help to interpret the problem and to define the limitations of solutions (Kitchener, 1983). For example, if an individual believes knowledge is absolute and truths can be transmitted, then for both simple puzzles and ill-defined problems the solution will be to apply an algorithm or a correct procedure. Conversely, an individual who has more sophisticated, relativistic beliefs about knowing may believe that alternate solutions may be constructed by individuals to solve the problem (King & Kitchener, 1994; Kitchener, 1983). These meta-metacognitive processes are typical of adult rather than children's thinking (King & Kitchener, 1994).

Considering the links noted in the literature between epistemological beliefs and teacher effectiveness, it is important to investigate the nature of such beliefs in pre-service teacher education students with a view to understanding teaching practice.

## **The Study**

This paper is a report on the beliefs about knowing, learning and teaching espoused by 25 pre-service Graduate Diploma in Education (primary) students. The aim of the study was to investigate the relationships between core beliefs about knowing and peripheral beliefs about learning and teaching.

The Graduate Diploma in Education was a one-year course that prepared individuals with undergraduate degrees to teach in primary schools in Queensland, Australia. The undergraduate qualifications of students included degrees in Business, Social Science, Leisure Management, Psychology, Visual and Performing Arts, Science, Literature, and Nursing. The group comprised 1 male and 24 females with a mean age of 27.65 years. As a group, students reported a considerable range of prior teaching experiences. These included secondary school teaching, training experience in the workplace, tutoring experience, parenting experiences, helpers at camps and church functions, classroom volunteers, working in after school care and working as a teacher aide.

Students were asked to discuss their epistemological beliefs using semi-structured interviews, which took place at the end of the year-long course. These conversations averaged about 60 minutes in duration. The questions related to beliefs about knowing were similar to those used by Belenky et al. (1986) in their study of women's epistemological beliefs. Students were asked to describe their beliefs about learning and teaching using similar questions to those used in the T&LiTE Project (1994). See Appendix 1 for details of interview questions.

The discussions were analysed using a predominantly inductive approach, which drew on relevant literature to interpret results. This descriptive-interpretative approach to analysis still made it possible to take account of many viewpoints before deriving theory (cf. Maykut &

Morehouse, 1994). After the transcripts of the discussions were read and categories had emerged, a 20% sample of the Interview 1 and Interview 2 interview transcripts were audited by three different colleagues. In the current study, the three judges recognised all categories as valid in the data (Lincoln & Guba, 1985). Such dependability (as a measure of trustworthiness) is considered to be stronger if the percentage of agreement is as high as possible. QSR NUD\*IST (Non-numerical Unstructured Data Indexing Searching and Theorizing) (Richards & Richards, 1994) was used to assist in the organization of data emerging from the transcriptions of the audiotapes.

## Findings

Overall, the comments made by students regarding their core beliefs about knowing were described as Received, Mixed and Constructed beliefs. From Received through to Constructed beliefs there is an increase in focus on beliefs that truth is constructed and reasoned and a corresponding decrease in focus on truths as absolute and received. Received beliefs present the most naïve perspective in this study because individuals only describe truths as received and absolute. In the next category, Mixed beliefs, students believe that some truths are constructed and reasoned. However, these students still held some beliefs in the reception of absolute truths. Finally, students with Constructed beliefs are aware that truths are predominantly constructed and reasoned. Overall, in this study, there appeared to be a progression in terms of sophistication of core beliefs from Received through to Constructed beliefs. These categories of beliefs about knowing will now be described and considered in relation to peripheral beliefs about learning and teaching. Table 2 is a summary of the categories of beliefs about knowing, learning and teaching and the number of students who were represented in these categories.

**Table 2: Summary of categories of beliefs and the numbers of students represented in each of the categories**

Beliefs about knowing	Beliefs about teaching & learning	Frequency
Constructed	Constructivist	7
Constructed	Mixed (constructivist & reproductive)	7
Mixed	Mixed (constructivist & reproductive)	10
Received	Mixed (constructivist & reproductive)	1

### **Constructed Beliefs**

Overall, there were 14 students who espoused Constructed beliefs. Students' responses that were categorised as Constructed beliefs indicated that some opinions were better than others if they were validated by research or other experiential evidence: truth was relative and therefore could be interpreted differently by individuals. However, variations occurred within this category.

Some responses were a description of Constructed beliefs with a passing recognition that absolute truths may exist in some contexts, for example:

J: So the nature of truth I think depends on context, that is probably the biggest theme throughout this year that I have really picked up. Sort of, facts are true of course, but in things that are about issues and opinions and beliefs and things, it totally depends on what perspective you are taking and there can be more than one valid truth about an issue.

These comments indicated that truth was a matter of personal interpretation and therefore an individual could not know an absolute, universal truth. However, these responses also indicated that truth might involve the reception of absolute truths in certain contexts, for example, learning mathematics.

Of this group of 14 students, seven students also espoused consistently constructivist peripheral beliefs about learning and teaching. The following transcript exemplifies this consistency between constructed core beliefs about truth and constructivist beliefs about learning and teaching for these seven students.

#### ***Beliefs about knowing***

L: Now I see truth as something that you discuss and read about and talk about with others and eventually leads to a change in your own self, your own opinion of your own beliefs and how you view the world. . . (that is) when you have got a variety of opinions . . . you have come to a conclusion about something and then somebody comes along with some other view that they think is right and you know it is not wrong, but it just doesn't conform to your beliefs. In the practical situation my deputy principal thought that his beliefs about teaching were the truth and I didn't believe it. (Truth) is idiosyncratic. I don't think that there are truths, I don't think it exists. . . ideas are always being challenged and I don't think that there is just one real truth.

#### ***Beliefs about learning and teaching***

L: Learning is like changing of the person. Being able to change a person's ideas and they have learnt something as a person when they are able to see the world differently. (I go about learning by) reading the literature, talking with other students, observing, listening to other peoples views. . . I have seen the effect on primary school classrooms. Like I don't like the children to just memorise I just want them to see the world differently and things like that. I don't know about myself though.

Interviewer: What sort of learning do you want them to engage in?

L: Cooperative learning, because. . . the students at the final prac probably had a pretty bad view of community and others and if you could encourage them to work together at an early age perhaps when they are adults they would be able to do that because they were quite violent. Critical learning. . . it was a low socio economic area and if they could, if I could encourage critical literacy and that so they could see that the dominant view, the dominant class view isn't always right.

This student, and others with Constructed beliefs, described learning and teaching from a constructivist perspective. This means that their comments regarding learning and teaching were focussed on learning as a process of active, personal construction of meaning. Such beliefs are described as constructivist because understanding emerges from a construction of the information in relation to the learners' prior knowledge rather than a focus on aggregating quantities of

information that remain unconnected to prior knowledge. These students clearly evidenced consistency between sophisticated core beliefs and constructivist beliefs about teaching and learning.

The remaining seven students who espoused Constructed beliefs did not evidence such clear consistency between core and peripheral beliefs. Such students described Constructed beliefs but their beliefs about teaching and learning were not always constructivist in nature. Mostly the lack of sophistication in regards to their beliefs about teaching and learning emerged in relation to their responses regarding their definition of teaching in which they described active or individualised ( $n=6$ ) rather than constructivist perspectives. “Active” teaching beliefs involved challenging children to discover information for themselves but the information was a ‘given’: It was not described as a personal construction of meaning. “Individualised” beliefs about teaching meant that teaching needed to focus on catering to individual children’s needs.

### ***Mixed Beliefs***

Ten students were described as having Mixed beliefs because they clearly described multiple categories of core beliefs throughout their interviews. Comments categorised as Mixed beliefs indicated that truths were personally constructed and that absolute truths were received. This means that individuals construct personal truths that are supported with evidence and individuals receive absolute (right/wrong and universal) truths from an external source. Individuals actively create their own truths and passively receive truths that are a direct representation of reality. The following transcript exemplifies such beliefs.

### ***Beliefs about knowing***

G: There’s something that are you know obviously true maybe like some of the maths, like some things are black and white but generally truth still for me comes from taking what is around you and putting your own interpretation on lots of things, so I guess listening to other people and making some judgements I suppose about what you believe about that.

### ***Beliefs about learning***

G: (Learning is) finding out about things, ... getting to understand or know about something that you maybe haven’t know about before. I try and relate it to something that I already know that, compare it to something else

Interviewer: How do you know when you have learnt something then?

G: Passed an exam, I mean I guess that is probably one way, you learn as much that you can put it down on paper. I think that I have learnt something when I can probably confidently tell someone else about it, or in the case of the kids at school I can help them with something, in the case of the skill if I can actually do it, the exam but if I can tell someone else about it or I can have an opinion, if I can develop some sort of opinions on something.

### ***Beliefs about teaching***

G: Some of the lessons I did about, model things for them, show them things, and let them actually try it out, let them try things out...so I guess taking into account what their needs are, what their perspective, what is relevant to them. Even at grade one there is still a bit of telling in there, if only just to provide that sort of background or set the scenes for things or put it in context, whatever.

As expected, these students did not hold consistently constructivist beliefs about teaching and learning.

### ***Received Beliefs***

The student who described Received beliefs described how individuals receive absolute (right/wrong and universal) truths from an external source: Individuals passively receive truths that are a direct representation of reality. The student held a mixture of constructivist and reproductive beliefs about learning and teaching as indicated below.

#### ***Beliefs about knowing and teaching***

C: When I talk about truth I guess it is things that are pretty much laid out as in I believe in absolute not relativistic truths. If you have a white board and you look at the white board it is white but if somebody else looks at the white board through rose coloured glasses they think it is rose where in fact it hasn't changed the fact that the white board is still white. The teacher will generally, could be considered the expert in the environment of the children so while he guides or she guides them, but while they are guiding them towards the truths or facts or whatever they are doing they don't actually get the children to do all the research and everything themselves they merely get something to highlight those truth, so the expert there is, it is transmitting the information just not in the normal chalk and talk sort of way. Some people call it a facilitating of them coming to an understanding but he's still guiding and getting them to learn the information he wants.

#### ***Beliefs about learning***

C: I guess the easiest way I can say it now is that learning is when you have basically changed your worldview. Minute details in some points but it is basically the level of knowledge and understanding you have is modified by knowing something new and also it helps if you relate it to things and that helps you gain understanding

This student described some constructivist learning strategies, beliefs about learning as a change in worldview and learning outcomes as indicated by 'being able to explain'. She clearly described only reproductive teaching strategies. This student seemed to be functioning more like a student with Mixed beliefs. It is possible that this student, who was also quite oppositional to the notion of reflecting on epistemological beliefs, under different circumstances, may have espoused a more sophisticated level of beliefs (cf. Perry, 1970).

## **Discussion**

The categories of beliefs about knowing that have emerged in this study suggest a continuum of epistemological beliefs similar to those noted by Perry (1970) and Baxter Magolda (1993). Students' core beliefs about knowing reflected a range of beliefs from Received through to Constructed beliefs. The recognition of Mixed beliefs is a variation to the positions postulated by the developmental theories because these categories of beliefs offer a more differentiated view of students' beliefs in transition from multiplism to relativism (Perry, 1970) and transitional to independent (Baxter Magolda, 1993) ways of knowing.

It could be expected that individuals who have Constructed beliefs about knowing that reflect the construction of reasoned truths might conceive of learning and teaching as a process of

construction of personal meaning or hold a constructivist view. Similarly, those who have Received beliefs might be expected to conceive of learning and teaching from a reproductive perspective where individuals receive information rather than construct personal meaning. This relationship was not always evident in this study. For example, some with Constructed epistemological beliefs described a mix of transmissive and constructed beliefs about learning and teaching.

It is possible that these students did not really hold the Constructed beliefs they espoused. This means that they may have espoused knowledge about their epistemology rather than actual belief. Beliefs, rather than knowledge, are more likely to influence teaching and learning behaviour (cf. Pajares, 1992). It was expected that students who espoused knowledge rather than beliefs would be more likely to describe beliefs inconsistently across categories.

Another possible explanation relates to the notion of beliefs in transition. When individuals are encouraged to reflect on their existing beliefs, they may experience confusion or disequilibrium (Piaget, 1954, 1963 cited in Woolfolk, 1998) as they wrestle with discrepancies between pre-existing beliefs and new information. This would may indicate that students are in the process of changing epistemological beliefs.

Yet a further explanation relates to the notion of focus in belief systems. Even though some students were described as having Constructed beliefs, some still mentioned in passing that truths existed. It is possible that Constructed beliefs are foregrounded in a system that includes other types of beliefs. The mixed nature of beliefs is not something that is evident in the developmental epistemological beliefs schemes of Perry and Baxter Magolda. Therefore from this perspective, it is possible that the nature of epistemological beliefs is something closer to Schommer's view of epistemological beliefs. Schommer (1990) described epistemological beliefs as a multidimensional set of independent beliefs. This means that it is possible for individuals to have epistemological beliefs that are both sophisticated (more relativistic) and naïve (more dualistic). Schommer (1990) described five dimensions of epistemological beliefs that included (a) Omniscient Authority (beliefs in the source of knowledge), (b) Certain Knowledge (beliefs in the certainty of knowledge), (c) Simple Knowledge (beliefs in structure of knowledge), (d) Quick Learning (beliefs in the speed of learning), and (e) Innate Ability (beliefs in the stability of knowledge) (Schommer, 1990). Schommer has described these 5 dimensions as a kind of frequency distribution where 'for example, sophisticated learners may believe a vast amount of knowledge is evolving, some knowledge is yet to be discovered, and a very small amount of knowledge is unchanging. . . On the other hand, naïve learners may believe a vast amount of information is certain, some knowledge is yet to be discovered, and a very small amount of knowledge is changing.' (1994, p.302). This multiplicity of dimensions suggests 'that epistemological beliefs do not necessarily develop in synchrony' (Schommer, 1994, p.302) and that learning may in fact be determined by individual as well as by a combination of beliefs.

Teacher education courses need to address epistemological beliefs to prepare teachers for complex demanding teaching roles that require alternate solution construction in everyday problem solving. Teachers increasingly need to deal with diversity in their professional lives. Indeed, such pluralism is a feature of society in general. They need to manage and interact with a broad range of students, parents, colleagues and administrative personnel, often in order to address a range of ill-defined problems. Complex or ill-defined problems that are inherent in social interaction may require meta-metacognitive processes in order to interpret the problem and

to define the limitations of solutions (Kitchener, 1983). It seems, then, that if we are going to prepare teachers for complex demanding teaching roles, we need to address epistemological beliefs so that prospective teachers are more able to deal with ill-defined problems and recognise the importance of constructivist beliefs for themselves as learners and for the children they teach.

## **Appendix 1 Interview questions**

### ***Beliefs about knowing interview questions.***

Sometimes people talk about 'searching for truth.' I'm not sure what they're talking about. What are your views? In learning about something you really want to know, what is the role of an expert? How do you know someone is an expert? What do you feel and what do you do when experts disagree? What do you do if lecturers disagree? If experts disagree on something today, do you think that some day they will come to some agreement? Why or why not? How do you know what is right/true? Do you agree with this person who says that where there are no right answers anybody's opinion is as good as another's?

### ***Beliefs about learning and teaching interview questions.***

1. Students' approaches to learning.

What is learning? Can you describe how you prefer to go about learning? How do you know when you have learnt something?

2. Student perceptions of teaching.

Can you describe what you think good teaching is? Why? How do you know if you have taught something?

## **References**

- Baxter Magolda, M. B. (1988). The impact of the freshman year on epistemological development: Gender differences. Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA, April 5-9.
- Baxter Magolda, M. B. (1993). The convergence of rational and interpersonal knowing in young adults' epistemological development. Paper presented at the Annual meeting of the American Research Association, Atlanta, April 12-16.
- Belenky, M. F., Clinchy, B. M., Goldberger, N. R., & Tarule, J. M. (1986). *Womens' ways of knowing: The development of self, voice and mind*. USA: Basic Books.
- Bem, D. J. (1970). *Beliefs, attitudes, and human affairs*. California: Brooks/Cole.
- Brown, A. (1987). Metacognition, executive control, self-regulation and other more mysterious mechanisms. In F. Weinert & R. Kluwe (Eds.), *Metacognition, motivation and understanding* (pp. 65-116). Hillsdale, N.J.: Erlbaum.
- Hofer, B., & Pintrich, P. R. (1997). The development of epistemological theories: Beliefs about knowledge and knowing and their relation to learning. *Review of Educational Research*, 67, 1, 88-144.
- Kardash, C. M., & Scholes, R. J. (1996). Effects of preexisting beliefs, epistemological beliefs and need for cognition on interpretation of controversial issues. *Journal of Educational Psychology*, 88, 2, 260-271.
- King, P. M., & Kitchener, K. S. (1994). *Developing reflective judgment: Understanding and promoting intellectual growth and critical thinking in adolescents and adults*. San Francisco: Jossey-Bass.
- Kitchener, K. S. (1983). Cognition, metacognition and epistemic cognition. A three level model of cognitive processing. *Human Development*, 26, 222-232.
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. California: Sage.
- Maykut, P., & Morehouse, R. (1994). *Beginning qualitative research. A philosophic and practical guide*. London: The Falmer Press.

- Noddings, N. (1991). Stories in dialogue: Caring and interpersonal reasoning. In C. Witherell & N. Noddings (Eds.), *Stories lives tell. Narrative and dialogue in education* (pp. 157-170). New York: Teachers College Press.
- Pajares, M. F. (1992). Teacher's beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research*, 62, 3, 307-332.
- Perry, W. G. (1970). *Forms of Intellectual and Ethical Development in the College Years*. New York: Holt, Rinehart and Winston.
- Perry, W. G. J. (1981). Cognitive and ethical growth: The making of meaning. In A. W. Chickering (Ed.), *The modern American college* (pp. 76-116). San Francisco: Jossey-Boss.
- Posner, G., Strike, K., Hewson, P., & Gertzog, W. (1982). Accommodation of a scientific conception: Toward a theory of conceptual change. *Science Education*, 66, 2, 211-227.
- Richards, T., & Richards, L. (1994). QSR NUD\*IST. Alladin Systems Inc, California.
- Rokeach, M. (1968). *Beliefs, attitudes and values*. San Francisco: Jossey-Bass Inc.
- Schommer, M. A. (1990). Effects of beliefs about the nature of knowledge on comprehension. *Journal of Educational Psychology*, 82, 3, 498-504.
- Schommer, M. A. (1994). Synthesising epistemological belief research: Tentative understandings and provocative confusions. *Educational Psychology Review*, 6, 4, 293-319.
- Sutton, R. E., Cafarelli, A., Lund, R., Schurdell, D., & Bischel, S. (1996). A developmental constructivist approach to pre-service teachers' ways of knowing. *Teaching and Teacher Education*, 12, 4, 413-427.
- T&LiTE. (1994). The Teaching and Learning in Tertiary Education (T&LiTE) Project. A report prepared for the Teaching and Learning Committee, Queensland University of Technology by the Research Concentration in Cognition in Learning and Development, School of Learning and Development, Queensland University of Technology.
- Woolfolk, A. (1998). *Educational psychology* (7th ed.). Toronto: Allyn and Bacon.

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