

## Personal epistemological and metacognitive awareness<sup>1</sup> in first year preservice education students<sup>2</sup>.

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### ABSTRACT

This paper examines preservice teaching students' personal epistemological and metacognitive awareness (PEMA) and changes that occurred in these over the first semester of university study. Reflective learning journals of a selective sample of 18 students were analysed for evidence of PEMA. Rather than identifying particular epistemological beliefs, or defining their relationship with metacognitive behaviour, the study focused on students' awareness of these phenomena within their own thinking. Clear links were found between PEMA, self-regulated learning, and academic success. This has implications for pedagogical policy, particularly within the first year experience.

### Keywords

Metacognition, self-regulation, achievement, teacher training, higher education, transition

### INTRODUCTION

A common complaint heard from university educators is that their students, or at least a mentionable number of them, just don't "get it"; that the point of learning tasks, or the broader curriculum, just seems to be beyond them (see Cantwell, 2004; Cantwell, Scevak, Bourke & Holbrook, 2012a). Exactly what is meant by "getting it" is often obscure. However, it is a reasonable conjecture that the "it" being referred to is about the depth or level of knowledge presumed to be the target of study, and the potential mismatch between the assumptions underpinning the task and the assumptions of knowledge brought to it by the students. We suggest that examining the assumptions about knowledge that students bring to their learning may help explain individual differences in the quality of learning outcomes.

Learning is an outcome of the processes by which students deal with information. Such processes are not random, but are outcomes of higher-order representations of knowledge itself. These form a framework of beliefs within which individuals interpret, accept, or reject information. This framework of beliefs about knowledge is termed *personal epistemology* (Hofer & Pintrich, 1997), and provides a context through which individuals interpret their environment to generate meaning and understanding. This process underpins self-regulation of learning: the activation and maintenance of cognitions and behaviours oriented toward attainment of learning goals (Zimmerman & Pons, 1986). It is argued here that personal epistemology frames metacognitive decision-making (Cantwell et al., 2012a, 2012b).

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<sup>1</sup> PEMA: Personal epistemological and metacognitive awareness

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A diverse body of research has explored the construct and function of personal epistemology. Much of the theory has assumed a developmental trajectory, and “advanced” epistemological beliefs have been associated with increased learning outcomes (Schraw & Sinatra, 2004; Mason & Bromme, 2010). Since Schommer (1990) first proposed a system of epistemological dimensions, various models have been put forward that step away from the original linear developmental approach. Different combinations of dimensions have been suggested, including, for example, certainty of knowledge, source of knowledge, and speed of learning; although beliefs about learning have been challenged as not strictly epistemological (Hofer & Pintrich, 1997, c.f. Elby, 2009).

Through this debate, the principle has been largely accepted that students may hold varying positions on different dimensions of epistemological beliefs, resulting in individual combinations of naïve and advanced beliefs. More recently, however, the use of terms such as *advanced* has been questioned, with some researchers preferring “adaptive” (Braten, Stromso & Samuelstuen, 2008) to reflect the suitability of a belief within a context. This is an important area of theoretical discussion, but is beyond the scope of this paper which focuses on the role of students’ awareness of their personal epistemology more than the specific beliefs they hold on particular dimensions. Epistemological awareness is seen as significant because it may permit introspection into, and therefore control of, the processes of metacognition.

Metacognition involves the control of cognitive activities that process, manipulate, and store information. Because epistemological beliefs influence perceptions and evaluations of information, they therefore inform metacognition, and, in turn, self-regulation of learning. Bromme, Pieschl and Stahl (2010) describe epistemological beliefs as an “apprehension structure” which aids the calibration of metacognitive self-regulation. Other researchers also employ models consistent with this approach (Muis, 2007; Muis & Franco, 2009). Conceptualisations of these processes include significant recursion, with cognition feeding back to inform metacognition and metacognition influencing the framework of personal epistemology. Although metacognition and personal epistemology are frequently addressed as independent constructs, the self-evident overlap and interaction would suggest that they may be conceptualised alongside each other. This is reflected in terms such as “epistemic cognition” (Kitchener 1983, as cited in Bromme et al. 2010; Cantwell et al. 2012a), referring to cognition which specifically focused on knowing and knowledge, and Hofer’s (2004) description of “epistemological understanding as a metacognitive process”. For an overview of the complexities surrounding metacognition, see Veenman, Van Hout-Wolters and Afflerbach (2006).

More recently Cantwell et al. (2012a, b) have posited a model of “epistemic metacognition”, built on the premise that epistemological beliefs are part of an integrated array of beliefs informing metacognitive processes. Empirical research increasingly supports the proposition that epistemological beliefs, cognition, and metacognition interact with each other. Therefore, while relatively stable traits may become established in individuals, there is always potential for adjustment and adaptation. New contexts or challenging tasks may instigate disequilibrium and increase the need for adaptation, potentially triggering metacognitive or epistemological development. It has been suggested that commencing university study may be one such catalysing situation (Kincannon, Gleber & Kim, 1999; Cantwell, 2007; Cantwell, Scevak & Parkes, 2010). Intervention during the first year of study may be effective in guiding the formation of domain-specific epistemological beliefs which are thought to be more malleable than their general-level counterparts (Kienhues, Bromme & Stahl, 2008).

Direct control of students’ cognition is not possible. It also is difficult to monitor or measure cognition. It is more viable to influence metacognition, and, through metacognition, epistemological beliefs which have been described as “*partly* subconscious” [emphasis added] (Bromme et al., 2010) and so might be “cognitively penetrable convictions” (Graham & Neisser, 2008, p.176). Additionally, metacognitive behaviour can quite easily be monitored via simple self-report measures (Kincannon et al., 1999). In fact, the nature of self-report itself may affect participants’ awareness of metacognition, and potentially trigger adaptations (Stacey, Brownlee, Thorpe & Reeves, 2005). Previous research has shown that deliberate prompting can stimulate cognitive and metacognitive processes, thus enhancing learning outcomes (Hubner, Nuckles, & Renkl, 2006). Further, the use of think aloud protocol has demonstrated that students can spontaneously verbalise dimensions of epistemological beliefs (Mason

& Boldrin, 2008) as part of metacognitive processes (Hofer, 2004). It is reasonable to expect that the unguided self-report of the variety found in journal writing might also generate insights into epistemological beliefs and metacognitive processes.

As mentioned above, it has been demonstrated that pedagogical strategies which blend metacognitive training with content can improve metacognitive ability as well as academic performance (Gill, Ashton & Algina, 2004; Hubner et al., 2006; Kincannon et al., 1999). Pieschl, Brommer and Porsch (2008) have argued for “explicit discourse” (p. 219) about epistemological questions in the classroom, a theme which ties in with current debate in the Academic Literacies field (e.g. Hocking & Fieldhouse, 2011; Klinger & Murray, 2012). Further, the activation of epistemological beliefs and metacognitive strategies appears to be highly influenced by both the content which is processed and the context in which this occurs (Hammer & Elby, 2002; Bromme et al. 2010; Muis & Franco, 2009), adding weight to the argument for a blended, embedded pedagogical approach. If personal epistemology can be fostered through pedagogy, this is relevant for educational institutions involved in pre-service teacher training. In this paper it is argued that promoting increased PEMA supports better academic achievement.

### Aims

Despite its significance for metacognition and thus for learning, personal epistemology operates implicitly as a framework of assumed beliefs rather than as consciously constructed convictions. However, as discussed above, consciousness of metacognition is relatively high. This makes metacognition much more accessible than personal epistemology. As Graham and Neisser (2000) explain:

It is, in fact, also necessary to recognize that metacognition is not just an activity, it is an achievement or skill. We can be more or less reflexively attuned to our first-order attitudes, and better or worse at recognising and interpreting them. (p. 176)

In this study, student journals were analysed to investigate evidence of PEMA, and to compare this alongside reporting of self-regulation to explore links between these constructs and their relation to academic success. It was hypothesised that:

- a) evidence of PEMA would be present alongside evidence of successful self-regulation
- b) both PEMA and self-regulation would show a link with academic success in a course

Academic success was measured by the final grades that students achieved in this course. The journals used for analysis were not directly assessed, so they offer a separate source of evidence for PEMA which can be compared against academic achievement through coursework assignments and exam performance.

### Definitions

Clear and uncontested definitions are rare in this field (Schunk, 2008; Mason & Bromme, 2010; Bromme et al., 2010). The obvious conceptual overlap which occurs between constructs can lead to confusion or misinterpretation of findings, as well as contributing to weaknesses of discriminant validity (Mussel, 2010). Conceptual clarity of constructs should be a goal of all research, in order to facilitate collaboration and to ‘focus the conceptual lens’ (Dinsmore, Alexander & Loughlin, 2008). This research focused on individuals’ conscious recognition and consideration of their own epistemology and metacognition. Such conscious deliberation necessarily forms part of wider metacognition, or “thinking about thinking” (Flavell, 1979), and hence there exists a degree of conceptual overlap.

Similarly, while metacognition is intimately connected to self-regulation by monitoring and controlling cognition, self-regulation spans both cognitive and behavioural domains (for a deeper discussion see Dinsmore et al., 2008). While the literature sometimes shows a preference for “epistemic” as opposed to “epistemological”, this paper uses the latter due to its predominance in the field, and as such adopts Hofer and Pintrich’s (1997) definition of beliefs about “knowledge and knowing”. The term *advanced* is used in this study to describe epistemological beliefs that have traditionally been considered more sophisticated or desirable, including beliefs in fluid, uncertain knowledge and evaluative active construction of knowledge. However, this does not mean that

alternative stances usually considered naive are maladaptive, because what is adaptive changes according to task, context, and purpose. This is discussed further below.

## METHOD

A case-study approach was implemented based on weekly reflective journals produced by 18 pre-service teaching students as part of an undergraduate Educational Psychology course. Of these students 13 were female, and students' ages ranged from 18-36 with a mean of 20 years. The journals were not directly assessed, but were used as the basis for an assessed reflective essay. The journals analysed were selected to represent students with a range of course scores, with one third representing the highest achievers, one third the lowest and one third those with results just above and below the mean course score. At this institution a score below 50 represents a fail grade, 51-64 is a pass, 65-74 is a credit, 75-84 is a distinction, and scores above 85 a high distinction. For this course, the final scores were calculated from both take-home essay assignments and a formal end of semester exam. Table 1 shows more detail about the individual participants, with pseudonyms used in place of real names. Information identifying individual students or their scores was detached, and journals were placed in random order before analysis.

The first six weeks of each journal were analysed, which for most students represented their first experience of university learning. It was anticipated that challenges encountered during this period may have generated some degree of cognitive dissonance, thus stimulating heightened PEMA. The journal entries were guided by weekly focus questions, and completed independently by students outside of lectures or tutorials. This means that students' views were produced without any probing from interviewers or direction from questionnaire items, either of which might have imposed a framework upon results. It was expected that only students' explicitly held beliefs would be represented, providing direct insight into conscious PEMA and enabling a candidness and depth of reflection which might not be achieved through interviews or questionnaires (Hoover, 1994). Further,

**Table 1:** Participant characteristics

Student (n. 18)*	Score	Grade	Age
Adam	85.7	HD	19
Becky	76.8	D	20
Charlotte	76.5		21
Diane	71.0	C	19
Ellie	69.9		23
Fran	69.6		18
Georgina	62.4	P	22
Harry	61.6		19
Ian	60.6		18
Jemma	60.2		20
Kylie	60.1		21
Lily	58.3		18
Max	49.7	F	19
Natasha	49.2		18
Paula	43.6		18
Rosie	43.3		22
Sarah	41.8		36
Tom	37.0		19

\* Pseudonyms used.

HD = High Distinction, D= Distinction, C= Credit, P = Pass, F = Fail

the use of students' learning journals meant that evidence was clearly contextualised, in contrast to most investigations into personal epistemology (Mason & Boldrin, 2008). This methodology was therefore both appropriate and valid for investigating PEMA, with subsequent interpretation conducted within a theoretical framework.

Students were not informed of the focus of this research before producing their journals. As a result, conscious PEMA was reported without distraction or bias from external encouragement. As all evidence was self-generated, the participants themselves identified the issues that they considered worthy of recording. This offered more authenticity than might have been achieved through other methods. The use of student learning journals contributes an alternative perspective in a field dominated by interviews and questionnaires. After analysis was conducted, each journal was assigned a neutral label. Each journal was then given an author pseudonym for the purpose of reporting and discussion of results. Ultimately only five male students' journals were involved in this study, reflecting the mainly female composition of the cohort. A more balanced sample would be preferable but as gender was not a target variable it was not considered that this would undermine the validity of results.

## RESULTS

As anticipated, the analysis showed clear links between PEMA and successful self-regulation, with both constructs relating strongly to academic success. Students with strong evidence of PEMA, demonstrating high awareness of their own epistemological and metacognitive strategies as well as awareness of a wider range of approaches, achieved higher academic grades. This linked to reporting of successful SRL, supported by the academic outcomes. Conversely, students showing less evidence of PEMA, revealing a narrow epistemological range, did not demonstrate successful SRL and achieved weaker academic outcomes. The key results for each group of students are outlined below with illustrative excerpts from their reflective journals.

### The high achievers

Students in the most academically successful group achieved final course grades between 69.6 and 85.7, representing credits, distinctions, and one high distinction. These students not only produced the greatest volume of comments to illustrate their epistemological and metacognitive attitudes, but also their comments expressed the type of beliefs and behaviours that are typically associated with sophisticated positions on epistemological scales. For example, Charlotte's remarks (below) show a transition towards acceptance of uncertain knowledge:

“the world [is] increasingly grey and the rules right and wrong don't fit any more.”  
 “I'm never sure about much, things always change.” (Charlotte)

Similarly, Adam states that absolute truth is not achievable, and students must compromise by accepting the “best possible truth”.

“[we can only reach] the best possible truth, by considering all available evidence and applying rational thought.” (Adam)

Comments like these reveal an active, evaluative stance, as opposed to passive receptivity. This active construction of knowledge is typical of these higher-achieving students, who also desire deep understanding. In contrast with less successful students who might be satisfied with surface reproduction, the high achievers do not accept information until they understand how it relates to a bigger conceptual picture:

“Learning is an active process... The answers aren't going to be spoon-fed to me. If I want to learn and understand, I have to do it myself. I have to seek to understand through active reading and research.” (Fran)

“Learning is not characterised by adding more facts.” (Adam)

“I needed to understand the mechanics behind it so I knew what to do.” (Charlotte).

While these students recognise the role of an effective teacher, they also see themselves as instrumental in their own success. This is seen in statements that show internal locus of control and strong self-efficacy:

“If I do well, I credit myself for doing well, and the coordinator... if I don’t do well, I did the best I could at that given time.” (Becky).

“Character traits don’t determine one’s abilities.” (Diane).

These are confident students who blend intrinsic motivation (“I enjoy learning” [Becky]; “I was satisfied ... when I did well” [Charlotte]) with external goals (“I’m aiming for high achievement” [Adam]; “I wish to receive good marks” [Becky]). It is difficult to distinguish here between cause and effect, so it is unclear whether success leads to confidence or confidence to success. There is likely a spiralling, reciprocal pattern. However, it seems that students who have strong self-efficacy and a belief in active learning to “construct new beliefs” (Charlotte) are those who excel academically and are prepared to work hard:

“I don’t fully understand all of this as yet, but I’ll read it over again.” (Fran)

Of course as first year debutants there is still evidence of more naïve beliefs, and dependence on external support. Fran acknowledges “I need to... get the assistance I need to move forward”. This may reflect an adaptive shift towards approaches that are more appropriate for beginner-level study of novel concepts (Braten et al., 2008). Later Fran realises:

“I’ve been focussing on such complex things that I’ve forgotten that the basics are often the answer.” (Fran)

For students familiar with mastery of high school material, the challenge of university courses may force a temporary ‘backwards’ shift towards strategies appropriate for beginner learners. In such a situation, the adoption of naïve beliefs may be considered an adaptive reaction to the context. For example, it may be appropriate for students initially to accept information from external authorities without questioning it until they have built strong enough disciplinary foundations to begin interpreting and critiquing new evidence for themselves. Even if this backwards shift does occur, however, these high achievers are unlikely to consider material learned and ‘finished’ until they reach deep understanding and conceptual integration of ideas.

Another characteristic of this group of successful students is their clear and detailed insight into their own weaknesses, for example:

“[I exhibit] unwillingness to ask for help ... partly because of shyness and a feeling I have had for a while that asking for help displays weakness.” (Charlotte)

“I have felt apathetic and unmotivated because everything is going in one ear and out the other ... But this apathy is my affective response to my learning environment.” (Fran)

“I’m a procrastinator, I get anxious when I procrastinate ... I get angry and frustrated with myself for not achieving goals quickly and wasting time.” (Charlotte)

This kind of recognition may represent the first step in challenging negative behaviours and developing adaptive strategies. These students understand that strategies can be learned and practised, that successful students are not born brilliant but achieve success through strategic application of their ability. This means there is capacity for development:

“The skills and methods [successful students] use to remember and organise their study are the main factors.” (Diane)

“Every person I’ve met has facilitated some change or growth in me... Can initial perceptions be changed? Yes.” (Charlotte)

“We acquire skills.” (Adam)

“Things will become easier.” (Diane)

These attitudes are likely to connect with and influence other dispositions such as attributions, motivation, and volition. Collectively, these beliefs and behaviours provide students with the means to succeed at university study.

### **The ‘average’ achievers**

Students in the central category show some similarities with the higher achievers, although overall these journals tended to report more content from lectures and reading, with less personal reflection. These students passed the course, with final scores ranging from 62.4 to 58.3 (50 was the minimum score required for a pass). At this level, there are multiple comments reflecting a belief that knowledge comes from external sources rather than being internally constructed, for example:

“Teaching is being able to pass on information to others.” (Lily).

“I now realise how important it is to correct children’s misconceptions.” (Kylie)

There is an implicit belief here that ‘information’ or ‘knowledge’ is static, something that is transmitted from one individual to another. However some students also recognise the role of deeper, more active learning:

“Good teachers help students develop a perspective and their own opinion.” (Lily).

This inconsistency in Lily’s statements may reflect unformed professional beliefs, or shifting epistemological beliefs, both of which may be consistent with a first year pre-service teaching student’s early experiences of university. Georgina, who achieved the highest grade of this middle group, also shows contradiction. This kind of inconsistency may illustrate the gap between higher level approaches promoted by a teacher-training degree and lower level approaches typical of some first year students.

“I expect to be able to understand ... due to effective teaching.” (Georgina)

“I learn from ... individuals that know something I don’t.” (Georgina)

“People need to be actively involved in their own understanding ... and form a new opinion and understanding.” (Georgina)

A difference in the general attitude of this group, compared to the higher group, is seen in their self-esteem and self-efficacy. Particularly at the lower end of the group, students report not just lack of motivation but lack of faith in their own capability:

“My head is what is referred to as scrambled eggs! ... I feel as though even though I am working hard I am still struggling to keep up.” (Jemma).

Like the higher group, these students are aware that other strategies can be developed, but their comments typically reflect future intentions:

“I’m going to make some major adjustments in my learning processes and strategies” (Lily)

“I expect to be trained to effectively self-regulate” (Ian)

It is noticeable that Ian’s comment expresses not only a future focus but also an element of passivity, implied by his expectation that somebody else will take responsibility for this desired development. At the higher end of this group, students seem to recognise that there might be more effective ways of learning, and express ambition to achieve the learning styles that are promoted in their course. Harry’s comment is especially interesting because he expresses a desire to develop intellectually but describes this as “absorb[ing] information”, implying a naive underlying belief in passive learning of fixed and external knowledge.

“I want to be able to understand new information as a deeper learning approach.” (Georgina)

“My aim is that ... I will intellectually develop into a learner that can absorb information both affectively and in an omnipotent sense.” (Harry).

### **The low achievers**

In the weakest group of students, there was a clear expectation that correct answers exist and these should be provided by an external source. When these students encounter complicated and difficult content, it is seen as a fault of the lecturer rather than something for which the student could take responsibility:

“Teaching, to me, is passing on knowledge of new things.” (Natasha)

“I am expecting [to be] provided with all the information which is relevant and correct.” (Rosie)

“The lecture again wasn’t structured well and was difficult to understand.” (Paula).

These students seem to struggle to control multiple concepts, and want fixed, discrete truths. Such convenient facts are not available in a course that deliberately presents a range of theories and possibilities. Some comments hint at beliefs in quick learning, and these seem to link with negative affect when learning is not quick. There are some similarities here with aspects of the average group, but in stark contrast with the more academically successful students who were comfortable with difficult learning and prepared to re-read material until it made sense. For the lower-achieving students, the conflict between expectations and experience is difficult to resolve:

“I am still very confused ... sometimes I feel every time I learn something it can be contradicted.” (Natasha).

“I found the reading difficult ... I struggled to retain attention. I felt a sense of panic that I didn’t understand it properly.” (Natasha).

Interestingly, these academically unsuccessful students are capable of recognising their own position in what they perceive as a hierarchy of learning styles. In some cases this recognition further reinforces their low self-esteem as learners:

“I find that repetition is the only way that I retain anything, but I’m sure that someone said that it is the worst way to learn.” (Paula)

“I am a learner who memorises information by rote learning.” (Sarah)

“I am guilty of rote learning.” (Natasha)



In other cases a sense of (possibly false) confidence is revealed, such as when Max states:

“I feel like that [sic] if I commit and make an effort it can happen, but if no effort is made it won't.” (Max)

Max achieved a grade of 49.7, so it seems he did not “commit and make an effort”, or perhaps he did invest time and energy but without application of appropriate strategies. Typically, lower-achieving students over-focus on “correct” (Rosie) content without developing strategies to manage that information and evaluate it to generate their own evidence-based arguments. While there is awareness that other approaches to learning exist, there is little understanding of how to implement more sophisticated strategies. Perhaps these students possess strategic knowledge that is more declarative than procedural. Thus awareness of epistemological and metacognitive strategies remains less developed for these students who remain focused on naïve beliefs.

## DISCUSSION

All students face challenges in tertiary study, and even academically successful students sometimes resort to naïve strategies. The difference between success and failure seems to be the ability to translate information initially gained through naïve learning strategies into coherent, integrated schemata which can feed into more sophisticated strategies for analysis. By the time they reach university, academically proficient students have a long history of applying advanced strategies to their study. They can make the transition from novice to expert. Even when they have little prior knowledge of a new subject, their previous experience of success and intrinsic motivation (“I enjoy learning”) gives them the impetus to work hard in order to achieve. These students have built strong general self-efficacy, and while their confidence may sometimes falter (“I have insufficient self-discipline”; “I don't fully understand all of this as yet”) they possess the academic resilience to push through and reach for deeper understanding (“I'll read it over again”; “things will become easier”; “I needed to understand the mechanics behind it”).

It is successful self-regulation that allows these students to attain highly in their academic work and probably attain highly in other areas of their lives. Their strong sense of PEMA enables them consciously to trial various approaches from the range of epistemological resources (Hammer & Elby, 2002) they possess until they discover successful strategies. This argument is consistent with Bromme et al.'s (2010) hypothesis that more sophisticated learners are better able to “calibrate” their learning processes to align them with a particular task's requirements, whereas naïve learners demonstrate less epistemological and metacognitive flexibility. While these finer-grain details and reasonings require further clarification through future research, it is clear that self-regulation influences learning and academic success. Is it possible to raise students' awareness of the personal epistemology that underlies their metacognition and self-regulation? If it is, then understanding and nurturing PEMA may enable teachers to facilitate learning more effectively. This applies to student teachers who go on to classroom practice in primary and secondary schools as well as to the university teachers responsible for their initial training.

## Conclusions

Most students enter university showing great naivety (Brownlee, Walker, Lennox, Exley, & Pearce, 2009). Various techniques have been proposed to support first year students in a practical way, for example, showing them how to reference their work. However, it may be more helpful to illuminate the process of learning itself, showing students how to develop themselves as effective learners. This is significant when research on prior knowledge shows that when prior knowledge is low students tend to engage in rehearsal learning strategies regardless of their expectations or ambitions in terms of achievement (Muis & Franco, 2009). If most first year students resort to naïve, performance-oriented learning strategies, then this period is an opportunity to intervene and guide the development of wider ranging, more adaptive techniques and approaches.

The findings presented here support previous claims that students' personal epistemology can be influenced by their educational experiences (e.g. Lehrer, Schauble, & Lucas, 2008). This study uses analysis of student journals to focus on epistemological *awareness* as opposed to specific beliefs or assumptions. It is difficult to access individuals' personal epistemology without risking distortion of data through 'led' methods such as questionnaires or influencing responses in an interview situation. The insights of this study are drawn from authentic, contextualised data interpreted through a theoretical framework. They indicate that strong PEMA is linked with high achievement.

This adds weight to the argument that epistemological considerations should form part of any effective pedagogy. We support an approach that integrates traditional course content with a focus on students' metacognitive and epistemological development. University education traditionally is content-heavy, and the development of self-regulatory skills is often seen as something that will happen automatically, or something that is important but belongs outside of credit-bearing courses. In reality, it is impossible to separate the teaching of content from the teaching of skills needed to manipulate the content. Each discipline should produce graduates who not only 'know' the required content but also possess the ability to analyse and evaluate the validity of arguments, judging the evidence to defend their opinions.

Universities are responsible for scaffolding students' epistemological and metacognitive abilities (and transitions) as part and parcel of the tertiary package, to offer what Pieschl et al. (2008) term "epistemological sensitisation". This may be most relevant within pre-service teaching courses, whose graduates are likely to need sophisticated PEMA for their professional practice. This is important not only for teachers' effective design and delivery of curriculum content but also because, consciously or not, they are likely to pass on their personal epistemological and metacognitive beliefs to their students.

### **Limitations and Directions for Future Research**

The participants involved in this research were studying learning theory and metacognition. While demographic data were not collected, students within this cohort were largely middle class Caucasian Australians. The small sample cannot provide widely generalisable conclusions. Future studies should investigate larger sample populations over greater durations, using mixed methodologies to capture PEMA from various perspectives. While the methodology used here was valid in terms of capturing students' awareness of personal epistemology, form of self-report is vulnerable to conscious control, that is, participants may offer what they perceive to be correct responses. Particularly in an educational psychology course, students may be expected to have an awareness of what learning approaches are deemed sophisticated or desirable. This may influence what they write even in ungraded reflective journals. The analysis of participants' journals also was limited to the first six weeks in order to limit the impact of students' developing content knowledge upon their expression of PEMA. However, in the early stages of learning a new subject, there may be little difference between the behaviours of naive and sophisticated students, with differences becoming more apparent as more knowledge is gained (Pieschl et al., 2008). A longitudinal study could examine this argument.

In future research, it would be interesting to combine analysis of journals with interviews and with quantitative instruments such as the Epistemological Beliefs Questionnaire (EBQ) (Schommer, 1990) or the Epistemic Beliefs Inventory (Schraw, Bendixen, & Dunkle, 2002). In addition, more attention must be given to culturally diverse samples and to participants in non-western settings. It is short sighted to investigate human cognition by focusing on narrow, homogenous samples as have formed the basis of most extant literature, including this study. The few studies that have been conducted in East Asian cultural contexts indicate that the frameworks which have emerged from largely North American origins are far from universally applicable (e.g. Chan & Elliot, 2002, 2004; Mori, 1997; Zhang, 1999). Further, there is epistemological variation due to cultural differences even within the Western sphere (Haerle & Bendixen, 2008), between institutions in culturally similar countries such as Canada and the United States (Muis & Sinatra, 2008), and even inside one country (Tabak & Weinstock, 2008). Furthermore, because personal epistemology and metacognition are used

in all aspects of life, investigations of their use in non-academic contexts are needed. This may clarify what constructs are universal and what features affect development or adaptation of personal epistemology within and between cultures. Lastly, “social epistemology” (Goldman, 2010) or “relational epistemology” (Brownlee & Berthelsen, 2008) offers a new perspective on both existing and emerging theories and models.

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