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# Capturing epistemic reflexivity for teacher educators teaching about/to/for diversity in teacher education

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ABSTRACT

Internationally, there is a growing body of evidence which shows that newly graduated teachers do not feel prepared to teach the increasingly diverse student body in contemporary classrooms. However, to date, we have limited understanding of the ways in which teacher educators work with preservice teachers to enhance their knowledge about diversity and how to address the diverse needs of students in their classrooms. To further understand teacher educators' pedagogical decision making in the context of preparing preservice teachers for diverse classrooms, a way of capturing epistemic thinking in this space is required. The current study used the Epistemic Reflexivity Survey for Teacher Educators (ERS-TE) to explore the relationships between teacher educators' Epistemic Aims, Reliable epistemic processes (REPs), Criteria for Knowledge (Epistemic Ideals), Reflexivity (decision making) and Teaching Practices. Two hundred and eighty-six teacher educators across Australia and New Zealand completed the survey. Results indicated that epistemic aims related to understanding critical connections predicted engagement with reliable epistemic thinking processes, reflexivity, and teaching practices related to critical thinking and social justice. Findings are discussed in terms of implications for teacher educators' work with preservice teachers with respect to teaching about, to and for diversity.

## 1. Introduction

Graduate teachers in Australia and New Zealand feel under-prepared to teach diverse groups of learners and continue to experience challenges with respect to the culture, language, ability, and class of the students in their classrooms [1–3]. Internationally, such as in the UK and USA, calls have been made for university-based teacher educators to address such challenges within teacher education programs [4–6]. Despite these calls, we still lack a full understanding about how teacher educators can support preservice teachers' learning to teach diverse groups of children [7,8]. One way in which we might understand better how to support preservice teachers is by turning our attention to pedagogies used within teacher education programs, and the epistemic cognition (perspectives and processes related to knowledge and knowing) that underpins pedagogical decision making. While a robust body of evidence points to the

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role of epistemic cognition in instructional practices (see for example Buehl and Fives, 2016 [9]), little research attention has been placed on teacher educators' epistemic cognition and pedagogical decision making in the context of preparing preservice teachers for diverse classrooms [10]. Further, there are no existing instruments that measure teacher educators' epistemic thinking in this space. To address this gap, this paper explores the utility and psychometric properties of a new measurement, the Epistemic Reflexivity Survey for Teacher Educators (ERS-TE) which is designed to measure the relationships between epistemic constructs and teacher educator reflexivity for diversity education. In what follows, we first describe the epistemic reflexivity framework for teacher education in the context of diversity education. Next, we overview the research methods and survey design, before presenting the psychometric properties, descriptive statistics and regression analyses that explore the associations between epistemic constructs, reflexivity and teaching practices. We then turn to a discussion of these findings with a focus on the centrality of epistemic aims within the ERS-TE measure.

### 1.1. *Epistemic reflexivity framework in teacher education*

Recently Australian researchers, Loughran and Menter, proposed that "Teaching is not just about the 'doing' of teaching, it is also about the 'why'" [11].(p216) This leads us to question the role of teacher education pedagogies which simply seek to pass on ideas for best practice with respect to teaching diverse groups of children. Loughran and Menter argued that teacher educators should "enact, articulate and display" specialist knowledge, skills and abilities above and beyond relaying "tips and tricks" about classroom practice [11].(p217) This focus on the 'why' of teaching is what Loughran and Menter refer to as second order teaching, which requires interrogating pedagogies in the context of professional knowledge bases.

In this paper we explore such second order teaching by presenting a new conceptual framework, titled *Epistemic Reflexivity- Teacher Education for Diversity (ER-TED)*. [12] This epistemic reflexivity framework identifies teacher educators' epistemic cognitions in pedagogical decision making with respect to teaching *about*, *to*, and *for* diversity in teacher education. Teaching *about* diversity refers to teacher educators imparting facts and knowledge about diverse learners; teaching *to* diversity encompasses the skills and adjustments needed to include these learners; and finally teaching *for* diversity focuses on social justice aspects of diversity (for an in-depth analysis see Rowan et al. [13]). We argue that an exploration of teacher educators' epistemic reflexivity will enable greater understanding of the complexity of working with pre-service teachers to support teaching *about*, *to* and for *diversity*. This new understanding will contribute to new ways of promoting effective critical pedagogies in teacher education that support diversity, and ultimately, address the long-standing inequities present in marginalised groups of students continuing to under-perform across educational


**Fig. 1.** Epistemic reflexivity–teacher education about/to/for diversity (ER-TED) framework [23].

outcomes.

Over the last five decades, a substantial body of research has explored the epistemic cognitions we hold about the nature of knowledge and processes of knowing and how these impact on teaching and learning (for a review see Hofer, 2016 [14]). However, little is known about how epistemic cognition relates to teacher educators' reflexivities for teaching about/to/for diversity. Following Archer [15], we take reflexivity to involve decision making in which individuals and groups engage in the recursive processes of discernment (identifying what is important and worth pursuing), deliberation (weighing up competing personal, cultural, and structural influences) and dedication (taking action) with respect to epistemic cognition (for application to teacher education see Ryan et al., 2019 [16]). We have previously theorised that bringing together epistemic cognition and reflexivity provides a transdisciplinary way in which to understand how teachers (and we now argue–teacher educators) understand, engage in, and enact pedagogical decisions which are epistemically informed [10,17]. This focus on epistemic reflexivity relates to the why of teaching, reflects second order teaching [11] and is distinct from the exclusively sociological perspective derived from the work of Bourdieu [18]. The *Epistemic Reflexivity- Teacher Education for Diversity* (ER-TED) framework, depicted in Fig. 1, provides a transdisciplinary conceptual framework for understanding and measuring teacher educators' epistemic reflexivity for teaching about/to/for diversity. Each of the phases of the epistemic reflexivity framework are now explained with reference to teaching diversity in teacher education programs.

### *1.1.1. Discernment*

The first phase of epistemic reflexivity is described as discernment (see top circle in Fig. 1). This first phase highlights the need for teacher educators to identify an approach to helping preservice teachers to teach about/to/for diversity using an epistemic cognition lens. We use the *AIR* framework of epistemic cognition [19,20] to inform our epistemic lens (for a detailed review see Lunn Brownlee et al., 2017; 2022 [12,17]). The AIR framework includes epistemic *A*ims, *I*deals and *R*eliable processes and provides a way in which we can view epistemic reflexivity as situated, practical and social in nature [21]. Teacher educators' reflexive processes become epistemic in nature when they identify the epistemic lens for their decision making about teaching practices with respect to teaching about/-to/for diversity.

Epistemic *Aims* are the goals that teacher educators discern and may include epistemic aims such as gaining "knowledge, deep understanding, explanation, justification, true belief, the avoidance of false belief, useful scientific models, and wisdom" [20] (p428). In our framework, these epistemic aims relate to the goals that teacher educators identify for the preservice teachers they are supporting. For example, an epistemic aim related to gaining knowledge might involve teacher educators identifying that preservice teachers need to learn specific, accurate content about effective teaching strategies to support diverse groups of children in their classrooms (reflects teaching *about* diversity [13]). On the other hand, teacher educators who discern epistemic aims related to explanation or justification would intend that preservice teachers critically analyse and evaluate competing perspectives and theories to challenge the status quo with respect to, for example, social justice (teaching *for* diversity [13]; see also Lunn Brownlee et al., 2022 [12]).

The next part of the AIR framework relates to epistemic *I*deals, which are the criteria for establishing what constitutes good knowledge or effective explanations [21]. For example, if the epistemic aim of gaining knowledge about effective teaching strategies is identified, then the criteria for evaluating what constitutes good knowledge might include having accurate information (rather than being based on personal experiences for example). On the other hand, if the epistemic aim relates to justification, then the criteria for effective explanations might include evaluating diverse research and theories to ensure informed perspectives on teaching.

The final part of the AIR framework includes *R*eliable epistemic processes (REPs). These are the processes used to achieve epistemic aims [21]. For example, a teacher educator might discern that to achieve an epistemic aim related to justification, preservice teachers should engage in argumentation processes during tutorial discussions with others. Argumentation processes in which positions are explored, tested, and adjudicated upon to reach consensus can be a reliable epistemic process for achieving the aim of justified knowledge. However, argumentation processes could prove to be unreliable in achieving this aim if, for example, preservice teachers feel uneasy about presenting their opinions, individuals dominate the conversations in tutorials, or teacher educators present themselves as the mediators of all knowledge (cf. Chinn et al., 2014 [20]).

Taken together, epistemic *A*ims, *I*deals and *R*eliable processes can be discerned by teacher educators as part of identifying their key concerns about supporting preservice teachers to learn about teaching diverse groups of children. We argue that identifying epistemic aims, ideals and reliable processes help teacher educators to consider the "why" of teaching, thus enabling a pedagogy of teacher education which focuses on second order teaching [11].

### *1.1.2. Deliberation*

Having discerned or identified key concerns using an epistemic lens, the next phase for teacher educators' pedagogical decision making requires deliberation (see Fig. 1, bottom circle). Such deliberation involves consideration of how the epistemic *A*ims, *I*deals and *R*eliable processes for teaching about/to/for diversity can be calibrated with their teaching practices to support preservice teachers' learning to teach diverse groups of children [15,17]. Returning to the epistemic aim of justification, during deliberations, teacher educators would calibrate their teaching practices with the identified epistemic aims and reliable processes so that, for example, preservice teachers are supported through various critical dialogues and tutorial debates (argumentation) to question different perspectives they experience both in their tutorial interactions and in their readings. During deliberations and calibration, the evaluation of cultural emergent properties (CEPs) (e.g., institutional values, ideologies), structural emergent properties (SEPs) (e.g., course demands, adhering to requirements of addressing teacher professional standards) and personal emergent properties (PEPs) or individual characteristics (e.g., self-efficacy for teaching about/to/for diversity) within the context are considered [15]. For example, what if the process of argumentation is stalled because preservice teachers have not engaged in the required readings? (this reflects a

structural emergent property). How can the teacher educator adapt to these new conditions during their deliberations? Does the epistemic aim need to be adjusted to accommodate this lack of foundational knowledge? Deliberations are therefore an exercise in being adaptable and cognisant of a range of constraints and enablements as they emerge in the teaching context. This adaptability in some ways reflects Barzilai and Chinn's "adaptivity in epistemic thinking" [22] (p356).

#### *1.1.3. Dedication*

In the final phase of the ER-TED framework (See Fig. 1 circle on the left) the deliberations identified in the previous phase are put into action – this is known as dedication [15]. The decisions teacher educators make with respect to supporting preservice teachers to teach diverse groups of children are enacted in lectures, tutorials, or online teaching contexts. These actions are evaluated with implications for re-considering their deliberations.

The ER-TED framework enables us to explore how teacher educators can discern, deliberate on, and then dedicate to teaching about/to/for diversity. This framework is innovative because it uses an epistemic cognition lens to help construct a second order pedagogy of teacher education, in which the "why" of teaching is foregrounded based on core views about the nature of knowledge and knowing. The epistemic reflexivity framework epistemically links 1) how we understand diversity, 2) preservice teachers' learning about teaching about/to/for diversity, and 3) teaching practices used by teacher educators in teacher education programs.

In drawing on the AIR framework, we were able to explore teacher educators' "actual epistemic actions (e.g., how people reason about topics)" [21] (p472) with respect to their pedagogical decision making (reflexivity) around teaching about/to/for diversity. This extends the field of epistemic cognition research which has often focused on epistemic beliefs rather than everyday practices. Sinatra also identified how research in epistemic cognition is "now moving towards considering a broader range of epistemic practices" [24] (p479). She also argued that it is important that we find ways to identify and measure "the processes of epistemic cognition in action in more nuanced ways than dichotomised beliefs dimensions" [24].(p482) Sinatra calls for the investigation of "the *process* of epistemic cognition in action as one thinks and reasons about knowledge within and across specific contexts and disciplines" [24].(p486) Our focus on epistemic reflexivity enables us to nuance epistemic cognition by exploring Epistemic *A*ims, *I*deals and *R*eliable processes in the specific context of teaching actions related to supporting preservice teachers to teach diverse groups of children.

While there has been work documented on attempting to measure reflective thinking (see, for example, Tuttici et al., 2017 [25]), *reflexivity* in teaching practice has often been explored using narrative and discourse analysis of largely small participant samples. Further, reflexivity, focused on epistemic cognition, has not previously been measured. The opportunity to measure and validate specific items of epistemic reflexivity for teacher educators can provide the basis for a rigorous pedagogy of teacher education. To meaningfully inform pedagogy, data from large sample sizes are required across teacher educator cohorts. In this paper we present a new survey measure of epistemic reflexivity which captures teacher educators' pedagogical decision making in relation to teaching diverse learners. This new survey applies the theoretical framework described above to measure the epistemic constructs of *A*ims, *I*deals and *R*eliable processes and explores the influence of these constructs on reflexive pedagogical decision making. The purpose of this study was twofold; 1) to explore the utility and psychometric properties of a new measurement instrument, the Epistemic Reflexivity Survey for Teacher Educators (ERS-TE); and 2) to explore relationships between epistemic constructs and teacher educator reflexivity in relation to preparing pre-service teachers for teaching about/to/for diversity.

## 2. Methodology and methods

### *2.1. Participants and procedure*

Two hundred and eighty-six teacher educators completed the online survey, Epistemic Reflexivity Survey for Teacher Educators (ERS-TE). Participants were from Australian and New Zealand Universities, mostly female (80.4%) and the median age group was 51–60 years (32.1%). Almost half had 10 years or more tertiary teaching experience (46.1%). Anonymous survey data were analyzed using SPSS 25 [26].

Teacher educators were recruited through email invitation between April and July 2019. Email invitations promoting the survey were sent to the Deans of Education at Australian Universities offering pre-service teacher education programs for distribution to academic staff. In addition, invitations were sent out through the researchers' professional networks, for example the Australian Teacher Education Association (ATEA). Snowball sampling was also used in the recruitment strategy. Participants from New Zealand were also included in the survey as teacher educators from New Zealand often attend Australian events such as the annual ATEA conference and New Zealand pre-service teacher education programs are similar to those in Australia. Ethical approval was granted for this research through the Queensland University of Technology Human Research Ethics Committee. All participants provided written informed consent to participate in the survey.

### *2.2. Measure*

The 92 item Epistemic Reflexivity Survey for Teacher Educators (ERS-TE) consists of three epistemic scales: *Epistemic Aims*, *Epistemic Ideals* (criteria for knowledge) and *Reliable Epistemic Processes (REPs)*; a *Reflexivity* scale where participants were asked about their decision-making (deliberations) as teacher educators in the context of teaching to/about/for diversity with preservice teachers; and a scale about *Teaching Practices* where participants were asked about their teaching practices in their tutorials or lectures with preservice teachers. The ERS-TE was developed based on literature with respect to epistemic cognition and reflexivity, social lab data from a previous phase of the research [16] and items adapted from Ponnock [27] (epistemic belief items) and Carmeli et al. [28]

(reflexivity items). All items are rated on a 7-point Likert type scale from strongly disagree (1) to strongly agree (7). An exploratory factor analysis was conducted to identify the relevant dimensions of the ERS-TE with this sample of teacher educators.

## 3. Results

The results of the study are presented in three sections. The first two sections relate to the first aim of this study; to explore the utility and psychometric properties of the ERS-TE. In the first section, factor analyses of the ERS-TE subscales are reported. In the second section, descriptive statistics for each of the subscales of the ERS-TE including correlational analyses of the relationships between subscales are presented. Due to the volume of data, only a summary of the most highly correlated items (Pearson *r* coefficient above 0.4) is presented. This analysis gave a reference point to address the second aim of this study: to explore relationships between epistemic constructs and teacher educator reflexivity in relation to preparing pre-service teachers for teaching about/to/for diversity. These relationships are explored through regression analyses and presented in the third section. The series of ORS regression analyses were used to explore the extent to which *Epistemic Aims* can predict *Reliable Epistemic Processes (REPs)*, *Epistemic Ideals*, *Reflexivity* (decision making) and *Teaching Practices*, and the extent to which *Epistemic Ideals* predict *Reflexivity* and *(REPs)*. These relationships were chosen for further investigation as the correlational data suggested a strong relationship, and for their alignment with our theoretical framework.

### 3.1. Section 1. psychometric properties of the ERS-TE

The subscale structures of the ERS-TE were explored through a principal-components factor analysis (PCA) with orthogonal (VARIMAX) rotation. The Kaiser-Meyer-Olkin (KMO) test indicated sampling adequacy for all questions, with KMO values above the acceptable limit of 0.5, while Bartlett's test of sphericity (significance $<0.05$) verified that the correlations between items were large enough to conduct the PCA. In each analysis, an initial estimate of the possible number of factors was established from the size of the eigenvalues, a final judgement on the number of meaningful factors was then determined by examination of the scree plot for each analysis. Given the sample size, a cut-off for factor loadings was set at 0.40 [29].

#### 3.1.1. Epistemic aims

A two-factor solution afforded the simplest, interpretable structure for *Epistemic Aims* and explained 65% of the variance. Factor One (7 items, $\alpha = 0.89$) related to aims about *Knowledge* while Factor Two related to aims about making *Critical Connections* (6 items, $\alpha = 0.90$). Example items for each of the subscales are "Know that diversity in children takes many different forms" (*Knowledge*) and "Connect understandings about diversity to topics taught in other units in their teacher education program" (*Critical Connections*). The factor loadings for each item, item communalities and percentage of variance accounted for by each factor are presented in Table 1.

#### 3.1.2. Epistemic ideals–criteria for knowledge

A two-factor solution afforded the simplest, interpretable structure for *Epistemic Ideals* and explained 62% of the variance. Factor One related to the *Value of Evidence* (6 items, $\alpha = 0.85$) while Factor Two related to *Personal Perspectives* (3 items, $\alpha = 0.66$). Example items for *Epistemic Ideals* are "Evidence to support their claims or conclusions" (*Value of Evidence*) and "Alignment with preservice teachers' personal experiences" (*Personal Perspectives*). The factor loadings for each item, item communalities and percentage of variance accounted for by each factor are presented in Table 2.

**Table 1**
Principal components factor analysis with Varimax rotation for epistemic aims.

| | F1 | F2 | $h^2$ |
|---|---|---|---|
| **Factor 1: Knowledge (alpha =.891)** | | | |
| acquire accurate knowledge about misconceptions and stigmas related to groups of diverse children | **.633** | .511 | .662 |
| know that all learners differ in some way | **.792** | .215 | .674 |
| know that diversity in children takes many different forms | **.770** | .372 | .731 |
| understand how their own beliefs about diversity shape their teaching practice | **.617** | .549 | .682 |
| acquire accurate information about diversity | **.585** | .412 | .511 |
| know about a range of teaching activities to be used with diverse learners in the classroom | **.728** | .169 | .558 |
| understand the way emotions impact upon children's ability to learn | **.628** | .328 | .503 |
| **Factor 2: Critical connections (alpha = .898)** | | | |
| seek and evaluate different ideas through research | .141 | **.783** | .633 |
| develop deep understandings about teaching for diversity | .474 | **.587** | .570 |
| connect understandings about diversity to topics taught in other units in their teacher education program | .337 | **.769** | .705 |
| explain and justify perspectives about teaching to/about diversity | .362 | **.804** | .777 |
| understand how their own lives have been shaped by other people's attitudes towards difference | .343 | **.776** | .720 |
| understand the way emotions/personal experience can impact upon preservice teachers' willingness to engage with complex conversations about diversity | .417 | **.695** | .657 |
| **Percent of Variance** | **33.3%** | **31.1%** | |

KMO = 0.919; Bartlett's test of sphericity $\chi^2$ (78) = 2077.7, $p < .001$.

#### 3.1.3. Reliable epistemic processes (REPs)

A three-factor solution for the *REPs* scale provided an interpretable structure and explained 63% of the variance. Factors related to *Personal Reflection* (5 items, α = 0.87), *Teaching Judgement* (7 items, α = 0.85) and *Critical Reflection for Social Justice* (3 items, α = 0.78). Example items for *REPs* are: "Reflect on their personal experiences with diversity" (*Personal Reflection*); "Weigh up evidence (for accuracy, coherence, & suitability) before making teaching decisions" (*Teaching Judgement*); and "Critically reflect on their own teaching for social justice" (*Critical Reflection for Social Justice*). The factor loadings for each item, item communalities and percentage of variance accounted for by each factor are presented in Table 3.

### 3.2. Reflexivity

Three factors emerged from the *Reflexivity* scale data, explaining 59% of the variance. These factors included: *Reflection* on teaching strategies (7 items, α = 0.83); *Weighing Up* teaching beliefs, experiences, and strategies (5 items, α = 0.75); and *Evidence Informed Evaluation* of teaching strategies (4 items, α = 0.81). Example items for *Reflexivity* are: "I reflect on the different ways I teach preservice teachers about diversity and how these will generate deep understandings about diverse groups of children" (*Reflection*); "I reflect on my prior experiences with teaching to/about diversity and how this influences my selection of aims and how to achieve these" (*Weighing Up*); and "I look for evidence of whether my teaching practices are effective for developing deep and critical thinking in preservice teachers" (*Evidence Informed Evaluation*). The factor loadings for each item, item communalities and percentage of variance accounted for by each factor are presented in Table 4.

#### 3.2.1. Teaching practices

Three factors were interpretable from the *Teaching Practices* data explaining 52% of the variance. Factors were related to *Teaching Approaches* (9 items, α = 0.86), *Critical Pedagogy* (8 items, α = 0.83) and *Content* provided for acquiring knowledge (3 items, α = 0.52). Example items for *Teaching Practices* are: "Require preservice teachers to engage in debate about various explanations of how to teach groups of diverse children" (*Teaching Approaches*); "Use statistical data and research to demonstrate longstanding patterns of success and failure within schools that can be tied to differences such as gender, socio-economics, geographical location" (*Critical Pedagogy);* and "Select content with a focus on breadth (rather than depth) of understanding about teaching to/about diversity" (*Content*). With only three items and a relatively low alpha, the factor *Content* should be interpreted with caution. The factor loadings for each item, item communalities and percentage of variance accounted for by each factor are presented in Table 5.

### 3.3. Section 2. descriptive statistics

Means and standard deviations for each of the subscales are presented in Table 6 and correlations between the subscales are presented in Table 7. While nearly all participants indicated that both factors for *Epistemic Aims*, all factors for *REPs*, the *Epistemic Ideal* factor of *Evaluation of Evidence*, and all factors for *Reflexivity* were "important" or "very important", there was still variation in responses (see Table 6). Correlational analyses revealed moderate relationships between all factors in the subscales of *Epistemic Aims*, *REPs*, *Epistemic Ideals*, *Reflexivity* and *Teaching Practices* although this relationship was weaker or non-significant for some factors (see Table 7).

### 3.4. Section 3. regression analyses

*Epistemic Aims* and *Epistemic Ideals* (criteria for knowledge) were examined further as independent variables influencing the other constructs measured. This strategy was determined by looking at the correlational analysis of relationships between variables, but also the ER-TED model as the theoretical framework underpinning this research [10,12]. As the first "D" of the framework relates to how teacher educators Discern *Epistemic Aims*, *Epistemic Ideals* and *REPs* for preservice teachers, we wanted to examine if these variables were predictive of the following "D″s, namely Deliberate (*Reflexivity*) then Dedicate (*Teaching Practices*). However, the relationship

**Table 2**
Principal components factor analysis with Varimax rotation for epistemic ideals.

| | F1 | F2 | $h^2$ |
|---|---|---|---|
| **Factor 1: Value of Evidence (alpha = .853)** | | | |
| accurate information about different groups of diverse children | **.681** | .198 | .435 |
| evidence to support their claims or conclusions | **.860** | .043 | .690 |
| logically valid claims (where evidence and assumptions are logically related) | **.875** | .018 | .735 |
| clear connection between ideas (where ideas are internally consistent) | **.869** | .154 | .747 |
| coherence with other accepted explanations and theories | **.564** | .535 | .577 |
| clear connections with a broad range of evidence | **.538** | .386 | .380 |
| **Factor 2: Personal Perspectives (alpha = .657)** | | | |
| alignment with preservice teachers' personal experiences | .126 | **.805** | .653 |
| value for future research | .214 | **.791** | .664 |
| no contradictions or "challenges" to other evidence | −.004 | **.652** | .400 |
| **Percent of Variance** | **34%** | **25%** | |

KMO = 0.822; Bartlett's test of sphericity ($\chi^2$ (36) = 816.6 p < .001).

**Table 3**
Principal components factor analysis with Varimax rotation for reliable epistemic processes.

| | F1 | F2 | F3 | $h^2$ |
|---|---|---|---|---|
| **Factor 1: Personal Reflection (alpha = .867)** | | | | |
| identify and evaluate own assumptions about teaching/about diversity beliefs explicitly (identify and make explicit) | **.690** | .014 | .438 | .669 |
| think about, understand & communicate their own & other's emotions | **.656** | .426 | .065 | .616 |
| reflect on their personal experiences with diversity | **.762** | .273 | .286 | .738 |
| think about how their own knowledge determines teaching approaches | **.685** | .160 | .268 | .567 |
| explicitly reflect on personal beliefs about teaching to/about diversity | **.885** | .054 | .157 | .811 |
| **Factor 2: Teaching Judgement (alpha = .852)** | | | | |
| evaluate claims made about how to effectively teach particular students/groups | .338 | **.484** | .275 | .424 |
| weigh up evidence (for accuracy, coherence, & suitability) before making teaching decisions | .089 | **.614** | .396 | .542 |
| reflect on the process of professional decision making about diversity in the classroom | .452 | **.518** | .408 | .638 |
| argue about the potential consequences of adopting different teaching strategies | .132 | **.597** | .576 | .706 |
| acknowledge different perspectives about the significance of diversity | .337 | **.601** | .278 | .552 |
| identify accurate knowledge about a range of suitable teaching strategies | .044 | **.794** | .114 | .646 |
| identify accurate knowledge about the characteristics of different groups of diverse learners | .079 | **.767** | −.175 | .626 |
| **Factor 3: Critical Reflection for Social Justice (alpha = .781)** | | | | |
| critically reflect on their own teaching for social justice | .522 | .026 | **.614** | .651 |
| identify and analyse deficit thinking | .273 | .123 | **.768** | .679 |
| challenge ideas presented within their teacher education degree | .291 | .202 | **.724** | .649 |
| **Percent of Variance** | **24%** | **21%** | **18%** | |

KMO = 0.896; Bartlett's test of sphericity ($\chi^2$ (105) = 1634.7 p < .001).

**Table 4**
Principal components factor analysis with Varimax rotation for reflexivity.

| | F1 | F2 | F3 | $h^2$ |
|---|---|---|---|---|
| **Factor 1: Reflection (alpha = .892)** | | | | |
| I reflect on what I understand diversity to mean as I make decisions about supporting preservice teachers to teach diverse groups of children | **.691** | .317 | .132 | .595 |
| I engage in deep level conversations with colleagues regarding my desired aims in teaching preservice teachers about diversity | **.783** | −.028 | .250 | .676 |
| I reflect on the different ways I teach preservice teachers about diverse groups of children | **.729** | .281 | .160 | .635 |
| I ask myself questions as to why I have adopted certain ways to teach preservice teachers about diversity and whether there are better alternatives | **.619** | .208 | .462 | .640 |
| I reflect on my prior experiences with teaching to/about diversity and how this influences my selection of aims and how to achieve these | **.592** | .499 | .158 | .624 |
| I consider enablements and constraints in my University context as I make decisions about how to deepen preservice teachers' understandings of teaching to/about diversity | **.587** | .091 | .217 | .400 |
| I consult my peers to determine the accuracy of the content I am teaching about diversity | **.624** | .258 | .056 | .459 |
| **Factor 2: Weighing Up (alpha = .752)** | | | | |
| I step back from approaches I use regularly to consider whether the teaching practices I use are the best available to meet my aims for preservice teachers' knowledge and knowing | .356 | **.530** | .316 | .507 |
| I change my teaching practices based on an analysis of preservice teachers evidenced knowledge and capabilities | .193 | **.747** | .175 | .626 |
| In deciding what and how to teach I consider aims, processes for achieving aims, and contexts (personal and situational) | .232 | **.547** | .288 | .436 |
| In a teaching situation I am able to change my aims and associated thinking processes as I learn more about my students | −.038 | **.749** | .118 | .576 |
| I use my beliefs about what it means to teach to/about diversity to reflect on my own teaching decisions | .401 | **.561** | .048 | .478 |
| **Factor 3: Evidence Informed Evaluation (alpha = .812)** | | | | |
| I consult research to evaluate and justify my instructional decisions as I am teaching to/about diversity | .547 | −.078 | **.615** | .684 |
| I look for evidence of whether my teaching practices are effective for developing deep and critical thinking in preservice teachers | .220 | .317 | **.743** | .701 |
| I look for multiple forms of evidence about whether my teaching practices are effective for challenging preservice teachers' ideas & concepts about diversity | .223 | .366 | **.697** | .669 |
| I consult research to determine the accuracy of theories I am going to teach | .107 | .148 | **.824** | .712 |
| **Percent of Variance** | **24%** | **18%** | **17%** | |

KMO = 0.881; Bartlett's test of sphericity, ($\chi^2$ (120) = 1489.3, p < .001).

proposed in the ER-TED framework is not linear, hence we examined the correlational analyses and further exploration of which variables were likely to predict others (for example, *REPs* influencing *Epistemic Aims* or *Epistemic Ideals*). Demographic variables included in all models were *Gender*, *Age*, *Number of years teaching*, *Highest Educational Qualification* and *Teaching Background* (i.e., Early Childhood, Primary, Secondary).

Multiple regression analyses were conducted on each set of variables of interest, with demographics added into the models to determine their contribution to the variance. All variables were entered into the model simultaneously. The first series of models included *Epistemic Aims* as predictor variables and *REPs*, teacher educator *Reflexivity* and *Teaching Practices* as outcome variables (see Table 8 and Figs. 2–4). The second series of models included *Epistemic Ideals* (criteria for knowledge) as predictor variables and teacher educator *Reflexivity* and *REPs* as outcome variables (see Table 9 and Figs. 5 and 6).

**Table 5**
Principal components factor analysis with Varimax rotation for teaching practices.

| | F1 | F2 | F3 | $h^2$ |
|---|---|---|---|---|
| **Factor 1: Teaching Approaches (alpha = .863)** | | | | |
| Encourage informal sharing stories from Professional Experience placements to identify different ways that teachers do (or do not) recognize and respond to the diversity of learners | **.662** | .121 | .175 | .483 |
| Allocate time in class for preservice teachers to talk with each other so they are able to discuss the course content more openly | **.709** | .183 | .011 | .536 |
| Require preservice teachers to engage in debate about various explanations of how to teach groups of diverse children | **.548** | .485 | .038 | .537 |
| Construct activities that require preservice teachers to solve problems related to teaching groups of diverse children | **.626** | .446 | .141 | .611 |
| Model the use of theory and theoretical vocabulary when discussing teaching to/about diversity | **.441** | .359 | .096 | .333 |
| Use seminar activities that focus on analysis of connections between the university subject and professional experiences | **.555** | .438 | .124 | .515 |
| Create assessment opportunities to promote reflexivity about teaching groups of children | **.561** | .453 | .180 | .553 |
| Choose pedagogies that motivate and inspire preservice teachers to know and to care about the way meanings attached to diversity impact on their students | **.599** | .340 | .292 | .560 |
| Create an environment where preservice teachers feel safe to contribute to conversation | **.759** | −.044 | −.001 | .578 |
| **Factor 2: Critical Pedagogy (alpha = .832)** | | | | |
| Encourage the use of personal journals to reflect on their own experiences of teaching groups of diverse learners | .154 | **.493** | .006 | .267 |
| Use simulated experiences of working with diverse groups of learners | .308 | **.480** | .147 | .347 |
| Use seminar discussions to identify what happens when preservice teachers do not respond appropriately to learner diversity | .383 | **.627** | .144 | .561 |
| Provide multiple opportunities through discussion for preservice teachers to reflect upon their own lives, and connections to concepts being covered (e.g., gender or class) | .494 | **.525** | .242 | .578 |
| Allocate time to discuss the emotional challenges of preservice teachers engaging in discussion about various forms of diversity, and to establish the university learning environment as a 'safe place' | .493 | **.526** | .103 | .530 |
| Use a diverse range of discussion prompts, e.g., case studies, popular culture resources, movies | .344 | **.585** | .347 | .581 |
| Use statistical data and research to demonstrate longstanding patterns of success and failure within schools that can be tied to differences such as gender, socio-economics, geographical location | .110 | **.765** | .037 | .598 |
| Provide support and space for students to get involved in campaigns for action with respect to diversity in the community | .031 | **.789** | .067 | .628 |
| **Factor 3: Content (alpha = .516)** | | | | |
| Use content and learning resources that are not controversial (or emotionally charged) so as not to alienate students | .008 | −.128 | **.709** | .519 |
| Use narrative stories (case studies)– both written and visual/audio visual | .234 | .454 | **.481** | .492 |
| Select content with a focus on breadth (rather than depth) of understanding about teaching to/about diversity | .169 | .190 | **.782** | .677 |
| **Percent of Variance** | **22%** | **22%** | **9%** | |

KMO = 0.901; Bartlett's $\chi^2(190) = 1696.7$, $p < .001$.

**Table 6**
Descriptive statistics for the subscales of the ERS-TE.

| Subscale and factors | M (SD) | Range | α |
|---|---|---|---|
| Epistemic Aims | | | |
| Knowledge (7 items) | 6.57 (.60) | 3–7 | 0.89 |
| Critical Connection (6 items) | 6.36 (.76) | 2.7–7 | 0.90 |
| Reliable Thinking Processes | | | |
| Personal Reflection (5 items) | 6.20 (.75) | 3.2–7 | 0.87 |
| Teaching Judgement (7 items) | 6.18 (.67) | 3.6–7 | 0.85 |
| Critical Reflection for Social Justice (3 items) | 6.27 (.82) | 1.7–7 | 0.78 |
| Epistemic Ideals (Criteria for Knowledge) | | | |
| Evaluation of Evidence (6 items) | 6.15 (.69) | 3–7 | 0.85 |
| Personal Perspectives (3 items) | 4.47 (1.3) | 1–7 | 0.66 |
| Reflexivity (decision making) | | | |
| Reflection (7 items) | 5.52 (.88) | 2.7–7 | 0.83 |
| Weighing Up (5 items) | 5.75 (.74) | 3.4–7 | 0.75 |
| Evidence Informed Evaluation (4 items) | 5.79 (.93) | 2.5–7 | 0.81 |
| Teaching Practices | | | |
| Teaching Approaches (9 items) | 5.65 (.94) | 1–7 | 0.86 |
| Critical Pedagogy (8 items) | 4.69 (1.1) | 1.1–7 | 0.83 |
| Content (3 items) | 4.67 (1.1) | 1–7 | 0.52 |

### *3.4.1. Epistemic aims and REPs*

Results for the model including *Epistemic Aims* as an independent variable and the *REP* factor of *Personal Reflection* as a dependent variable explained 42.3% of the variance in *Personal Reflection*. The *Epistemic Aims* factors of *Knowledge* ($B = 0.274$, $p = .025$) and *Critical Connections* ($B = 0.533$, $p < .001$) and *Number of years teaching* ($B = -0.070$, $p = .038$) were significant predictors. For the *REP* factor of *Teaching Judgment*, the *Epistemic Aims* factors of *Knowledge* ($B = .440$, $p < .001$) and *Critical Connections* ($B = 0.384$, $p < .001$) were the only significant predictors explaining 39.8% of the variance. For the final *REP* factor of *Critical Reflection for Social Justice*, the only significant predictor was the *Epistemic Aim* factor of *Critical Connections* ($B = .536$, $p < .001$) explaining 29.1% of the variance.

### *3.4.2. Epistemic aims and teacher educator reflexivity*

Results for the model including *Epistemic Aims* as an independent variable and *Reflexivity* as a dependent variable explained 31.1%

**Table 7**
Correlations between the subscales for each of the factors.

| | Aims | Aims | Processes | Processes | Processes | Ideals | Ideals | Practices | Practices | Practices | Reflexivity | Reflexivity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Know-ledge | Critical Connections | Personal Reflection | Teaching Judgement | Social Justice | Eval-uation | Personal | Teaching Approach | Critical Pedagogy | Content | Reflection | Weighing Up |
| **Aims:** | | – | | | | | | | | | | |
| Knowledge | – | | | | | | | | | | | |
| Critical Connections | 0.78** | | | | | | | | | | | |
| **Processes** | | | | | – | | | | | | | |
| Personal Reflection | 0.58** | 0.63** | – | – | | | | | | | | |
| Teaching Judgement | 0.58** | 0.60** | 0.57** | 0.57** | | | | | | | | |
| Social Justice | 0.45** | 0.54** | 0.66** | | | | | | | | | |
| **Ideals** | | | | | | | – | | | | | |
| Evaluation of Evidence | 0.47** | 0.34** | 0.34** | 0.57** | 0.33** | – | | | | | | |
| Personal Perspectives | 0.17* | 0.10 ns | 0.20** | 0.26** | 0.10 ns | 0.38** | | | | | | |
| **Teaching Practices** | | | | | | | | | | – | | |
| Teaching Approaches | 0.51** | 0.53** | 0.36** | 0.36** | 0.34** | 0.25** | 0.14* | – | – | | | |
| Critical Pedagogy | 0.36** | 0.46** | 0.40** | 0.26** | 0.32** | 0.16* | 0.26** | 0.77** | 0.42** | | | |
| Content | 0.24** | 0.23** | 0.12 ns | 0.20** | 0.13 ns | 0.23** | 0.20** | 0.44** | | | | |
| **Reflexivity** | | | | | | | | | | | | |
| Reflection | 0.48** | 0.51** | 0.44** | 0.33** | 0.38** | 0.24** | 0.11 ns | 0.54** | 0.58** | 0.37** | – | – |
| Weighing Up | 0.44** | 0.47** | 0.42** | 0.40** | 0.34** | 0.34** | 0.16* | 0.48** | 0.46** | 0.30** | 0.71** | 0.59** |
| Evidence Informed | 0.39** | 0.47** | 0.31** | 0.44** | 0.46** | 0.34** | 0.08 ns | 0.50** | 0.45** | 0.18** | 0.63** | |

Note: ** Correlation is significant at the 0.01 level; * Correlation is significant at the 0.05 level.

**Table 8**
Epistemic aims and REPs, reflexivity and teaching practices.

| | *B* | 95% CI | β | *p* |
|---|---|---|---|---|
| **Reliable Processes Personal Reflection ADJ $R^2$ = .423** | | | | |
| *Epistemic Aims* | | | | |
| Knowledge | .274 | .035, .513 | .190 | .025* |
| Critical connections | .533 | .351, .715 | .492 | .000** |
| *Demographics* | | | | |
| Gender | −.016 | −.242, .211 | −.008 | .891 |
| Age | .018 | −.028, 0.64 | .047 | .446 |
| Years teaching | −.070 | −.136, −.004 | −.132 | .038* |
| Highest Ed Qual | −.018 | −.117, −.082 | −.020 | .728 |
| Teaching Background | −.022 | −.114, .070 | −.025 | .643 |
| **Reliable Processes Teaching Judgement ADJ $R^2$ = .398** | | | | |
| Epistemic Aims | | | | |
| Knowledge | .440 | .218, .662 | .326 | .000** |
| Critical connections | .384 | .216, .553 | .383 | .000** |
| Demographics | | | | |
| Gender | −.146 | −.353, .060 | −.082 | .163 |
| Age | .007 | −.035, .049 | .020 | .760 |
| Years teaching | .003 | −.058, .064 | .007 | .911 |
| Highest Ed Qual | −.004 | −.097, .089 | −.005 | .933 |
| Teaching Background | −.014 | −.099, .070 | −.019 | .736 |
| **Reliable Processes Social Justice ADJ $R^2$ = .291** | | | | |
| Epistemic Aims | | | | |
| Knowledge | .062 | −.233, .357 | .039 | .679 |
| Critical connections | .536 | .313, .758 | .453 | .000** |
| Demographics | | | | |
| Gender | .202 | −.073, .477 | .091 | .150 |
| Age | .011 | −.045, .067 | .026 | .701 |
| Years teaching | −.035 | −.115, .046 | −.059 | .396 |
| Highest Ed Qual | −.084 | −.208, .039 | −.084 | .180 |
| Teaching Background | −.104 | −.219, .010 | −.109 | .073 |
| **Reflexivity Reflection ADJ $R^2$ = .311** | | | | |
| Epistemic Aims | | | | |
| Knowledge | .378 | .053, .703 | .222 | .023* |
| Critical connections | .468 | .221, .715 | .370 | .000** |
| Demographics | | | | |
| Gender | .181 | −.129, .490 | .074 | .251 |
| Age | −.004 | −.066, .058 | −.009 | .898 |
| Years teaching | −.026 | −.116, .063 | −.041 | .562 |
| Highest Ed Qual | .091 | −.042, .225 | .087 | .179 |
| Teaching Background | .113 | −.013, .240 | .109 | .079 |
| **Reflexivity Weighing Up ADJ $R^2$ = .271** | | | | |
| Epistemic Aims | | | | |
| Knowledge | .252 | −.025, .529 | .178 | .075 |
| Critical connections | .355 | .147, .564 | .340 | .001** |
| Demographics | | | | |
| Gender | .254 | −.006, .515 | .127 | .056 |
| Age | .049 | −.004, .102 | .130 | .072 |
| Years teaching | −.037 | −.113, .040 | −.069 | .344 |
| Highest Ed Qual | .108 | −.007, .223 | .122 | .066 |
| Teaching Background | .123 | .015, .231 | .142 | .026* |
| **Reflexivity Evidence Informed Evaluation ADJ $R^2$ = .231** | | | | |
| Epistemic Aims | | | | |
| Knowledge | .076 | −.285, .437 | .043 | .678 |
| Critical connections | .562 | .290, .834 | .429 | .000** |
| Demographics | | | | |
| Gender | .153 | −.187, .492 | .060 | .376 |
| Age | .007 | −.062, .076 | .015 | .843 |
| Years teaching | .043 | −.055, .141 | .064 | .388 |
| Highest Ed Qual | −.078 | −.227, .071 | −.070 | .301 |
| Teaching Background | .069 | −.071, .208 | .063 | .335 |
| **Teaching Practices Teaching Approaches ADJ $R^2$ = .336** | | | | |
| Epistemic Aims | | | | |
| Knowledge | .479 | .144, .815 | .269 | .005** |
| Critical connections | .360 | .105, .615 | .271 | .006** |
| Demographics | | | | |
| Gender | .342 | .019, .665 | .134 | .038 |
| Age | −.045 | −.111, .021 | −.094 | .178 |
| Years teaching | .043 | −.053, .139 | .063 | .374 |

(*continued on next page*)

**Table 8** (*continued*)

| | *B* | 95% CI | β | *p* |
|---|---|---|---|---|
| Highest Ed Qual | −.163 | −.307, −.019 | −.143 | .027* |
| Teaching Background | .116 | −.022, .254 | .104 | .098 |
| **Teaching Practices Critical Pedagogies ADJ $R^2$ = .227** | | | | |
| Epistemic Aims | | | | |
| Knowledge | .144 | −.284, .571 | .066 | .508 |
| Critical connections | .653 | .327, .980 | .404 | .000** |
| Demographics | | | | |
| Gender | .111 | −.301, .522 | .036 | .597 |
| Age | −.031 | −.117, .054 | −.055 | .467 |
| Years teaching | .001 | −.119, .121 | .001 | .986 |
| Highest Ed Qual | −.181 | −.367, .005 | −.132 | .057 |
| Teaching Background | .123 | −.052, .299 | .093 | .168 |
| **Teaching Practices Content ADJ $R^2$ = .060** | | | | |
| Epistemic Aims | | | | |
| Knowledge | .417 | −.028, .862 | .209 | .066 |
| Critical connections | .091 | −.245, .426 | .061 | .595 |
| Demographics | | | | |
| Gender | .255 | −.120, .631 | .099 | .181 |
| Age | −.041 | −.126, .044 | −.077 | .343 |
| Years teaching | .045 | −.080, .171 | .059 | .475 |
| Highest Ed Qual | .056 | −.132, .244 | .044 | .558 |
| Teaching Background | .087 | −.087, .260 | .071 | .326 |

*p < .05, **p < .01.

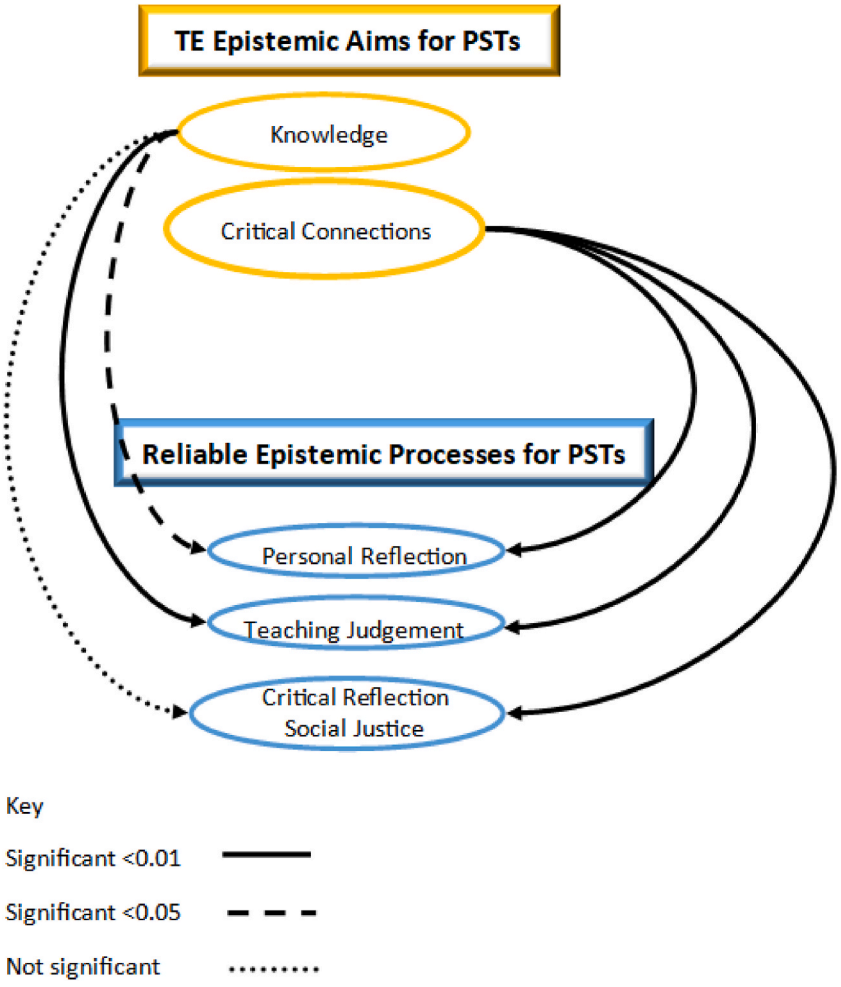


**Fig. 2.** Relationships between epistemic aims and REPs.

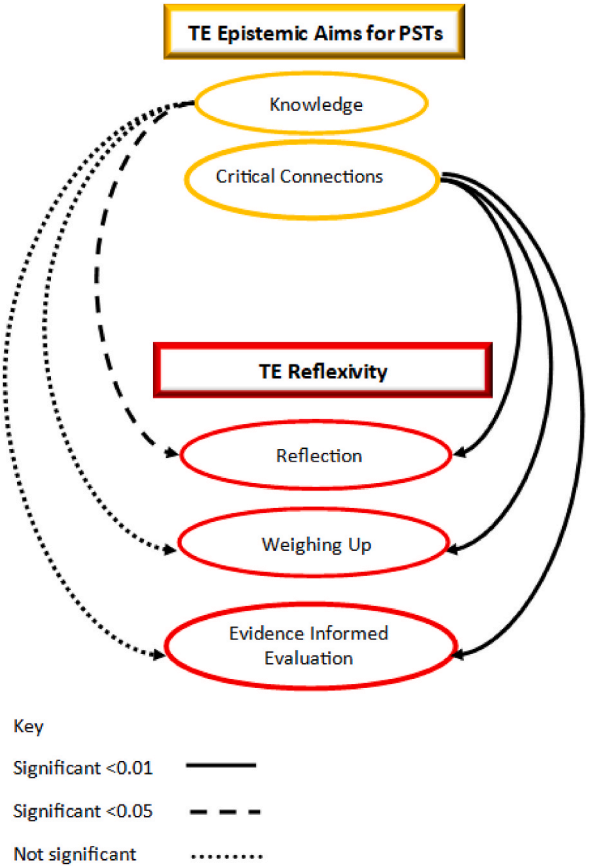


**Fig. 3.** Relationships between epistemic aims and reflexivity.

of the variance with both *Epistemic Aims* factors of *Knowledge* ($B = 0.378$, $p = .023$) and *Critical Connections* ($B = 0.468$, $p < .001$) as significant predictors. For the *Reflexivity* factor *Weighing Up*, the *Epistemic Aim* factor of *Critical Connections* ($B = .355$, $p = .001$) and *Teaching background* ($B = 0.123$, $p = .026$) were significant predictors explaining 27.1% of the variance. Finally, for the *Reflexivity* factor *Evidence Informed Evaluation,* only the *Epistemic Aim* factor of *Critical Connections* ($B = 0.562$, $p < .001$) was a significant predictor explaining 23.1% of the variance.

### 3.4.3. Epistemic aims and teaching practices

Results for the framework including *Epistemic Aims* as an independent variable and the *Teaching Practice* factor of *Teaching Approaches* as the dependent model explained 33.6% of the variance with the *Epistemic Aims* factors of *Knowledge* ($B = 0.479$, $p = .005$), *Critical Connections* ($B = 0.360$, $p = .006$) and *Highest Educational Qualification* ($B = -0.163$, $p = .027$) all significant predictors. For *Teaching Practices,* for the factor of *Critical Pedagogies*, the only significant predictor was the *Epistemic Aim* factor of *Critical Connections* ($B = 0.653$, $p < .001$) explaining 22.7% of the variance. *Epistemic Aims* did not significantly predict the factor of *Content* related *Teaching Practices*.

### 3.4.4. Epistemic ideals (criteria for knowledge) and teacher educator reflexivity

The only significant predictor of *Reflexivity* related to *Reflection*, explaining 8.2% of the variance, was Gender ($B = 0.552$, $p = .002$) with females more likely to endorse Reflexivity related to Reflection than males. Gender was also a significant predictor of the ideal Reflexivity Weighing Up ($B = 0.453$, $p = .002$) along with the epistemic ideal of Evaluation of Evidence ($B = 0.293$, $p = .001$) explaining 15.2% of the variance. Reflexivity Evidence Informed Evaluation was significantly predicted by the epistemic ideal Evaluation of Evidence ($B = 0.376$, $p < .001$), Gender ($B = 0.381$, $p = .032$) and Highest Educational Qualification ($B = -0.193$, $p = .014$) together explaining 13.2% of the variance.

### 3.4.5. Epistemic ideals (criteria for knowledge) and REPs

The *REP* factor of *Personal Reflection* was significantly predicted by the *Epistemic Ideal* factor of *Evaluation of Evidence* ($B = .295$, $p = .001$) and *Number of Years Teaching* ($B = -0.102$, $p = .016$) together explaining 13.7% of the variance. *Teaching Judgement* was also significantly predicted by the *Epistemic Ideal* factor of *Evaluation of Evidence* ($B = 0.509$, $p < .001$) along with *Highest Educational*

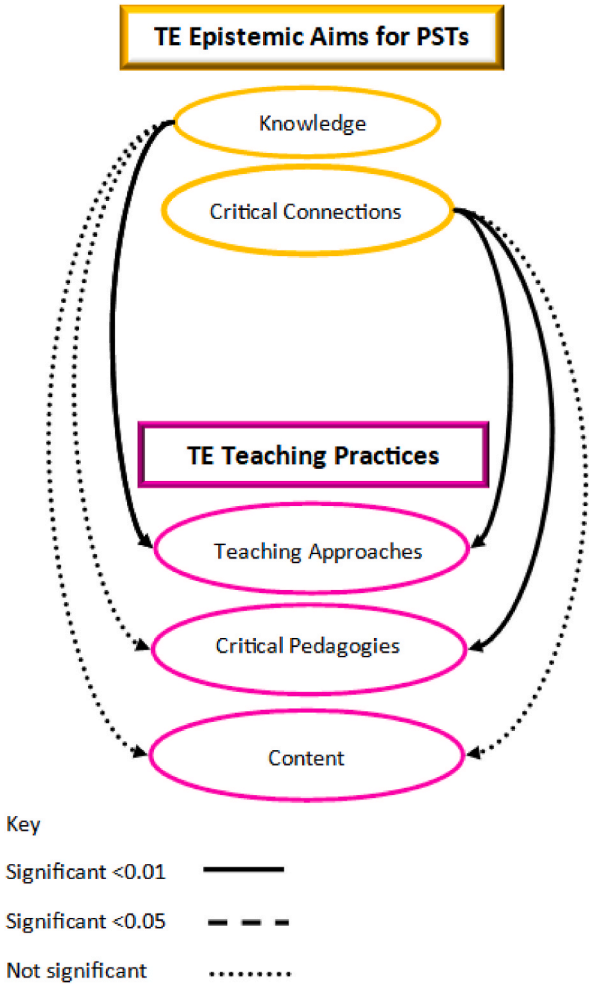


**Fig. 4.** Relationships between epistemic aims and teaching practices.

*Qualification* ($B = -0.106$, $p = .036$) together explaining 32.2% of the variance. Finally, the *REP* factor of *Critical Reflection for Social Justice* was significantly predicted by the *Epistemic Ideal* factor of *Evaluation of Evidence* ($B = .304$, $p < .001$), *Gender* ($B = 0.358$, $p = .013$), *Number of Years Teaching* ($B = -0.105$, $p = .011$) and *Highest Educational Qualification* ($B = -0.192$, $p = .004$) explaining 16.1% of the variance. The *Epistemic Ideal* factor of *Personal Perspectives* was not a significant predictor of *REPs*.

## 4. Discussion

The analyses presented in this paper indicated that the new ERS-TE is a promising measurement instrument to quantitatively investigate teacher educators' epistemic reflexivity for teaching diversity. Measurement of epistemic *A*ims, *I*deals and *R*eliable epistemic processes in this survey focused on teacher educators' discernment in relation to preparing preservice teachers to teach diverse groups of children in their classrooms. The factors that were identified indicated alignment theoretically and practically with the ER-TED framework, which identified constructs of reflexivity [15,16]. The various phases of the ER-TED framework, namely discern, deliberate and dedicate, are now discussed with respect to the constructs in ERS-TE.

### *4.1. Discernment constructs: epistemic aims, ideals, and REPs*

First, in the discernment phase of the ER-TED framework, epistemic aims relate to the goals that teacher educators identify for the preservice teachers they are supporting to learn more about teaching diverse groups of children. The two factors identified as epistemic aims indicated that teacher educators either centred on preservice teachers acquiring knowledge about diverse learners, or on pre-service teachers' understanding of critical connections with respect to diversity education. Chinn et al. identified epistemic aims as including "knowledge, deep understanding, explanation, justification, true belief, the avoidance of false belief, useful scientific models, and wisdom" [20] (p428). In particular, the epistemic aim of *Knowledge* in the ERS-TE seems to align well with Chinn's

**Table 9**
Epistemic ideals and TE reflexivity and REPs.

| | *B* | 95% CI | β | *p* |
|---|---|---|---|---|
| **Reflexivity Reflection Adj $R^2$ = .082** | | | | |
| *Epistemic Ideals (Criteria for knowledge)* | | | | |
| Evaluation of evidence | .164 | −.042, .370 | .126 | .117 |
| Personal perspectives | .075 | −.035, .184 | .105 | .179 |
| *Demographics* | | | | |
| Gender | .552 | .198, .906 | .226 | .002** |
| Age | −.012 | −.082, .058 | −.027 | .740 |
| Years teaching | −.044 | −.145, .057 | −.069 | .394 |
| Highest Ed Qual | −.009 | −.162, .144 | −.009 | .905 |
| Teaching Background | .087 | −.054, .229 | .086 | .225 |
| **Reflexivity Weighing Up Adj $R^2$ = .152** | | | | |
| *Epistemic Ideals (Criteria for knowledge)* | | | | |
| Evaluation of evidence | .293 | .127, .459 | .267 | .001** |
| Personal perspectives | .042 | −.046, .130 | .071 | .348 |
| *Demographics* | | | | |
| Gender | .453 | .174, .733 | .226 | .002** |
| Age | .041 | −.016, .097 | .113 | .157 |
| Years teaching | −.039 | −.120, .042 | −.075 | .344 |
| Highest Ed Qual | .028 | −.094, .151 | .032 | .649 |
| Teaching Background | .093 | −.019, .206 | .112 | .103 |
| **Reflexivity Evidence Informed Evaluation Adj $R^2$ = .132** | | | | |
| *Epistemic Ideals (Criteria for knowledge)* | | | | |
| Evaluation of evidence | .376 | | .284 | .000** |
| Personal perspectives | −.010 | | −.013 | .864 |
| *Demographics* | | | | |
| Gender | .381 | | .153 | .032* |
| Age | .005 | | .012 | .881 |
| Years teaching | .033 | | .052 | .512 |
| Highest Ed Qual | −.193 | | −.177 | .014* |
| Teaching Background | .049 | | .048 | .489 |
| **Processes Personal reflection Adj $R^2$ = .137** | | | | |
| *Epistemic Ideals (Criteria for knowledge)* | | | | |
| Evaluation of evidence | .295 | .127, .464 | .262 | .001** |
| Personal perspectives | .063 | −.029, .154 | .101 | .178 |
| *Demographics* | | | | |
| Gender | .246 | −.048, .539 | .116 | .101 |
| Age | .020 | −.039, .079 | .052 | .508 |
| Years teaching | −.102 | −.186, −.019 | −.189 | .016* |
| Highest Ed Qual | −.112 | −.242, .018 | −.120 | .092 |
| Teaching Background | −.029 | −.149, .090 | −.033 | .627 |
| **Processes Teaching Judgement Adj $R^2$ = .322** | | | | |
| *Epistemic Ideals (Criteria for knowledge)* | | | | |
| Evaluation of evidence | .509 | .379, .639 | .536 | .000** |
| Personal perspectives | .042 | −.027, .112 | .081 | .232 |
| *Demographics* | | | | |
| Gender | −.018 | −.243, .206 | −.010 | .873 |
| Age | .007 | −.038, .051 | .021 | .773 |
| Years teaching | −.043 | −.107, .022 | −.093 | .191 |
| Highest Ed Qual | −.106 | −.206, −.007 | −.136 | .036* |
| Teaching Background | −.045 | −.135, .046 | −.060 | .331 |
| **Processes Critical Reflection for Social Justice Adj $R^2$ = .161** | | | | |
| *Epistemic Ideals (Criteria for knowledge)* | | | | |
| Evaluation of evidence | .304 | .136, .471 | .268 | .000** |
| Personal perspectives | −.015 | −.103, .074 | −.024 | .747 |
| *Demographics* | | | | |
| Gender | .358 | .075, .641 | .174 | .013* |
| Age | .043 | −.014, .100 | .115 | .138 |
| Years teaching | −.105 | −.185, −.024 | −.196 | .011* |
| Highest Ed Qual | −.192 | −.320, −.064 | −.205 | .004** |
| Teaching Background | −.034 | −.150, .082 | −.039 | .566 |

*p < .05, **p < .01.

identification of knowledge as an aim. We posit the aim related to *Critical Connections* in the ERS-TE suggests a combination of what Chinn refers to as deep understanding and justification. The focus on critical connections supports the idea that teacher educators expect preservice teachers will critically analyse and evaluate competing perspectives and theories to challenge the status quo with respect to, for example, social justice (teaching *for* diversity [13]; see also Lunn-Brownlee et al., 2022 [12]).

Epistemic ideals, or the criteria for knowledge that preservice teachers use to identify good explanations (knowledge) about the

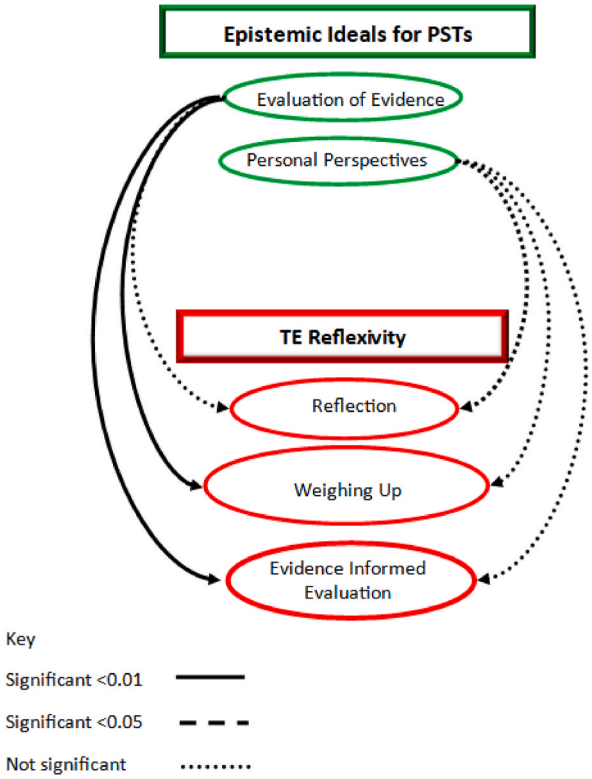


**Fig. 5.** Relationships between epistemic ideals and reflexivity.

best ways to teach about, to and for diversity, are also part of the discernment phase in the ER-TED framework. The two factors identified for epistemic ideals concerned criteria related to the value of evidence and criteria related to personal perspectives. According to Chinn and Rinehart, epistemic ideals are used to evaluate "epistemic products" [21] (p.469). If the epistemic aim is to acquire knowledge for example, then an appropriate epistemic ideal might include accessing accurate information or, indeed, ideals around the value of evidence as identified in the ERS-TE. With respect to epistemic ideals and reliable epistemic processes (REPs), all three factors of *REPs* identified in the ERS-TE (*Personal Reflection*, *Teaching Judgement* and *Critical Reflection for Social Justice*) were significantly related to the *Epistemic Ideal* factor of *Evaluation of Evidence*. This same factor, *Evaluation of Evidence*, did not predict the *Reflexivity* factor relating to *Reflection*, however, was predictive of the *Reflexivity* factors related to *Weighing Up* and *Evidence Informed Evaluation.* Further, there was no significant relationship between the *Epistemic Ideal* factor of *Personal Perspectives* and *Reflexivity*. This could indicate that as part of their discernment related to teaching diversity, teacher educators valued evidence in their decision-making over personal experience or opinion.

Reliable epistemic processes (REPs) also form part of the discernment phase of the ER-TED framework. REPs are described by Chinn and Rinehart as the thinking processes used to reliably achieve epistemic aims [21]. In the ERS-TE, teacher educators identify REPs for preservice teachers' learning about teaching diverse groups of children. The three factors identified for REPs were related to: *Personal Reflection* including items related to personal reflections of knowledge, beliefs, experiences and emotions; *Teaching Judgement*, making judgements about teaching including reflection around practices related to different knowledge and perspectives; and *Critical Reflection for Social Justice* that went beyond personal reflection or reflection on teaching practice to focus on reflection on their own teaching for social justice and analysis of deficit thinking. Regression analyses demonstrated that the epistemic aims of *Knowledge* and *Critical Connections* were significantly associated with the REPs of *Personal Reflection* and *Teaching Judgement* while the only significant predictor of the REP of *Critical Reflection for Social Justice* was the epistemic aim of *Critical Connections*.

### *4.2. Deliberation constructs: reflexive decision-making*

In the next phase of the ER-TED framework, deliberation, teacher educators engage in reflexive decision-making about how to support preservice teachers learning to teach diverse groups of children. When engaging in deliberation, teacher educators need to consider the ways in which identified epistemic aims, ideals and reliable epistemic processes (REPs) for preservice teachers can be calibrated with their teaching practices for supporting preservice teachers. Such deliberations involve teacher educators weighing up a variety of personal and contextual concerns before deciding on a course of action [15]. Both epistemic aims of *Knowledge* and *Critical Connections* were significant predictors of *Reflexivity* related to *Reflection* while the *Reflexivity* factors of *Weighing Up* and *Evidence Informed Evaluation* were only predicted by the epistemic aim of *Critical Connections*.

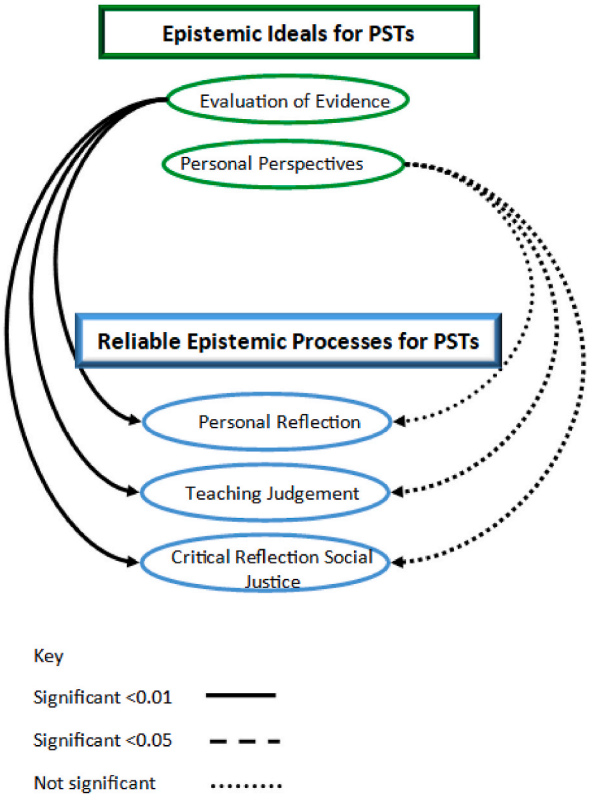


**Fig. 6.** Relationships between epistemic ideals and REPs.

### 4.3. *Dedication constructs: enactment of deliberations*

In the third and final phase of the ER-TED framework, teacher educators identify the enactment or dedication of their epistemic deliberations. Dedication in the ERS-TE describes specific teaching practices that are used by teacher educators to support preservice teachers to learn about teaching diverse groups of children. Three factors were interpretable from the data relating to *Teaching Approaches*, *Critical Pedagogy*, and *Content* related teaching practices or content provided for acquiring knowledge. The epistemic aims of *Knowledge* and *Critical Connections* significantly predicted teaching practices related to *Teaching Approaches* (strategies) and the epistemic aim of *Critical Connections* also significantly predicted *Critical Pedagogy*. *Epistemic Aims* did not significantly predict *Content* related teaching practices.

### 4.4. *Significance of epistemic aims in the ERS-TE*

It is interesting to note the important role played by epistemic aims with respect to other constructs in the ERS-TE. The epistemic aim related to *Critical Connections* was shown to predict the REP of *Critical Reflection for Social Justice* (critically reflect on their own teaching for social justice; identify and analyse deficit thinking). It also predicted two types of reflexive decision making namely *Weighing Up* (in deciding what and how to teach I consider aims, processes for achieving aims, and contexts–personal and situational) and *Evidence Informed Evaluation* (I consult research to evaluate and justify my instructional decisions as I am teaching to/about diversity). Further, the use of *Critical Pedagogies* as a teaching practice (e.g., I use statistical data and research to demonstrate long-standing patterns of success and failure within schools that can be tied to differences such as gender, socio-economics, geographical location) was also predicted by an epistemic aim of *Critical Connections*. While we have not been able to establish causality, it is clear that epistemic aims that focus on being critical and evaluating competing claims are related to expectations for preservice teachers to also engage in critical reflection for social justice. They are also related to how teacher educators engaged in evaluation during their decision making and then enact critical pedagogies that support preservice teachers to challenge essentialist assumptions about teaching diverse learners. We argue that teacher educators should consciously develop explicit and intentional evaluativist epistemic aims because it is more likely that such aims will calibrate with REPs related to reflection for social justice for preservice teachers and with teacher educators' critical pedagogies in teacher education programs The centrality of epistemic aims has been discussed in earlier work by Chinn et al. who argued that epistemic aims are the point from which all other epistemic processes are determined, and without them, there is no way to predict or explain other learning and reasoning outcomes [19]. The core importance of epistemic aims in developing teacher educator's epistemic reflexivity for teaching about/to/for diversity was evident in further research examining

case studies with 27 Australian and New Zealand teacher educators [12].

## 5. Limitations

In the development of a new measurement instrument, refinement will need to occur through additional investigations. It is possible that different factors relating to epistemic constructs will emerge with different samples. Further research and confirmatory factor analysis will clarify and develop the ERS-TE survey properties. In addition, Likert-type scale questions were used in the current instrument to measure reflexivity and epistemic cognition items. However, in our data there was often a lack of variation in responses. For example, nearly all participants indicated that epistemic aims related to knowledge were "important" or "very important" (as indicated by the mean score of 6.57 out of 7). While not relevant for the analyses discussed in the current paper, we included in our survey rank order and open-ended questions to counter this anticipated response pattern. For example, we asked participants to rank their three most important aims, ideals, and reliable epistemic processes to gain more detailed insight into their responses. In our sample, it is likely that participants were teacher educators already interested in diversity and already reflective or reflexive about their practices. Future research could explore these relationships longitudinally and with a sample that is more broadly reflective of the teacher education population.

Construct validity, whether the instrument truly measures the construct under investigation, is an important aspect of assessing the validity of any instrument. The development of the ERS-TE has addressed both content and face validity, both forms of evidence of construct validity. However, it should be noted that common or shared method variance may pose a threat to construct validity in the current study as respondents provided data related to both the predictor and dependent variables [30]. One way to reduce any common method variance would be longitudinal research whereby the predictor variables are measured prior to the dependent variables. This might be a useful future research direction. Finally, criterion validity, or how well the ERS-TE correlates with existing measures is more difficult to assess given that this is the first measure of epistemic reflexivity to our knowledge. Aspects of the survey that assess epistemic cognition may be able to be compared with existing measures of epistemic cognition in future research to provide some degree of criterion validity.

## 6. Conclusions

The current analysis has provided insight into the utility of a quantitative measurement of epistemic reflexivity in teacher educators. The ERS-TE represents the first systematic attempt to create a survey that draws on both epistemic cognition (using the AIR framework) and Margaret Archer's theory of reflexivity. The ERS-TE adds to previous research by capturing the links between epistemic cognition and reflexivity and demonstrating the important relationships between these concepts. Understanding and measuring how teacher educators engage in epistemic reflexivity for supporting preservice teachers to understand more about teaching diverse groups of children has the potential to inform teacher educators' pedagogy. Our analyses revealed promising psychometric properties for the survey factors identified in this investigation. Questions regarding the criterion validity of the ERS-TE can only be addressed through future research.

## Author contribution statement

Lyra L'Estrange; Sue Walker: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Jo Lunn-Brownlee: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Mary Ryan; Terri Bourke; Leonie Rowan; Eva Johansson: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

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## Data availability statement

Data will be made available on request.

## Declaration of interest's statement

The authors declare no conflict of interest.

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