Australian Journal of Educational & Developmental Psychology. Vol 8, 2008, pp1-14

New Zealand and Queensland teachers' conceptions of learning: transforming more than reproducing[1]

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ABSTRACT

Background. Two major conceptions of learning exist: reproducing new material and transforming material to make meaning. Teachers' understandings of what learning is probably influence their teaching practices and student academic performance.
Aims. To validate a short scale derived from Tait, Entwistle, & McCune's (1998) *ASSIST* inventory and to determine and compare the strength of agreement New Zealand and Queensland primary and secondary teachers had for both conceptions.
Samples. Two survey studies with three populations provided valid data: 235 NZ Primary teachers in 2001, and 784 Primary and 614 Secondary Queensland teachers in 2003. A survey of 81 NZ secondary teachers in 2000 did not have enough participants to generate stable estimates.
Methods. Five items defining learning were administered using a six point, positively-packed agreement rating scale. Data were analysed with MMLE confirmatory factor analysis with oblimin rotation. Multiple models were compared and results from the best fitting model (CFI and TLI>.90; RMSEA<.08) for all three samples are reported. Cohen's *d* effect size was used to determine significance of differences in conceptions mean scores.
Results and Conclusions. Psychometric properties of the two scales were good. Conceptions of learning were structured as two inter-correlated factors related to transforming and reproducing conceptions of learning. All samples agreed more with the transforming than the reproducing conception of learning; however, there were

[1] Acknowledgements: The feedback and comments of Professor John Hattie are especially appreciated. Funding for this research came from the Department of Education, Assessment and New Basics Branch, Queensland and from The University of Auckland Research Office. A brief version of the results in this paper was presented at the 2006 AARE conference by the first two authors. The opinions expressed here are those of the authors only.

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small group differences in mean scores. The response scale and items generated sufficient variation to detect differences in teachers' attitudes towards transforming and reproducing conceptions of learning.

INTRODUCTION

Research into how people think about and understand learning has focused on four inter-related dimensions (Biggs, 1987; Entwistle & McCune, 2004; Purdie, Hattie, & Douglas, 1996; Richardson, 2007). These include the reasons people have for learning (i.e., intentions or motivations), the dominant style they have (i.e., approach), and their understandings of what learning actually is. Three of these elements have been found to overlap, and so conceptions of learning have been used to talk about systematic mixtures of intentions, approaches, and understandings. Five hierarchical conceptions have been derived from the many international studies into thinking about learning (Entwistle & Peterson, 2004). From least to most sophisticated, these conceptions are: (1) acquiring factual information, (2) memorising what has to be learned, (3) applying and using knowledge, (4) understanding what has been learned, and (5) seeing things in a different way. This list has remarkable similarity to the conceptions of learning identified by Vermunt and Vermetten (2004) in their survey of some 1500 university-level students (i.e., construction of knowledge, intake of knowledge, use of knowledge, stimulating education, and cooperative learning).

In most conceptions of learning hierarchies, two major categories of conceptions have been specified by referring to the less and more sophisticated notions (Biggs, 1987; Howe, 1998; Marton, 1983; Marton, Dall'alba, & Beaty, 1993; Saljö, 1979; Vermunt & Vermetten, 2004). The lower class of conception has been described variously as quantitative, surface, or reproducing since an increase in the quantity of remembered material that is presented or reproduced on demand is implied by conceptions such as acquiring factual information and memorising what has to be learned. Thus, the reproducing class involves notions such as learning is increasing knowledge; learning is the accurate recall and reproduction of newly presented ideas and information; and learning is acquiring facts and procedures which can be used in practice. In contrast, the higher class of conception has been labelled as qualitative, deep, transforming, reconstructive, or seeking meaning, since learning involves changing and linking the material so that its qualities of relations, patterns, and multiple meanings can be understood profoundly. So, the transforming class of conceptions involves notions such as learning is making meaningful connections between and among new and old ideas and information; learning involves relating, structuring, and critical processing of new material; learning requires the abstraction of meaning; learning is interpreting and understanding reality, and learning is changing as a person.

The status of one conception relative to these two classes is a matter of some debate. Application or use of knowledge or learning in most formulations is associated with reproducing conceptions (Entwistle & Peterson, 2004). This result was found with New Zealand secondary students who associated use of information with the reproducing conception (Brown, 2002a). In contrast, Vermunt and Vermetten (2004) linked concrete processing strategies to the use of knowledge. Thus, they argued that there were three distinguishable conceptions of learning (i.e., reproducing, meaning-directed, and application-directed). It is not clear whether teachers would associate the use of information as a reproducing or transforming conception or whether it would be an independent construct. This research will shed some light on the status of this application conception relative to the reproducing and transforming conceptions of learning.

It has generally been found that students with deep, transforming conceptions of learning have higher academic performance, while those with surface, reproducing conceptions of learning have lower academic performance (Entwistle & Peterson, 2004). However, it is important to note that the hierarchical structure of conceptions of learning does not mean that those with a deep or transforming conception no longer practice reproducing strategies, such as rote memorisation. The most successful learners understand that both surface and deep

conceptions are legitimately involved in learning and are able to contingently select and implement appropriate strategies (Entwistle & Peterson, 2004; Purdie & Hattie, 1999; 2002; Saljö, 1979). It is not the case that surface conceptions are bad while deep conceptions are good; rather the hierarchy is inclusive—surface conceptions are good but insufficient and deep conceptions are good but insufficient. Thus, it may be better to construe the hierarchy as a developmental trajectory in which the best learning outcomes are exhibited when both reproducing and transforming conceptions are acknowledged and implemented.

The research literature frequently reports strong consistencies between how people conceive of learning and how they go about learning (Entwistle & Peterson, 2004). Those who emphasise reproducing conceptions of learning tend to make use of surface techniques (e.g., mnemonics and rote memorisation), while those who see learning as transforming, tend to report using deep techniques (e.g., concept maps, metaphor creation, and abstraction). Vermunt and Vermetten (2004) reported that theoretically similar conceptions and strategies of learning loaded onto the same principal components in their analysis. That is deep strategies of relating, structuring, and critical processing were associated with the transforming conception of construction of knowledge; while surface strategies of memorizing and rehearsing were associated with the quantitative conception of intake of knowledge.

How teachers conceive of learning is useful in understanding classroom teaching and assessment practices. Teachers are responsible not only for their teaching but also for student learning outcomes; thus, it is expected that teachers would have clear notions as to what the nature of learning is. Various curriculum statements in both New Zealand and Queensland make it clear that the ultimate goal of schooling is transforming, deep learning (Barker, 2001; Fraser, 2001; McGee, 1994; Sebba & Maxwell, 2005). Indeed, the emphasis on deep, personalised learning is so strong, that in many cases, the teacher might be forgiven for thinking surface, reproducing conceptions of learning were inappropriate.

Typically, secondary teachers might be expected to give greater emphasis to reproducing as a conception of learning since there is usually a significant amount of material to be learned for high-stakes qualifications. In Queensland, secondary school certification takes place over the final two years of secondary education, during which teachers play a significant role in assessing internally student learning. New Zealand secondary teachers are also internal assessors for the national qualifications systems during the final three years of secondary schooling, while at the same time preparing students for end-of-year examinations that are part of the same qualifications system. Thus, the relative importance of the reproducing conception may change because of the importance of secondary school qualifications and different practices in the two jurisdictions may influence the relative importance of the reproducing conception.

There is evidence that, perhaps more so among secondary teachers where there are pressures to prepare students for qualifications, teachers emphasise surface reproducing conceptions. Anthony (1994, 1997) noted the assessments given to senior secondary school students largely required factual reproduction of knowledge and that the students' resisted efforts to get them to implement a transforming conception of learning. Likewise, Brown (2002a) reported that New Zealand senior secondary school teachers held largely transforming conceptions of learning, while their students had largely reproducing conceptions of learning. Despite this, the same teachers reported resorting to implementing reproducing strategies in their classrooms in order to maximise students' academic performance on end-of-year qualifications (Brown, 2002b). In a detailed phenomenographic study of 16 secondary teachers' conceptions of learning in Queensland, ten were categorised as having largely reproducing conceptions (i.e., six acquisition and reproduction of content and skills; four development and application of skills and understanding) and six were classified as having a dominant transforming conception (i.e., three development of understanding in the student; three transformation of learners) (Boulton-Lewis, Smith, McCrindle, Burnett, & Campbell, 2001). This paper will assist in our understanding of how Queensland teachers rate these two conceptions of learning by making use of large-scale surveys.

This study reports teachers' conceptions of learning by making use of statements related to the Entwistle and Peterson (2004) categorisation of learning conceptions. Thus, reproducing conceptions of learning included: a) remembering things, b) getting facts or details, and c) applying information; while transforming conceptions of learning included d) seeing things in a different and more meaningful way, and e) understanding for myself. The advantage of this research, over previously reported studies, is that participants indicated to what extent they agreed with both conceptions and thus did not need to be classified as being in only one category of learning conception. Further, this research advances our understanding by examining systematically responses of large samples of participants and thus generates robust population estimates of how the two competing conceptions of learning are structured in the thinking of large communities of teachers.

This paper reports three studies conducted in New Zealand (NZ) and Queensland (Q) with items about two learning conceptions (i.e., reproducing & transforming) and aimed at determining and comparing the strength of agreement participants had towards each conception. The studies also established the psychometric merits of the abridged scale to analyse the strength of opinion held by primary and secondary school teachers in two educational jurisdictions. While there is at least one more conception of learning, variously called achieving or strategic (Biggs, 1987; Entwistle & McCune, 2004), this conception was not used in the studies, in part, because teachers are not the learners. The achieving conception is especially relevant to learners who are about to undertake high-stakes qualifications assessments but this context is not usually part of the teachers' experience.

METHOD

Instrument

Out of nearly 60 items, just five were focused on definitions of learning and these were selected, with permission, from the Tait, Entwistle, and McCune (1998) *Approaches and Study Skills Inventory for Students* (ASSIST). The five items related to transforming and reproducing definitions of learning (Table 1). The ASSIST online documentation[3] indicates that items related to building up knowledge, remembering well, and using information are reproducing, while those related to seeing things in a new way and understanding material for oneself are transforming. The ASSIST developers reported in Table 1 of the online documentation that the transforming conception loaded .41 on deep approaches to learning, while the reproducing conception had a .23 loading on surface-apathetic approaches to learning, which suggests a potential consistent relationship between beliefs about the meaning of learning and methods or strategies used to learn. The ASSIST used a proximity rating scale (i.e., how close is this definition to yours), with five balanced options. Results for these five items have not been included in published reports as the developers found that the items lacked variation (V. McCune, personal communication, 5 September 2007). Consequently, it is not possible to compare these results to those of the developers. One of the objectives of this research was to determine whether an alternate response scale would increase variation and precision in participant responses to these items.

Although the ASSIST was developed for use with tertiary students, it was suspected that the learning definition items would be appropriate for use with school teachers. The research reported here was carried out in the context of larger studies into teachers' conceptions of assessment, teaching, curriculum, and learning, it was deemed necessary to use but five of the ASSIST conceptions of learning items. As a consequence, this paper reports for the first time, the psychometric properties for the scales that identify two conceptions of learning.

In contrast to the ASSIST's proximity rating scale, an agreement response scale (i.e., how much do you agree with this definition) with six positively-packed ratings (Lam & Klockars, 1982) was adopted. The rating scale had four positive agreement response points and two

[3] Items available from Approaches to Study Skills Inventory for Students, ©1997, Centre for Research on Learning and Instruction, University of Edinburgh, available at http://www.tla.ed.ac.uk/etl/questionnaires/ASSIST.pdf.

negative response points identifying the degree to which participants agreed or disagreed with each statement. The scale responses were 'strongly disagree', 'disagree', 'slightly agree', 'moderately agree', 'mostly agree', and 'strongly agree'; each point was scored 1 to 6 respectively. This type of response format has been found to be especially effective when participants are inclined to agree with all statements (Brown, 2004). Thus, it is possible that the lack of variation in the items reported by the ASSIST developers is a function of the balanced scale they used. If participants are inclined to agree with each definition, a balanced scale collapses all shades of positive attitude into two score points. In contrast, the positively-packed rating scale permits finer distinction among the varying degrees of positive agreement. If successful in creating stable measurement properties, then it may be possible to use these items successfully with a positively-packed agreement response scale.

Participants

Data were obtained from three studies conducted between 2000 and 2003. Study 1 in 2000 surveyed 81 New Zealand secondary school teachers of Year 11 (Brown, 2002b), Study 2 (in 2001) surveyed a nationally, representative sample of 241 New Zealand primary school teachers working with students in Years 5 to 7 (i.e., ages 10 to 13) (Brown, 2002b), while Study 3 (2003) surveyed representative samples of 784 Queensland primary (Years 1 to 7) teachers and 614 Queensland secondary school teachers (Years 8 to 10). The NZ secondary sample was drawn from six schools in the Wellington region, and thus, cannot be taken as representative and data are used here for indicative purposes only. The schools in the Queensland sample covered the range of school types in the state including urban, rural and remote. The nature of the Queensland state school system is that teachers are employed by the system rather than individual schools. The effect of this is that there is not marked assortment by schools and over time there is considerable movement of teachers among schools. These processes lead to a relatively homogenous blending of teachers across the state schools. Note also that in terms of national qualifications assessments, the New Zealand secondary teachers in Year 11 and beyond would be participating in the assessment of students for national qualifications, whereas the Queensland secondary teachers would be preparing their students for qualifications in Years 11 and 12.

Sample size is critical in factor analysis, especially as the number of parameters increases (Browne & Cudeck, 1989; 1993), with numbers greater than 500 recommended for most cases (Chou & Bentler, 1995). To maximise sample size, any missing at random data for participants who had completed at least four of the five items was imputed with the expectation maximisation (EM) procedure (Dempster, Laird, & Rubin, 1977). Maximum likelihood estimation was used since it provides best population estimates when samples are small (Hoyle & Duvall, 2004). Nevertheless, the two New Zealand samples are relatively small and data may still be subject to chance artefacts. Thus, confirmation from the independently collected large samples in Queensland would support the validity of the model.

Analysis

Analysis of the responses was conducted with confirmatory factor analysis (CFA) using maximum likelihood estimation (Osborne & Costello, 2005). Unlike exploratory factor analysis, CFA allows tighter specification of multiple hierarchies or paths between factors by utilising the factor patterns, correlation patterns, covariance patterns, and residual or error values within a data matrix (Hoyle, 1995). Simultaneously, CFA determines the estimates of all parameters that most nearly reproduce the matrix of observed relationships in a data matrix (Klem, 2000). In CFA, relationships between variables and latent factors not predicted by theory are set to zero, while the expected relationships are free to load onto their appropriate factors (Byrne, 2001). A general advantage of CFA is that, unlike regression or general linear model approaches, it does not ignore the error variance parameters and thus leads to more accurate estimations of relationships (Byrne, 2001; Thompson, 2000). The strength of the specified relationship between a latent factor and a contributing observed variable is indicated by a standardised partial regression weight (β). This value indicates how much of a standard

deviation change there is in the contributing variable for every standard deviation increase or decrease is in the latent variable.

The fit of a CFA model is indicated by indices that take into account simultaneously the number of cases, the degrees of freedom[4], and the number of freely estimated parameters. While non-statistically significant values for χ^2 are taken to indicate good fit of the model to the data, it is well established that χ^2 is overly sensitive to large sample sizes (Cheung & Rensvold, 2002). The Tucker-Lewis (TLI) and comparative fit (CFI) indices show good fit when they are >.95 and acceptable if >.90 (Hoyle, 1995); though, both indices are sensitive to complex models (i.e., those with more than three inter-correlated factors) (Cheung & Rensvold, 2002). The root mean square error of approximation (RMSEA) is less affected by sample size or model complexity and values <.08 are considered acceptable and <.05 are good (Steiger, 2000).

Since multiple models may be used to analyse the same data, seven logically possible models were tested using the Queensland data since that provided the most robust sample sizes. The models were:

(Model 1) all items on one factor,

(Model 2) three items on reproducing and two items on transforming with the two factors inter-correlated,

(Model 3) items as Model 2 but with the two factors loading onto a common second-order factor,

(Model 4) three items on transforming and two items on reproducing with the two factors inter-correlated,

(Model 5) items as Model 4 but with the two factors loading onto a common second-order factor, and

(Model 6) two items on transforming and two items reproducing (no use information) with the two factors inter-correlated,

(Model 7) items as Model 6 but two factors loading onto a common second-order factor.

The equivalence of a model between two or more groups can be examined by determining the size of shift in χ^2 or the CFI relative to the unconstrained model as various parameters are constrained to be equal. Non-statistically significant differences in χ^2 and shifts of no more than .01 CFI indicate that the model is equivalent between two groups (Cheung & Rensvold, 2002). The invariance of the best fitting model was examined using the data from the two Queensland groups as these two groups both provided large samples. All CFA was carried out with AMOS (Arbuckle, 2005).

Mean scale scores were calculated for the preferred model by averaging all items loading onto each conception. The significance of differences in mean scale scores was determined by the use of Cohen's (1992) *d* effect size. An effect size is a measure of the difference between two means as a ratio of the pooled standard deviation. An effect size of less than .20 is trivial, greater than or equal to .20 is considered small, greater than or equal to .50 is medium, and effects greater than or equal to .80 are considered large.

RESULTS

The fit characteristics of the seven models tested with the two groups of Queensland teachers are presented in Table 1. Model 6 had consistently the best fitting characteristics for these two conceptions (i.e., TLI and CFI >.95, RMSEA<.05). This model removed the 'use of information' item. Although, the modification indices indicated that this item had paths to both conceptions, such modeling generated inadmissible solutions. The implications of this

[4] Degrees of freedom are calculated by AMOS according to Rigdon's (1994) procedure: df=[(m*(m+1))/2] - (2*m)- [(ξ*(ξ-1)/2], where m= number of manifest variables; ξ = number of exogenous factors. When two groups are analysed simultaneously *df* is doubled.

item will be considered later. A two correlated factors model is preferred over the hierarchical model for its parsimony. Thus, two conceptions of learning were found as expected—reproducing and transforming—both of which consisted of two items.

Table 1. Model Fit Statistics for Queensland Teacher Groups

Model	Items	*df*	χ^2	χ^2/df	*p*	RMSEA	CFI	TLI
1. One factor	5	10	610.16	61.02	.00	.207	.69	.38
2. Two correlated factors	3 transforming 2 reproducing	8	169.41	21.18	.00	.120	*.92*	.79
3. Two factors hierarchical	3 transforming 2 reproducing	8	169.41	21.18	.00	.120	*.92*	.79
4. Two correlated factors	2 transforming 3 reproducing	8	101.98	12.75	.00	.092	*.95*	.88
5. Two factors hierarchical	2 transforming 3 reproducing	8	101.98	12.75	.00	.092	*.95*	.88
6. Two correlated factors*	2 transforming 2 reproducing	2	6.26	3.13	.04	*.039*	*.99*	*.98*
7. Two factors hierarchical	2 transforming 2 reproducing	2	6.26	3.13	.04	*.039*	*.99*	*.98*

Note. Models calculated using two Queensland groups simultaneously; parameters meeting thresholds displayed in italics; *=preferred model; RMSEA=root mean square error of approximation; CFI=comparative fit index; TLI=Tucker-Lewis index.

Multi-group comparisons of Model 6 with the two Queensland groups found no statistically significant differences in measurement weights (*df*=2; χ^2=.88; *p*=.64; CFI=.99), structural covariances (*df*=5; χ^2=5.56; *p*=.35; CFI=.99), and measurement residuals (*df*=9; χ^2=12.67; *p*=.18; CFI=.99) of the constrained models as compared to the unconstrained model. This further confirms the usefulness of Model 6. Model 6 also had good fit to the responses of the NZ primary teacher sample (*N*=241; *df*=1; χ^2=1.18; *p*=.28; TLI=.98; CFI=.99; RMSEA=.028). However, the model generated an inadmissible solution for the NZ secondary teachers, most likely attributable to the small sample size. Thus, results for this group are excluded from further analysis. The structure of Model 6 for the three remaining groups is shown in Figures 1 to 3. All regression weights were equal to or greater than .50; indicating that the manifest items were strongly predicted by the specified latent factors. Note that the items in the figures are not ordered according any theoretical, hierarchical order.

Item and scale level data are reported in Table 2. Mean scores for the transforming learning conception for all three groups were higher than those for reproducing learning. Means were about 5.0 Mostly Agree for Transforming, and just under 4.0 Moderately Agree for Reproducing. The effect size differences within each group for the two different conceptions were substantial; that is, NZ Primary *d*=1.75; QLD Primary *d*=1.27; QLD Secondary *d*=1.31. It is clear then that all groups of teachers agreed much more with the transforming conception of learning, contradicting the findings of Boulton-Lewis et al. (2001) who classified more Queensland secondary teachers as reproducing than transforming in their learning conceptions.

The effect size differences between samples for each conception were trivial to small, with the largest difference being between New Zealand primary and Queensland secondary teachers around the Transforming conception. Differences between the two primary groups were trivial; likewise the differences between the two Queensland groups were trivial. This result may suggest an interaction between sector and jurisdiction—but the current study did not have sufficient New Zealand secondary teachers to test such possibilities. Thus, despite the small differences in mean scale scores, the teachers in both jurisdictions and sectors agreed much more with transforming rather than reproducing as the purpose of learning.

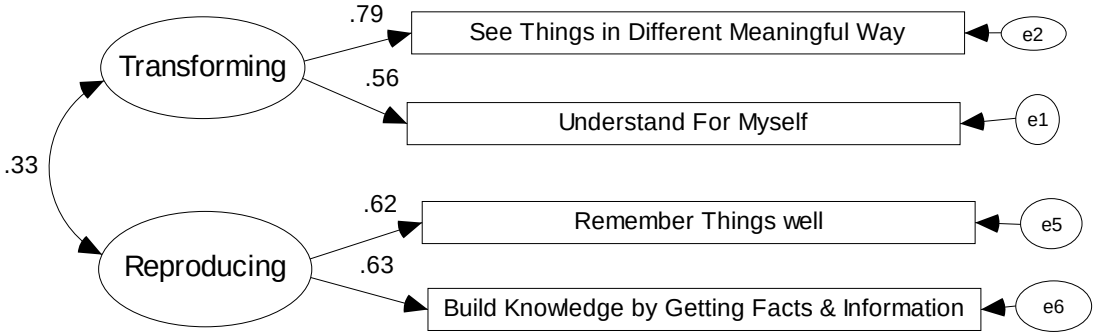
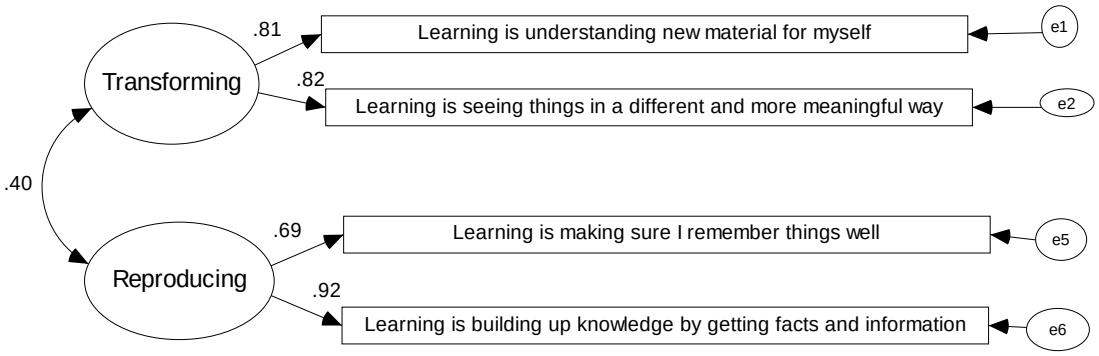
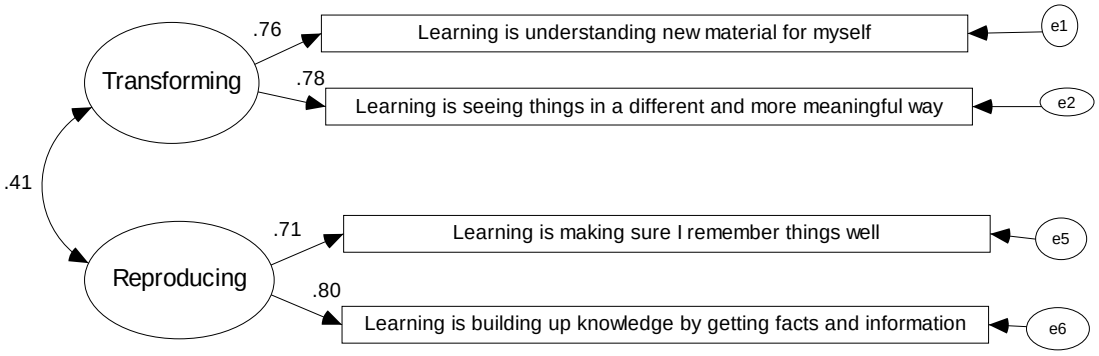


Figure 1. Conceptions of Learning New Zealand Primary Teachers: Model 6



Note. *N*=784; fit statistics reported in Table 1.

Figure 2. Conceptions of Learning Queensland Primary Teachers: Model 6



Note. *N*=614; fit statistics reported in Table 1.

Figure 3. Conceptions of Learning Queensland Secondary Teachers: Model 6

Table 2. Model 6 Learning Conceptions Statistics

	New Zealand Primary		Queensland Primary		Queensland Secondary	
Factors and Statements	*M*	*SD*	*M*	*SD*	*M*	*SD*
Reproducing Learning	**3.86**	**.90**	**3.85**	**1.13**	**3.73**	**1.06**
Learning is building up knowledge by getting facts and information	4.36	1.05	4.24	1.23	4.13	1.19
Learning is making sure I remember things well	3.35	1.10	3.46	1.27	3.34	1.22
Transforming Learning	**5.25**	**.67**	**5.14**	**.88**	**4.99**	**.86**
Learning is understanding new material for myself	5.28	.81	5.12	.97	5.00	.97
Learning is seeing things in a different and more meaningful way	5.22	.77	5.17	.95	4.98	.95
Inter-factor correlation (*r*)	.33		.40		.41	
Effect Sizes						
Reproducing NZ Primary	—		.01		.13	
Reproducing QLD Primary	—		—		.11	
Transforming NZ Primary	—		.13		.32	
Transforming QLD Primary	—		—		.17	

Note. Model 6 inadmissible for NZ secondary sample and thus not reported.

DISCUSSION

This study aimed to ascertain whether sufficient variation in responses to five items about the nature of learning could be elicited using a positively-packed, agreement rating scale. The research has shown that stable, well-fitting measurement models using four of the items were generated by teacher responses using the rating scale. Thus, we argue that these items can be effectively used in investigating teacher opinions about the nature of learning provided a similar rating response format is used. Further research with tertiary students and the same rating scale may result in useful information from these items, in contrast to the nil findings by Tait, Entwistle, and McCune (1998). Thus, this multi-sample study of teacher responses to these ASSIST statements has shown that they can be used to measure two fundamental conceptions of learning.

This research aimed to discover whether the ASSIST learning definition items could be used to identify the structure of teachers' thinking about the nature of learning. Our research showed that these two conceptions of learning were stable and reliably measured across jurisdictions and sectors. Although these two conceptions may be conceived as hierarchical (i.e., reproducing is subordinate to transforming) there was no evidence that this was the case in this sample. A causal model in which reproducing was subordinate to transforming had exactly the same fit as one in which transforming was subordinated to reproducing; thus, we concluded that an inter-correlated model rather than hierarchical one best accounts for the thinking of teachers about the nature of learning. Therefore, it was not the case among these three groups of teachers that transforming was hierarchically related to reproducing as might be expected if teachers' conceptions of learning had mirrored relations found with students (Entwistle & Peterson, 2004; Purdie & Hattie, 2002). This relationship contradicts the notion that transforming conceptions incorporate reproducing conceptions. The model indicates plurality of conceptions rather than a hierarchy or a continuum; an argument also made by Richardson (2007). This result reinforces the argument that teachers' conceptions are plurally simultaneous regardless of analytic hierarchies (Fodor, 1998; di Sessa, 1988; Green, 1971;

Lakoff & Johnson, 1999). Thus, this research contradicts the approach in which teachers are classified as having one or the other conception of learning (Boulton-Lewis et al., 2001). The teachers had both conceptions and, although one was more dominant than the other, we would expect teachers to be able to invoke either conception depending on context.

The strong commitment teachers had to transforming learning is in line with education policies and priorities in both jurisdictions. Indeed, transforming conceptions of learning are associated with student-centred teaching, student-centred curriculum, and greater academic performance (Entwistle & Peterson, 2004). Fortunately, the data here show that teachers did not equate agreeing with transforming learning with disagreeing with reproducing learning; emphasising reproducing learning would not automatically equate to disagreeing with or not making use of transforming learning. If teachers had had a simplistic dichotomy between reproducing and transforming conceptions that may inadvertently lead to ignoring the importance of being able to reproduce information or of being able to transform knowledge. It is clear from studies with students that the best learners understand and use both reproducing and transforming conceptions and practices (Entwistle & Peterson, 2004; Purdie & Hattie, 2002). Thus, teacher education and professional development policies need to, as these teachers do, emphasise both transforming and reproducing conceptions of learning.

It should be noted that the instrument and model do not capture all the various reported conceptions of learning – not all the conceptions identified by Vermunt and Vermetten (2004) and Richardson (2007) fall within these two conceptions. However, the scales do capture two of the most prominent and dominant conceptions of learning. Although, good instrument development practices suggest that each factor should have more items (Gable & Wolf, 1993), especially when used with small sample sizes (i.e., $n \leq 100$), sample sizes ≥ 400 have been associated with accurate identification of factors using only two items (Marsh, Hau, Balla, & Grayson, 1998). Nevertheless, we would recommend that the current instrument be expanded with more items that capture the fullest sense of transforming and reproducing conceptions. For example, Brown (in press), basing item construction on the SOLO taxonomy (Biggs & Collis, 1982), found that New Zealand primary teachers associated the following statements about assessment with statements similar to the transforming items used in this research:

- Assessments that measure student ability to understand relationships between ideas or information
- Assessments that measure whether students can derive abstract principles from ideas or information.

Thus, we recommend using such taxonomies as a basis for drafting more items that appear to be associated with transforming learning.

This research found that the 'use of information' item as a definition of learning is ambiguous and could not be properly fit to the model. How this item is understood by teachers turns on how they understand the ideas of using and what information is. It may be conceived as reproducing if 'use' means exact replication (i.e., follow the procedure exactly as taught) and as transforming if 'use' means apply it in a new or complex situation (i.e., use general principles to solve a new problem). It may be reproducing if 'information' means facts and details, whereas it may be transforming if 'information' means theories, abstractions, relations, and so on. Further scale development by creating items designed to elicit these two different options is warranted.

This research aimed to identify the strength of agreement New Zealand and Queensland teachers had to two conceptions of learning (i.e., reproducing & transforming). All three groups agreed considerably more with the transforming conception than the reproducing one. Although this result might be predicted by policy emphases on transforming learning, these studies provide a robust empirical basis for making generalisations about the conceptions of teachers in Queensland and New Zealand concerning the nature of learning. It is worth noting that all three groups of teachers agreed with both approaches to learning; learning to teachers means both transforming AND reproducing. Mean differences in conceptions scores were generally small between the three groups, which is remarkable given so many differences

between jurisdictions and sectors. What this means, of course, is that insofar as conceptions of learning are considered there is no noticeable negative washback effect among secondary teachers from the Queensland high-stakes qualifications assessment system operating in Years 11 and 12.

It is important to remember that these results are based on teachers' verbal espousal of their conceptions of learning and that these conceptions do not necessarily play out in practice. Brown (2002b) reported that a small sample of New Zealand secondary teachers implemented predominantly reproducing learning practices and strategies despite having a stronger commitment to transforming conceptions of learning and Boulton-Lewis et al. (2001) identified more Queensland secondary teachers as having reproducing conceptions of learning than transforming views. Šteh and Marentič Požarnik (2005) indicated that secondary students in Slovenia perceived that two-thirds of classroom tasks required low-level cognitive processing, while their teachers reported that only half the tasks required reproducing learning. Research into teachers' use of questions has indicated that most teachers require surface oriented, simple recall of factual knowledge and that only a very small proportion of teachers' classroom questions require transformative conceptions or deep approaches (Airasian, 1991; Barnette, Orletsky, & Sattes, 1994; Gall, 1970, 1984; Kloss, 1988). Thus, further research is required to determine the degree to which the strong agreement with transforming learning is put into practice in classroom assessments and instruction. This instrument can be used in conjunction with research that maps teachers' espoused conceptions of learning to their actual teaching practices and student outcomes. This type of research could assist in determining the relative effectiveness of espoused and practiced conceptions of learning.

In summary, this research has contributed to the literature on teachers' conceptions of learning. First, we found four items that measured two conceptions of learning among three large samples of teachers from Queensland and New Zealand, despite the items having been written initially for use among tertiary students. Second, we found that the model and mean scores were very similar across samples, with all teachers agreeing with both conceptions, though more so with transforming than reproducing. Third, we found that the psychometric properties of the items were robust due, in part, to the use of the positively-packed agreement rating scale. We recommend future use of these items be accompanied by this type of rating scale. A fourth finding was the ambiguity of the use or application of knowledge and information item; we gave suggestions as to how items could be written that more explicitly link application to both reproducing and transforming conceptions. Fifth, we found that the data supported a pluralistic understanding of these two conceptions of learning better than a hierarchical model. The weak inter-correlation between the conceptions clearly points to plurality and further research is needed to establish the contexts which invoke each conception.

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