SOCIO-EMOTIONAL KEY COMPETENCIES: CAN THEY BE MEASURED AND WHAT DO THEY RELATE TO?

E. R. PETERSON,
School of Psychology,
The University of Auckland

S. F. FARRUGGIA, R. J. HAMILTON,
G. T. L. BROWN
Faculty of Education,
The University of Auckland

AND

M. J. ELLEY-BROWN
Faculty of Business and Law
Auckland University of Technology

Abstract

Four socio-emotional New Zealand Curriculum key competencies (Managing Self, Participating and Contributing, Relating to Others and Thinking) were investigated in a two-part study. The first part used a questionnaire to quantitatively model the four key competencies in a sample of 995 secondary students. The second part examined whether the key competency models found in part 1 related to academic efficacy, school connectedness and academic achievement within a subsample of 297 secondary students. The models had acceptable statistical fit and were invariant. All models were related to academic efficacy and school connectedness, but none related directly to achievement. This is the first study to try to quantitatively model the New Zealand key competencies and demonstrate a direct relationship between the socio-emotional key competencies and academic efficacy and school connectedness.

Key words

Key competencies, achievement, school connectedness, academic efficacy secondary school

Introduction

In 2005, the Organisation for Economic Co-operation and Development (OECD) recommended that Key Competencies (KCs) be included in educational curricula in order to help develop good citizens and cohesive and economically successful societies. Building on the OECD KCs, New Zealand developed the Key Competencies in 21st Century Schooling (Sewell, 2009), which were introduced into the national curriculum in 2007 (Ministry of Education [MoE], 2007, p. 34). One issue facing all countries that have chosen to integrate the KCs into their curriculum is whether to assess, and if so, how best to assess the KCs. For important instructional, monitoring and accountability reasons, identifying how best to assess KCs would appear to be one way forward (Hipkins, Boyd, & Joyce, 2006). There are difficulties, however, when taking this approach. First, there are numerous assessments for competencies relating to literacy, numeracy and knowledge which together form a large part of the school curriculum and hence are typically assessed using teacher-administered subject-based tests as well as in national examinations (Trier, 2002). However, there are few assessments specifically designed to measure the socio-emotional KCs which include life skills such as how to deal with oneself, ones emotions, others and relationships (Trier, 2002). In addition, because the KCs cut across domains and are learnt in formal and informal settings, valid assessment must be authentic, i.e., situated in a range of real life contexts or situations (Gordon et al., 2009). It is also important that KCs assessment does not atomize the KCs so that the complexity inherent in the KCs is lost and/or complex relationships between KCs are ignored (Boyd & Watson, 2006; Hipkins, Boyd, & Joyce, 2006). For example, Hipkins (2006) noted that in the New Zealand Curriculum, the KC "Managing Self" could be interpreted as behaving well and being ready to learn, but this leaves out identity and knowing who you are, where you come from, and how you fit in.

By focusing on how the four New Zealand socio-emotional KCs are defined and potentially measured (Crick, 2008; Reid, 2006), this paper contributes to our understanding of the assessment of the KCs. In addition, the paper has the potential to guide schools in fulfilling the Ministry of Education's expectation that schools "encourage and monitor the development of the key competencies" (Ministry of Education, 2007, p. 38).

The issue of KC measurement within New Zealand is complicated in part because the meanings of the individual KCs lack conceptual clarity (Gordon et al., 2009). This makes it difficult for schools to a) enhance these competencies and b) demonstrate enhancement. While it is problematic to measure KCs when construed broadly, educational psychologists have established tools to measure underlying aspects of each KC, e.g., motivation, self-awareness, cognitive strategies, autonomy (Brown et al., 2005).

This paper draws on these tools to create a KC questionnaire with the aim of starting a conversation about whether and how the New Zealand KCs can be assessed. It is divided into two parts: 1) whether measurement models of the New Zealand KCs can be constructed, and 2) whether structural models of the KCs are associated with three academic-related outcomes: school connectedness, academic efficacy, and achievement.

Part 1: The measurement of the socio-emotional Key Competencies

Aim

Using established instruments from the field of educational psychology, the aim of Part 1 is to model the KCs embedded within the New Zealand Curriculum and then test the statistical fit of the theoretical models. The psychometrically sound scales chosen to measure each KC were conceptually fitted with KC definitions as defined in the New Zealand Curriculum (MoE, 2007). We initially tested whether the associations between the scales and the KCs we proposed in Table 1 (below) exist (Hypothesis 1).

Method

Participants

A total of 995 Year 10 secondary school students from five New Zealand schools (4 co-educational, 1 single sex female) volunteered to take part in the study (*M* age = 14.2 years; *SD* = 0.50). The sample consisted of 69% females; 32% New Zealand European, 21% East Asian, 16% Pacifica, 11% Indian, 10% Māori, and 10% other). The participants were from high (62%), middle (24%), and low (14%) decile schools. Our sample represented 71% of the total number of Year 10 students at those schools (995/1406).

Procedures

Year 10 students from five Auckland-area secondary schools were approached and 995 agreed to participate. All participants and their parents signed a consent form. The 30-minute questionnaire was administered during school hours.

Measures

The questionnaire contained scales selected to represent important aspects of the NZ socio-emotional KCs (see Table 1). The Emotional Management and Control and Emotion Understanding questions used a five point Likert scale (1 = strongly disagree; 5 = strongly agree). All remaining items, with the exception of questions regarding extra-curricular activities, used a balanced six-point Likert scale (1 = strongly disagree; 6 = strongly agree). A co-curricular activities question asked students to identify the activities in which they took part, e.g., team sports, music and performance clubs, volunteer groups, and the number of hours spent doing these activities per week (< 1 hour, 1–5 hours, 5–10

hours, and > 10 hours). A brief description of the scales used to measure each competency is given in Table 1 (below).

Results[i]

Data analysis

Participants with more than 10% missing data were removed; a loss of 5% of the participants, and the expectation–maximisation procedure (Dempster, Laird, & Rubin, 1977) was used to impute any remaining missing values.

Scale reliability

The final set of scales used in the study showed moderate to high internal consistency with Cronbach's coefficient alpha ranging between 0.65 to 0.88 (see Table 2 below). The only exception was the Cronbach's alpha of the mini-IPIP Neuroticism factor ($\alpha = .54$) which may have been due to the scales' lower discriminative value when used with Asian populations (current sample has 21% Asian students).

Correlations among the subscales

Initially, construct validity of the KC questionnaire was examined using polychoric correlations within each KC (see Table 2, above). The correlations between the scales within each KC were low to moderate with most being between .20 and .50. In the Managing Self competency some of the correlations were positive and others negative. This is because the avoidance of work factor and the neuroticism (or highly anxious) factor were expected to be negatively related to the notion of managing one's self.

Item response theory and exploratory and confirmatory factor analysis[i]

In order to derive the properties of the scales in this study we used Mplus (Muthén & Muthén, 2007) to fit multidimensional IRT models to each scale. These models were then run in AMOS 17.0 (Arbuckle, 2005) to examine the structure of each conceptually derived KC model. For Managing Self, the constructs were grouped into three second-ordered factors, including Independence, Knowledge and Protection of Self, Emotion Management and Control (see Table 2, above). For Participating and Contributing, the two co-curricular items, hours per week and number of activities were combined using a second-order factor.

Choosing appropriate standards for evaluating the fit of structural models is controversial, especially when using large samples and multi-factorial hierarchical models. The solution, to some extent, seems to be to report multiple measures of goodness-of-fit (e.g., $\chi2$, CFI, gamma hat) and badness-of-fit (e.g., SRMR, RMSEA; Fan & Sivo, 2005; Hu & Bentler, 1999), and in particular to use fit statistics that are less affected by complex models, sample size and model misspecification. Based on an extensive review of the literature (e.g., Fan & Sivo, 2005; Hu & Bentler, 1999) the following standards were selected to evaluate model fit: statistically non-significant χ^2 per *df*, gamma hat > .90, and RMSEA and SRMR < .08.

Our results were in keeping with Hypothesis 1 in that we found that there are existing instruments which relate to the New Zealand socially oriented KCs of Thinking, Managing Self, Relating to Others, and Participating and Contributing, and that these hypothesised associations can be grouped into models which have acceptable statistical fit amongst this sample of secondary school students. The four fitting KC models, were then tested in an aggregate model, combining all KCs into one model, but the degree of overlap between the constructs was high, resulting in poor statistical fit.

---

[i] More details related to these analyses can be found in an unpublished technical report (Peterson, Farruggia, Hamilton, Brown, & Elley-Brown, 2013).

Table 1:   Scales used in the Key Competency Questionnaire and their associated key competency

Key Competency	Source	Description	No. Items
Managing Self			
Independence Factor			
Avoiding Novelty scale	Midgley et al. (2000)	Assesses whether students have a preference for avoiding unfamiliar or new work.	5
Psychosocial Maturity Inventory (PSM) Self-Reliance subscale	Greenberger, Chen, Dmitrieva, & Farruggia (2003)	Assesses social and psychological maturity, focusing on social validation, sense of control and initiative.	10
Knowledge and Protection of Self factor			
Conscientiousness	Donnellan, Oswald, Baird, & Lucas (2006)	Assesses degree to which an individual is organised, reliable, motivated, self-disciplined, persistent and neat.	4
Emotion regulation - reappraisal factor	Abbreviated from Gross & John (2003)	Assesses whether individuals reappraise their emotions and modify their behaviour (reappraisal)	6
Ethnic identity	Roberts et al. (1999)	Assesses the strength of students' ethnic identity.	3
Emotion Management and Control factor			
Emotional Management & Control-Short form	Abbreviated from Palmer, Stough, & Luebbers (2003)	Assesses the ability to manage and deal with one's own and others' positive and negative emotions.	8
Neuroticism	Donnellan et al. (2006)	Assesses degree to which a person gets worried and nervous, is emotional unstable and may have difficulty coping.	4
Participating and Contributing			
Co-curricular questions - Hours per weeks - No. of activities		No. of activities and hours spent. Total hours participating in activities. Response options were 1 hour or less, between 1 and 5 hours, between 5 and 10 hours, and more than 10 hours.	
Extroversion	Donnellan et al. (2006)	Assesses extent to which someone is person focused, social, active and talkative.	4
PSM social commitment subscale	Greenberger, Josselson, Knerr, & Knerr (1974)	Assesses social and psychological maturity, focusing on feelings of community, willingness to work for social goals, readiness to form alliances and interest in long-term social goals.	11

Key Competency	Source	Description	No. Items
Relating to Others			
Agreeableness	Donnellan et al. (2006)	Assesses whether a person is compassionate and sensitive to others' thoughts, feeling and emotions.	
PSM Communication subscale	Greenberger et al. (1974)	Assesses social and psychological maturity, focusing on the ability and confidence to get along, listen to and mix with others.	10
Emotion Understanding Short Form	Abbreviated from Palmer et al. (2003)	Assesses the ability to understand and recognise emotions in others.	5
Connectedness to nature	Abbreviated from Mayer & Frantz (2004)	The top five loading items of this scale were used. Assesses participant's connection to the natural world.	5
Thinking			
Rational and Experiential Inventory	Marks, Hine, Blore, & Phillips (2008)	Assesses whether students engage with and enjoy critical and creative thinking and problem solving.	10
Intellect	Donnellan et al. (2006)	Assesses whether a person is actively curious and imaginative with an interest in ideas.	4
Future Outlook Inventory	NICHD Study of Early Child Care and Youth Development (2008)	Assesses the ability to foresee short and long-term consequences and the decision-making processes.	8
Continuous Lifelong Learning (COL-Inventory)	Peterson et al. (2010)	Assesses beliefs on whether learning is something that they do throughout life.	7

Table 2:   Correlations between subscales in each proposed key competency and the scale reliabilities

	Thinking							Relating to Others							
	KC	1	2	3	*M*	*SD*	alpha		KC	1	2	3	*M*	*SD*	alpha
1	FO				3.73	0.81	.72	1	CN				3.78	0.83	.65
2	LLL	.49**			4.93	0.81	.88	2	COM	.13**			3.88	0.74	.75
3	REI	.46**	.44**		3.80	0.75	.87	3	EU	.28**	.37**		3.56	0.60	.81
4	INT	.21**	.25**	.28**	4.44	0.86	.62	4	AG	.20**	.33**	.44**	4.47	0.86	.71

	Participating & Contributing							Managing Self										
	KC	1	2	3	*M*	*SD*	alpha		KC	1	2	3	4	5	6	*M*	*SD*	alpha
1	EX				3.95	1.07	.76	1	A							3.12	1.05	.86
2	SC	.13**			3.98	0.76	.76	2	SR	-.47**						4.26	0.76	.77
3	HrA	.12**	.14**		2.21	1.31		3	CON	-.15**	.14**					3.57	1.01	.65
4	NoA	.19**	.22**	.51**	3.01			4	ER	-.20**	.16**	.12**				4.06	0.86	.84
								5	EI	-.10*	.10*	.09*	.16**			3.14	0.62	.83
								6	EMC	-.25**	.25**	.19**	.18**	.03		2.86	0.83	.82
								7	NEU	.13**	-.17**	-.13**	-.09*	-.02	-.53**	3.22	0.88	.54

Note. KC = Key Competency; FO = Future Outlook; LLL = Lifelong Learning; REI = Rational Experiential Inventory; INT = Intellect; CN = Connected to Nature; COM = Communication; EUR = Emotion Understanding and Recognition; AG = Agreeableness; EX = Extroversion; SC = Social Commitment; HrA = Hours of Activities; NoA = Number of activities; A = Avoidance; SR = Self Reliance; CON = Conscientiousness; ER= Emotion Reappraisal - Reappraisal; EM= Emotion Management; EI =Ethnic Identity; NEU = Neuroticism; ** *p* <.001, * *p* <.05

Part 2: Relating the Key Competency models to outcomes

Aim

This second part of the study was conducted to examine the extent to which students' responses on the four separate KC models identified in Part 1 could be related to three school outcomes: achievement, academic efficacy and school connectedness (enjoying and feeling a part of school). We made four additional hypotheses concerning these relationships.

Hypothesis 2. Managing Self will be related to all three school outcomes.

Research has generally found that moderate self-reliance, emotional management and control, avoiding novelty, and high conscientiousness and low neuroticism are related to academic achievement and academic efficacy (Dyrness & Dyrness, 2008; Petrides, Frederickson, & Furnham, 2004; Poropat, 2009). The relationship between the Managing Self scales and school connectedness has not been examined. It seems likely that someone who is able to manage themselves, and think positively and calmly about situations may relate better to others (peers and teachers) and enjoy school more (Graziano, Reavis, Keane, & Calkins, 2007). This also highlights the interconnected nature of the KCs with the Managing Self KC being potentially important for the Relating to Others KC.

Hypothesis 3: Relating to Others will be positively associated with school connectedness.

Students who have good communication skills can interpret and read others' feelings and situations well, are sensitive towards others and tend to have better relationships with teachers and peers, which may then be related to greater school connectedness (e.g., Mcgraw, Moore, Fuller, & Bates, 2008).

Hypothesis 4: Participating and Contributing will be related to academic achievement and school connectedness.

Research has generally shown that academic achievement and school connectedness is enhanced by students participating in extra-curricular activities (e.g., McNeely, Nonnemaker, & Blum, 2002). However, some research has suggested that these associations may be confounded with socio-economic status and family income (Wylie, 2005).

Hypothesis 5: Thinking will be related to academic efficacy and academic achievement.

Research has found that a) students who focus on the present or the future generally report preparing more for assessments and have higher academic achievement (Bowles, 2008); b) secondary school students who report having a belief that learning is a lifelong process achieved higher grades in both English and Mathematics (Peterson, Brown, & Irving, 2010); and c) the personality trait intellect is associated with improved academic outcomes (Poropat, 2009).

Method

Participants and procedures

Participants in Part 2 of the study were a subset of those that participated in Part 1 and had available achievement data (see below for details) (N = 297; Age: M = 14.2, SD = .43). The sample consisted of 52% females; 30% New Zealand European, 18% Indian, 15% Asian, 14% Pacifika, 9% Maori, and 14% other ethnicities. The majority of the students were from low or middle decile schools (41% low, 48% middle) and 11% were from high decile schools.

Measures

In addition to the KC questionnaire described in Part 1 (see Table 1, above), students' achievement in English was measured using the Literacy tests within the Assessment Tools for Teaching and Learning (asTTle V4) test system (Hattie et al., 2004). Asttle tests use pre-calibrated IRT score values for each test item, and as a result, regardless of which test is sat by the students, their total scores can be compared across classes, years and schools. The academic efficacy scale was taken from PALS (Pattern of Adaptive Learning Survey; Midgley et al., 2000) and the School Connectedness measure

was adapted from the McNeely, Nonnemaker and Blum (2002) School Connectedness Scale. Each scale consisted of five items and employed a six-point Likert scale (1 = strongly disagree; 6 = strongly agree).

Data analysis[i]

Initially the KC models identified in Part 1 were tested to see if they were a good fit when applied to the smaller sample used in Part 2. In order to check whether the larger sample (N = 644) and the reduced sample used in Part 2 (N = 297) were drawn from the same population, we also examined the KC models to see if they were invariant across the two samples (Wu, Li, & Zumbo, 2007). Finally, the power of each KC model to explain the three different outcome measures was assessed. The same criteria for model fit used in Part 1 were used in Part 2.

To be invariant, several criteria needed to be met. There is some debate over what degree of invariance is required. McArdle (2007) argues that only configural and metric invariance (i.e., equivalent zero parameters and factor regression weights) must be present; whereas, scalar invariance (i.e., equivalent factor intercepts) is required by other researchers (Vandenberg & Lance, 2000). It would seem that, provided configural and metric invariance evidence is found, factor scores can be compared, whereas scalar invariance is required to claim sample equivalence.

A traditional test of metric and scalar invariance is when the difference in χ^2 between the unrestricted model and the restricted models for the two groups is not statistically significant, indicating that the model fits both groups well (Byrne, Shavelson, & Muthén, 1989). However, since χ^2 statistics are overly sensitive to large sample sizes and complex models, a more robust test has been found in the difference of the comparative fit index (CFI); Cheung and Rensvold (2002) have shown that invariance can also be claimed if changes in CFI of no more than .01 are found.

Results

Measurement model invariance

After making adjustments in the analyses to address negative error variance within one model, the fit of the two-group measurement model for each KC was acceptable (see Table 3 below) and invariance was demonstrated indicating that the two samples were equivalent and therefore the factor scores can be compared (see Tables 4 and 5 below).

Structural model linking KCs to outcomes

To evaluate the structural KC models, we examined the squared multiple correlations (SMC) of all regressions onto school connectedness, academic efficacy, and achievement. The School Connectedness and Academic efficacy scales were found to be reliable (α = .86, α = .87, respectively).

The fit of each structural model for Part 2 was acceptable (see Table 6, below). Table 7 (below) indicates that all four KCs were statistically significant predictors of school connectedness and academic efficacy, accounting for between 7% and 55% of the variance. None of the KCs were statistically significant predictors of achievement.

---

[i] More details related to these analyses can be found in an unpublished technical report: Peterson, E. R., Farruggia, S. F., Hamilton, R. J., Brown, G. T. L., & Elley-Brown, M. J. (2013). Socio-emotional key competencies: Technical Report.

Table 3:   Fit statistics for the key competency measurement models in part 1

Key Competency	No. constructs	df	χ^2	p for χ^2/df	CFI	Gamma hat	RMSEA	RMSEA 90% CI	SRMR
Managing Self	7	11	19.30	.06	0.99	0.99	.028	(.000-.049)	.025
Participating	4	1	0.50	.48	1.00	1.00	.000	(.000- .076)	.005
Relating to Others	4	2	6.11	.05	0.99	0.99	.047	(.005-.091)	.019
Thinking	4	2	5.71	.06	0.99	0.99	.044	(.000-.089)	.016

Table 4:   Fit statistics for each key competency model for part 1 and part 2 groups

Key Competency	No variables	df	χ^2	p for χ^2/df	Gamma hat	CFI	RMSEA	RMSEA 90% CI	SRMR
Managing Self	7	23	40.400	.10	0.99	0.98	.028	(.013-.043)	.0640
Participating	4	2	1.909	.33	1.00	1.00	0.00	(.000-.064)	.0570
Relating to Others	4	4	6.960	.19	1.00	0.99	.028	(.000-.062)	.0293
Thinking	4	4	6.754	.19	1.00	1.00	.027	(.000 - .061)	.0218

Note. Part 1 group $N = 644$; Part 2 group $N = 297$.

Table 5:   Invariance statistics for the key competency measurement and structural models

Managing Self	CFI	ΔCFI		Participating & Contributing	CFI	ΔCFI
Unconstrained	0.977			Unconstrained	1.000	
Metric		0.006		Metric		0.014
Scalar		0.002		Scalar		0.003
Strict		0.001		Strict		0.002
Relating to others	CFI	ΔCFI		Thinking	CFI	ΔCFI
Unconstrained	0.993			Unconstrained	0.996	
Metric		0.001		Metric		0.003
Scalar		0.002		Scalar		0.001
Strict		0.004		Strict		0.003

Table 6:   Fit statistics for structural models in part 2 relating statistically significant paths from each key competency to academic efficacy, school connectedness and achievement

Key Competency	No. constructs	df	χ^2	p for χ^2/df	CFI	Gamma hat	RMSEA	RMSEA 90% CI	SRMR
Managing Self	9	24	42.632	.18	0.95	0.99	.051	.024-.098	.0521
Participating & Contributing	6	8	11.252	.24	0.92	1.00	.037	.000-.083	.0381
Relating to Others	7	14	34.600	.12	0.92	0.99	.071	.041-.101	.0426
Thinking	6	9	45.061	.03	0.97	0.99	.065	.047- .085	.0291

Table 7:   Standardised Factor loading and variance explained for each structural key competency model in part 2 on each outcome.

	School connectedness		Academic efficacy		asTTle (achievement)	
Key Competency	beta	SMC	beta	SMC	beta	SMC
Managing Self	.35	.12	.69	.47	NS	
Participating & Contributing	.58	.33	.38	.14	NS	
Relating to Others	.41	.17	.52	.27	.12[*]	.01
Thinking	.27	.07	.74	.55	NS	

Note. All loadings are statistically significant at $p < .05$;

* $p = .07$

Discussion

This study found that there are existing instruments which relate to the New Zealand socio-emotionally oriented KCs of Thinking, Managing Self, Relating to Others, and Participating and Contributing. However, when attempting to employ all these instruments simultaneously to measure related KCs, the value of the individual model measures was diminished. This is in keeping with Hipkins' (2006) assertion that any one New Zealand KC includes the use of all the other KCs.

The identified modelled instruments for the four socio-emotional KCs (Managing Self, Relating to Others, Participating and Contributing, and Thinking) had statistically significant associations with school connectedness and academic efficacy. This suggests that all four KCs are important for feeling part of school, enjoying school and for having confidence in one's academic abilities. The strongest predictor of school connectedness was Participating and Contributing, which is in keeping with the notion that those students who get involved in activities both in and out of the classroom feel a stronger connection to school (McNeely et al., 2002). The Managing Self KC accounts for the highest amount of variance in the academic efficacy measure. Those students who reported an ability to control and manage their emotions, show independence and have a sense of who they are, and strive to protect that, also believe they are able to control their learning and achieve.

The lack of significant relationships between the KCs of Managing Self, Thinking, and Participating and Contributing with achievement was surprising. Managing Self might not have related directly to achievement because the assessment was an external teacher-directed test, which are often highly structured and hence a high degree of student self-management may not be needed. A stronger relationship may be found with internal assessment, which typically requires a higher degree of self-regulation. In terms of the Thinking KC, a direct relationship with achievement may not have occurred due to the tests of achievement not having a strong critical thinking component. More research is needed to explore these possibilities.

Concluding comments

We believe our findings are the first to indicate empirically that four New Zealand socio-emotional KCs can be modelled using existing psychological scales and that when combined, they relate meaningfully to both academic efficacy and school connectedness. We acknowledge that our KC models suggest just one way in which the competencies can be understood and measured. There are likely to be many other possible interpretations along with other psychometric questionnaires that could be employed. This paper simply creates a starting point on which other models could be built and tested.

While the assessment of socio-emotional competencies is controversial, the results of this study help start the process of identifying potential assessable components of each KC. In addition, it suggests that if schools want to get a quick measure of baseline competencies against which KC change could be measured or monitored, a questionnaire approach such as this may be a starting point.

Another strength of our questionnaire is that the questions cut across domains. This addresses some concerns that KCs can only be measured if they consider differing and changing contexts, e.g., home, peers, neighbourhoods (Matters & Curtis, 2008; Gordon et al., 2009). Questionnaires that include different contexts or are pitched at a domain general level are more time and cost efficient than assessments undertaken in multiple different contexts.

There are a number of limitations to this study. The participants in the study are not representative of New Zealand's population, hence caution is needed when applying these findings to students in other schools and other year groups. We also used self-reported measures of the KCs which are open to self-reported bias. Finally as noted above, the nature of the achievement data used, that is, the use of teacher-directed test as opposed to internal assessments, was also potentially limiting.

In conclusion, while there are obviously more lines of research that could be pursued and other scales that could be examined with respect to potential relationships with each KC, this study provides an important platform from which other studies can be based. We have demonstrated that one interpretation of the four New Zealand socio-emotional KCs can be assessed using a collection of

existing psychological tools and that all four of these modelled KCs are important for developing school connectedness and academic efficacy.

Acknowledgements

References

Arbuckle, J. (2005). *Amos 17.0 Users' Guide*. Chicago, IL: SPSS.

Bowles, T. (2008). The relationship of time orientation with perceived academic performance and preparation for assessment in adolescents. *Educational Psychology: An International Journal of Experimental Educational Psychology, 28,* 551–565. doi:10.1080/0144341070188013

Boyd, S., & Watson, V. (2006). *Shifting the frame: Exploring the integration of the key competencies at six normal schools*. Wellington, New Zealand: NZCER.

Brown, G. T. L., Reddish, P., Leeson, H. V., Milfont, T. L., Brychkova, L., & Hattie, J. A. C. (2005). *Assessment of the key competencies: A proposal for inclusion in e-asTTle* (asTTle advisory report 19). Auckland, New Zealand: Assessment Tools for Teaching and Learning, Auckland Uniservices.

Byrne, B. M., Shavelson, R. J., & Muthén, B. (1989). Testing for the equivalence of factor covariance and mean structures—the issue of partial measurement invariance. *Psychological Bulletin, 105,* 456–466.

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling, 9,* 233–255.

Crick, R. D. (2008). Key competencies for education in a European context: Narratives of accountability or care. *European Educational Research Journal, 7,* 311-318. doi:10.2304/eerj.2008.7.3.311

Dempster, A. P., Laird, N. M., & Rubin, D. B. (1977). Maximum likelihood estimation from incomplete data via the EM algorithm (with discussion). *Journal of the Royal Statistical Society, Series B, 39,* 1–38. Retrieved from http://www.jstor.org

Donnellan, M., Oswald, F. L., Baird, B. M., & Lucas, R. E. (2006). The Mini-IPIP Scales: Tiny-yet-effective measures of the Big Five Factors of Personality. *Psychological Assessment, 18*(2), 192–203. doi:10.1037/1040-3590.18.2.192

Dyrness, R., & Dyrness, A. (2008). Making the grade in middle school. *Kappa Delta Pi Record, 44*(3), 114–118. doi:10.1080/00228958.2008.10516507

Fan, X., & Sivo, S. A. (2005). Sensitivity of fit indexes to misspecified structural or measurement model components: Rationale of two-index strategy revisited. *Structural Equation Modelling, 12,* 343–367. doi:10.1207/s15328007sem1203_1

Gordon, J., Halasz, G., Krawczyk, M., Leney, T., Michel, A., Pepper, D. … Wesniewksi, J. (2009). *Key competencies in Europe: Opening doors for lifelong learners across the school curriculum and teacher education* (Report No. 87). Warsaw, Poland: Center for Social and Economic Research.

Graziano, P. A., Reavis, R. D., Keane, S. P., & Calkins, S. D. (2007). The role of emotion regulation in children's early academic success. *Journal of School Psychology, 45,* 3–19.

Greenberger, E., Chen, C., Dmitrieva, J., & Farruggia, S. P. (2003). Item-wording and the dimensionality of the Rosenberg Self-Esteem Scale: Do they matter? *Personality and Individual Differences, 35,* 1241–1254.

Greenberger, E., Josselson, R., Knerr, C., & Knerr, B. (1974). *The measurement and structure of psychosocial maturity* (Report No. 170). Baltimore, MD: Johns Hopkins University..

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology, 85,* 348–362. doi:10.1037/0022-3514.85.2.348.

Hipkins, R. (2006). *The nature of the key competencies: A background paper*. Wellington, New Zealand: NZCER.

Hipkins, R., Boyd, S., & Joyce, C. (2006). *Documenting learning of the key competencies: What are the issues? A discussion paper*. Wellington, New Zealand: NZCER.

Hu, L. T. & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6,* 1–55. doi:10.1080/10705519909540118.

Marks, A. D. G., Hine, D. W., Blore, R. L., & Phillips, W. J. (2008). Assessing individual differences in adolescents' preference for rational and experiential cognition. *Personality and Individual Differences, 44,* 42–52.

Matters, G., & Curtis, D. (2008). *A study into the assessment and reporting of employability skills of senior secondary students*. Brisbane, QLD, Australia: Australian Council for Educational Research.

Mayer, F. S. & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology, 24,* 503–515.

McArdle, J. J. (2007). Five steps in the structural factor analysis of longitudinal data. In R. Cudeck & R. C. MacCallum (Eds.), *Factor analysis at 100: Historical developments and future directions* (pp. 99–130). Mahwah, NJ: LEA.

Mcgraw, K., Moore, S., Fuller, A., & Bates, G. (2008). Family, peer and school connectedness in final year secondary school students. *Australian Psychologist, 43,* 27–37. doi:10.1080/00050060701668637.

McNeely, C. A., Nonnemaker, J. M., & Blum, R. W. (2002). Promoting school connectedness: Evidence from the National Longitudinal Study of Adolescent Health. *Journal of School Health, 72,* 138–147.
doi:10.1111/j.1746-561.2002.tb06533.x

Midgley, C., Maehr, M. L., Hruda, L. Z., Anderman, E. M., Anderman, L., Freeman, K. E., & Urdan, T. (2000). *Manual for the patterns of adaptive learning scales*. University of Michigan. Retrieved from http://www.umich.edu/~pals/manuals.html

Ministry of Education. (2007). *The New Zealand Curriculum: The English-medium teaching and learning in Years 1–13*. Wellington, New Zealand: Learning Media.

Muthén, L. K., & Muthén, B. O. (2007). *Mplus User's Guide* (6th ed.). Los Angeles, CA: Authors.

NICHD Study of Early Child Care and Youth Development. (2008). *NICHD Study of Early Child Care and Youth Development: Phase IV instrument documentation*. Retrieved from https://secc.rti.org/Phase4InstrumentDoc.pdf

OECD. (2005). *The definition and selection of key competencies: Executive summary*. Paris, France: Author.

Palmer, B., Stough, C., & Luebbers, S. (2003). *Swinburne University of Technology (SUEIT) adolescent self-report version—2003*. Melbourne, VIC, Australia: Swinburne Centre for Neuropsychology, Swinburne University of Technology.

Peterson, E. R., Brown, G. T. L., & Irving, S. E. (2010). Secondary school students' conceptions of learning and their relationship to achievement. *Learning and Individual Differences, 20,* 167–176. doi:10.4236/psych.2013.41006

Peterson, E. R., Farruggia, S. F., Hamilton, R. J ., Brown, G. T., & Elley-Brown, M. J. (2013). *Socio-emotional key competencies: Technical Report*. Unpublished report.

Petrides, K. V., Frederickson, N., & Furnham, A. (2004). The role of trait emotional intelligence in academic performance and deviant behavior at school. *Personality and Individual Differences, 36,* 277–293. doi:10.1016/S0191-8869(03)00084-9

Poropat, A. E. (2009). A meta-analytis of the five factor model of personality and academic performance. *Psychological Bulletin, 135,* 322–338. doi:10.1037/a0014996

Reid, A. (2006). Key competencies: A new way forward or more of the same? *Curriculum Matters, 2,* 43–62.

Roberts, R. E., Phinney, J. S., Masse, L. C., Chen.Y. R., Roberts, C. R., & Romero, A. (1999). The structure of ethnic identity in young adolescents from diverse ethnocultural groups. *Journal of Early Adolescence, 19,* 301–322.

Sewell, K., (2009). *Why do key competencies matter?* [Video podcast]. Retrieved from http://keycompetencies.tki.org.nz/School-stories/Leaders-talk/Why-do-key-competencies-matter/Preparing-our-children

Trier, U. P. (2002). Twelve countries contributing to DeSeCo: A summary report. In D. S. Rychen, L. H. Salganki, & M. E. McLaughlin (Eds.), *Definition and selection of key competencies: Contributions to the second DeSeCo Symposium* (pp. 1–60). Neuchatel, Switzerland: Swiss Federal Statistical Office.

Vandenberg, R. J., & Lance, C. E. (2000). A review and synthesis of the measurement invariance literature: Suggestions, practices, and recommendations for organizational research. *Organizational Research Methods, 3*, 4–70.

Wu, A. D., Li, Z., & Zumbo, B. D. (2007). Decoding the meaning of factorial invariance and updating the practice of multi-group confirmatory factor analysis: A demonstration with TIMSS data. *Practical Assessment, Research & Evaluation, 12,* 1–26. Retrieved from http://pareonline.net/getvn.asp?v=12&n=13

Wylie, C. (2005, December). *Leisure activities and adolescent engagement in school learning*. Paper presented at NZARE, Dunedin, New Zealand. Retrieved from http://www.nzcer.org.nz/pdfs/14525.pdf