ISCY
International Study of City Youth

ISCY Technical Paper:
Measuring 21st Century Skills in ISCY

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Exploring the development of non-cognitive, or "21st century" skills, is an important goal of the International Study of City Youth (ISCY). This paper sets out a framework for measuring 21st century skills in ISCY alongside selected measures of student engagement and dispositions towards school, to inform analysis of the skills across the 12 cities participating in the ISCY project. The proposed framework draws on contemporary literature, as well as conceptual and quantitative analysis of the ISCY Student Survey data, to develop robust scales for measuring the skills in an international context.

Introduction

Increasing attention is being given in contemporary educational research to non-cognitive or 21st century skills[1], or capabilities believed to meet the demands of "21st century work" (Silva 2008, p. 1). While test scores have been centre stage in international comparisons, there has been growing recognition of the effects that education has on the development of interpersonal and intrapersonal skills and capabilities that affect the success of students in school and success in the labour market (e.g. Levin, 2012). Some studies point to lasting effects of non-cognitive skills on student's lives including impacts on educational, career and health outcomes (see, for example, Kautz et al., 2014). Emphasising these skills, alongside core literacy and numeracy, arguably creates "more powerful learning experiences that lead to deeper understanding and more useful knowledge in tune with our times" (Trilling & Fadel 2009, p. 172). Assessing such skills may also help make visible the achievements of students who do not perform well in academic tests, and the contribution schools make to their learning (Jordan 2010). Capturing how well these skills are developed is therefore an important goal of the International Study of City Youth (ISCY).

This paper sets out to establish a common framework for the measurement of 21st century skills, to be used by all cities involved in the ISCY project. ISCY is an international longitudinal study of 10th Grade students being conducted in 12 cities around the world, to find out more about student journeys through school into further study, work and life beyond school. As well as cognitive skills, student plans, attitudes to school, and engagement, the study aims to measure a range of 21st Century skills and the extent to which they affect student progress and later outcomes. Establishing a common framework for measuring 21st century skills in ISCY is not an easy task. The development of the ISCY Student Survey drew on many international instruments for measuring student skills, attitudes and behaviours (PISA student survey, ESLS student survey, the Gallup student poll, Education Longitudinal Study of 2002, High School Survey of Student Engagement, the University of Chicago Consortium for School

[1] The skills discussed in this paper have been variously referred to as "21st century" or "non-cognitive" skills in international literature. The term "21st century skills" has been adopted for this paper.

Research student survey, the big five questionnaire, as examples). Items from these instruments were used selectively and judiciously, to enable the survey to cover a broad range of topics while remaining at a manageable length for students. Translation into different languages also necessitated adjustments to some items, to maximise international consistency. Some entirely new items were also created, based on the interests and contemporary contexts of the participating cities. For these reasons, it is not possible to simply map ISCY survey items to established instruments, to easily determine which constructs they are measuring.

Previous work on 21st Century Skills

Since the ISCY Student Survey was created, new research in this field has emerged, including valuable syntheses of prior international literature (e.g. Farrington et al 2012; Gutman & Schoon 2013). The literature reflects a "confusing, overlapping array of concepts and terms" (Farrington et al 2012), with numerous scholars proposing various taxonomies of 21st century skills, each comprising a different set of constructs. While there may be general agreement in the literature that 21st century skills are important, there is far less agreement as to what these skills are; whether they are malleable; whether they have any effect on other outcomes; and how they might be measured (Gutman & Schoon 2013). This paper seeks to chart a course through this literature that will facilitate analysis for ISCY researchers.

Table 1 summarises the measurability, malleability, effect and strength of evidence for eight key groups of 21st century skills identified in the literature.

Table 1 Gutman & Schoon's summary of findings on non-cognitive (21st century) skills

	Quality of measurement	Malleability	Effect on other outcomes	Strength of evidence
1. Self-perceptions				
Self-concept of ability	High	Medium	Not available	Medium
Self-efficacy	High	High	High	Medium
2. Motivation				
Achievement goal theory	High	Medium	Low to medium	Medium
Intrinsic motivation	High	Medium	Low to medium	High
Expectancy-value theory	Medium	Not available	Medium to high	Medium
3. Perseverance				
Engagement	Medium	Not available	Not available	Low
Grit	Medium	No evidence	No evidence	Low
4. Self-control	Medium	Low to medium	Low	Medium
5. Meta-cognition	Medium	Medium to high	Medium to high	High
6. Social competencies				
Leadership skills	Low	Not available	No evidence	Low
Social skills	Medium	Medium to high	Low to medium	High
7. Resilience & coping	Medium	High	Low	Medium
8. Creativity	Medium	Not available	No evidence	Low

Source: Gutman & Schoon 2013, p. 2.

As Table 1 shows, current research on 21st century skills is characterised by a high volume of activity, but relatively limited evidence regarding clearly measurable constructs that are known to have an impact on learning. The task of developing a 21st century skills framework for ISCY therefore involves some degree of professional judgement, in identifying literature that best offers a pathway through this complicated field. Two frameworks were identified as particularly relevant to the ISCY project.

1. Bridging the gap between skills and personality

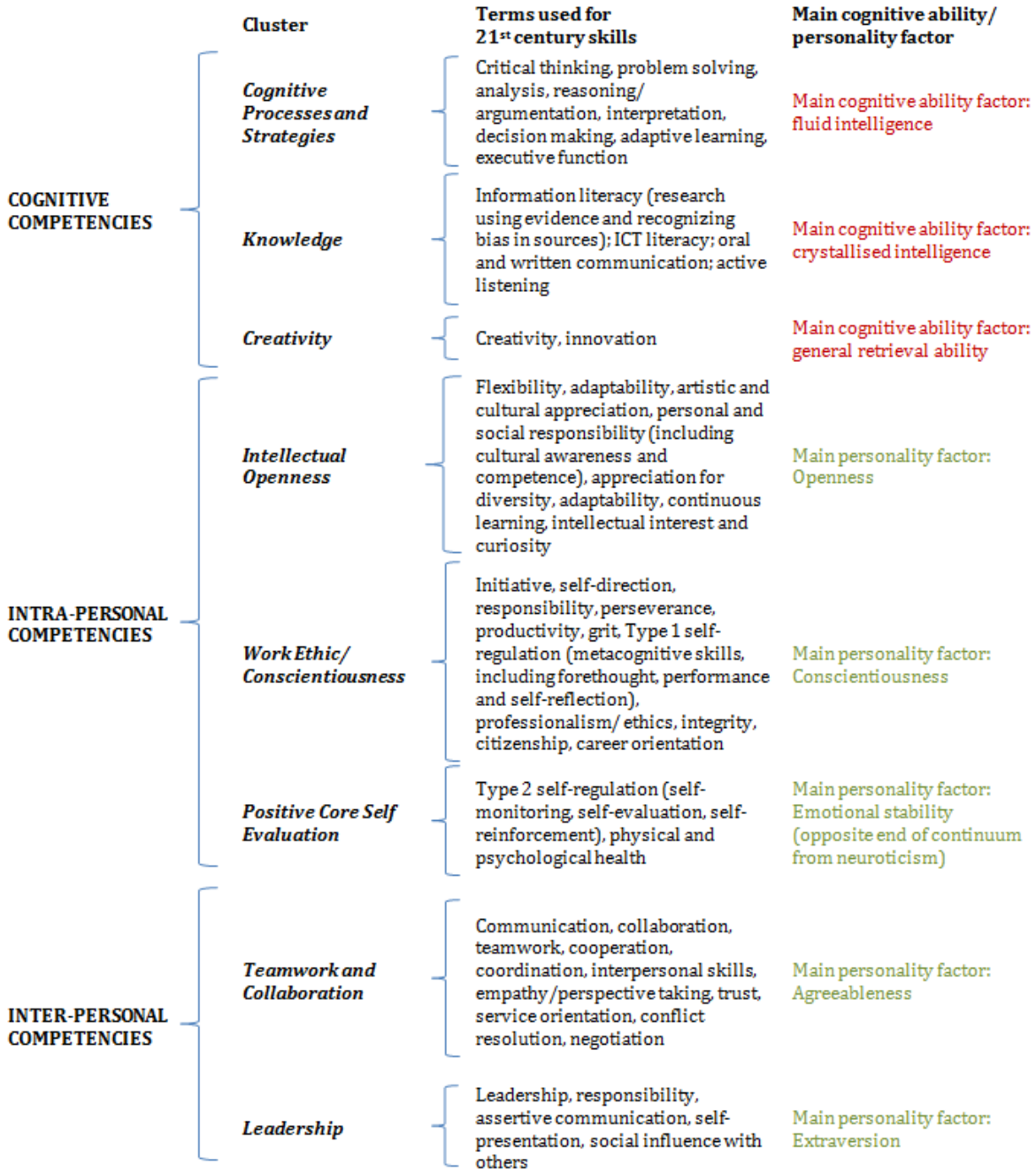
The first framework used in developing the ISCY 21st century skills framework is Pellegrino and Hilton's taxonomy (2012) (Figure 1), developed for the US National Academy of Sciences, and subsequently adopted in a recent US Department of Education report (Schectman et al 2013). This taxonomy identifies eight "clusters" of 21st century skills from the literature, and maps these against the "Big 5" personality traits (openness; conscientiousness; emotional stability; agreeableness; and extraversion), as well as three core cognitive abilities from Carroll's (1993) Cognitive Abilities Taxonomy (cognitive processes and strategies; knowledge; and creativity).

This taxonomy is valuable in bridging the gap between personality traits and 21st century skills. While these may sometimes be conflated, personality traits are more stable and less malleable than skills, and also more ambiguous in their desirability. For example, the personality trait of openness may be less desirable than conservatism in some circumstances (such as following a recipe); and even the trait of neuroticism has been found to have some positive effects (Turiano et al 2013). These traits are therefore unlikely to be useful measures of what schools should aim to cultivate in their students.

An example from the ISCY Student Survey is the item "I prefer to work alone". This arguably can be viewed as a measure demonstrating the personality trait of extroversion (in reverse). But what does this tell us about the individual as a learner? A preference to work alone does not necessarily equate to an inability to work well with others; indeed, preliminary analysis suggests that the correlation between agreement with this statement, and disagreement with the statement "I work well in groups", is not especially strong.

Skills are a far more useful measure, as they are malleable and therefore open to influence and development by schools. Skills are also more clearly desirable than personality traits, as they measure growth in what an individual can do, rather than their intrinsic qualities. While individuals with certain personality traits may develop some skills more easily than others, schools must seek to ensure that all students have opportunities to cultivate the skills that matter for life and learning. The taxonomy at Figure 1 lists the many skills that schools may seek to cultivate, to equip their students for future success.

Figure 1 21st century skills clusters, with associated cognitive abilities and personality traits



Source: Pellegrino & Hilton 2012, pp. 2-12–2-14 (adapted).

2. Connecting 21st century skills to educational success

The taxonomy at Figure 1 provides a useful conceptual foundation for differentiating between malleable skills and non-malleable traits, but it does not address how these skills operate within the education system. This is a key concern of the ISCY project,

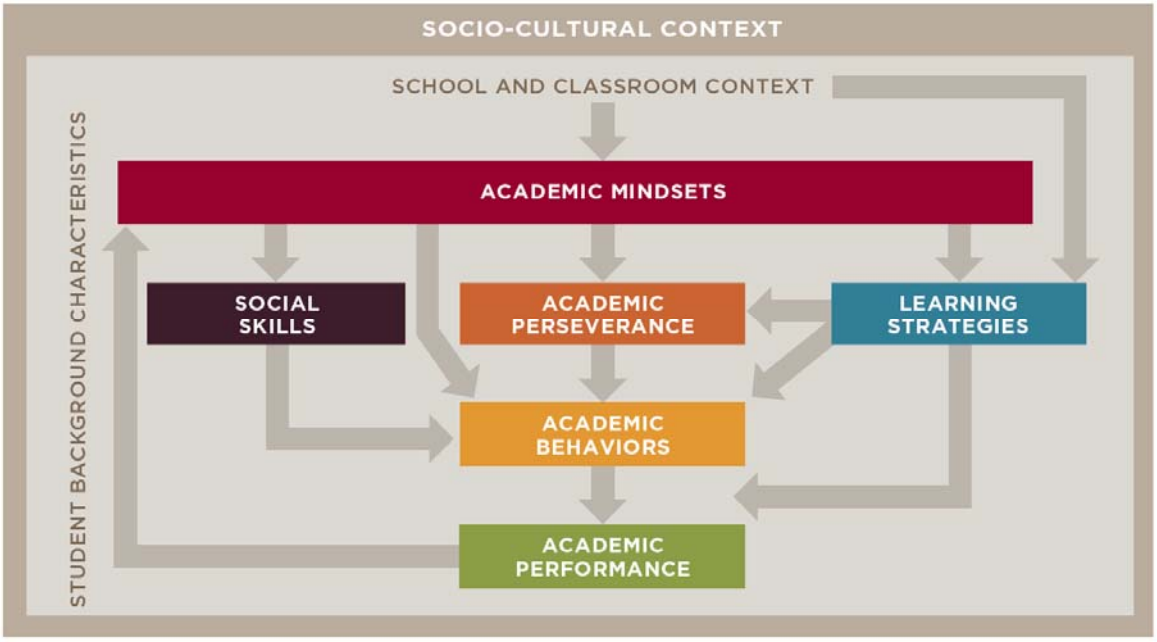
especially the role of 21st century skills in contributing to student achievement and reducing the impact of educational failure.

The University of Chicago Consortium on Chicago School Research (CCSR) has developed a hypothetical framework, showing how 21st century skills might support student achievement. A key feature of this framework is the notion of *academic mindsets*, which CCSR defines as follows:

- I belong in this academic community (sense of belonging)
- My ability and competence grow with effort (implicit theories of ability)
- I can succeed at this (self-efficacy)
- This work has value for me (expectancy-value theory)

CCSR suggests that educators focus their efforts on cultivating these mindsets, rather than attempting to foster skills that are "not directly malleable and depend considerably on context" (Nagaoka et al. 2013, p. 48). By fostering academic mindsets, educators can drive their students' *academic perseverance* (or persistence with academic tasks), as well as assisting in the development of *social skills* and *learning strategies*. In turn, these factors lead to improved *academic behaviours* (such as positive classroom behaviour and study habits), culminating in improved *academic performance*. As performance improves, positive academic mindsets are reinforced, creating a self-perpetuating cycle of improvement (Figure 2).

Figure 2 CCSR's hypothetical model of the relationship between non-cognitive factors (21st century skills) and academic performance



Source: Farrington et al 2012, p. 12.

This model is an attractive tool for organising the various skills, attitudes and behaviours measured in the ISCY Student Survey. Of course, ISCY cannot claim to

measure comprehensively all of the complex constructs in this model; for example, ISCY does not capture detailed information related to specific *learning strategies* adopted by students, which are captured in leading international measures of this construct (Pintrich et al. 1993). Nevertheless, the model provides a guide as to how ISCY survey items can be organised usefully into a series of scales that reflect current understandings of 21st century skills, and how they operate in interconnected ways to improve student learning.

Developing the ISCY Framework

The ISCY Framework for 21st century skills and engagement was developed inductively and deductively, using quantitative analysis of data from baseline ISCY Student Survey, supported by a review of current literature on 21st century skills and engagement, and using the various existing taxonomies or models of skills as guides. Twelve scales were developed for measuring the constructs of 21st century skills, academic dispositions and student engagement, with two further scales for measuring cognitive skills (maths and reading). The scales will be used in comparing data between ISCY cities, as well as comparing data for different student groups within and across cities.

The process for developing the ISCY Framework was as follows:

1. Identifying ISCY Student Survey items likely to measure constructs relevant to skills, engagement and dispositions;
2. Conducting a principal component analysis with baseline Student Survey data[2], to identify items that group into scales, and confirming the validity of scales;
3. Using the related literature on models of relationships between factors and outcomes, to organise the scales into a framework for analysis.

Each of these stages of development is detailed below. Once the framework was developed, a score for each ISCY student was calculated.

1. Identifying items likely to measure relevant constructs

The ISCY student survey questionnaires included numerous items on student characteristics, student family background, student perceptions and dispositions, views on school, engagement in school, educational and career plans, civic participation, political and social values, and 21st Century skills. Many of the items included in the ISCY student survey were based on items used in the OECD Programme for International Student Assessment (PISA) in order to promote consistency in international comparisons. This included items on engagement and dispositions as well as student background and characteristics. Many of the non-cognitive skill items were modelled on existing surveys and scales, such as the *Big Five* measuring openness, conscientiousness, agreeableness, extraversion, and emotional stability (see Borghans et al., 2008) and the University of Chicago School Consortium on School Research *My Voice, My School* student questionnaire measuring academic behaviours, relations with peers and teachers, dispositions, perseverance, and social skills.

[2] Cities with baseline data available were Melbourne, Ghent, Montreal, Hong Kong, Bergen, Barcelona, Sacramento, Santa Barbara, and Wroclaw.

The majority of measures of 21st century skills in the ISCY Student Survey are items in which students indicate their opinion on a Likert scale[3]. Some of these items provide a direct self-report of the student's skill level (such as "I am good at leading others"), whereas others provide indirect indicators of certain dispositions (such as "There is little to prevent me from reaching my goals"). Student self-report is a well-established method of measuring 21st century skills (Child Trends, 2014). Indeed, some researchers have argued that non-cognitive skills can only really be assessed through self-reported questionnaires that elicit dimensions such as the Big Five (see John & Benet-Martínez, 2000).

Other types of measures can also be valuable for inclusion such as measures of behavioural engagement that call on frequencies of behaviour. The strongest measures of behavioural engagement can be items relating to the frequency with which the student engages in behaviours, for example, those that are often associated with or predictive of disengagement from school, including skipping classes, coming late to school, or getting into trouble frequently with teachers due to their behaviour. In the ISCY survey, four such items had comparable data available for all cities. Other items were noted as potential measures of positive behavioural engagement, such as involvement in extra-curricular activities, but these are rather dependent on city and school policies linked to provision of such activities and therefore may not facilitate reliable international comparisons. These items may nevertheless be valuable for future analysis alongside the scales developed for ISCY, especially in measuring student engagement.

Other ISCY student survey items excluded from consideration for the current scale development work included:

- Items relating to the student's perception of their own school, as they relate specifically to the student's own school, rather than more general academic dispositions.
- Items related directly to a student's wellbeing outside of school (such as happiness with life at home), as the framework concerns student engagement with schooling and education.
- Items related to civic engagement. It is nevertheless recognised that civic engagement is an important skill for schools to cultivate, both for its intrinsic value and its flow-on effects for learning and engagement (Cress 2012).

Where possible, items were selected that were available for all cities. Most Likert-scaled items complied with this criterion, except for four items not available for Montreal.[4]

[3] It is acknowledged that the use of Likert scales for this purpose rests on certain assumptions:
- The distance between values within each Likert scale is considered to be equivalent. For example, the distance between "Disagree" and "Agree" is assumed to be equal to the distance between "Agree" and "Strongly agree".
- It is assumed that scales using a similar structure are comparable. For example, the scale "Strongly disagree/ Disagree/ Agree/ Strongly agree" is assumed to be comparable to "Very unhappy/ Unhappy/ Happy/ Very happy".

[4] The following items were excluded from the Montreal Student Survey:
- Right now I see myself as being pretty successful as a student;
- There is little that can prevent me from reaching my goals;

These items were still retained in the framework, as they measure important constructs. Values were imputed for these items for the majority of Montreal students.

2. Using principal component analysis to identify scale components

Principal component analysis (PCA) was conducted using a large number of potential survey items, to explore how the items tended to group or cluster. PCA is a commonly used technique for creating indices as its main purpose is to reduce the dimensionality in data without losing relevant information. The idea of the method is to convert a set of observations of correlated variables into a set of values of linearly uncorrelated variables called principal components which account for as much as possible of the variance of the included data items (see, Abdi & Williams, 2010).

PCA was conducted to explore how the identified potential skill, disposition and engagement variables grouped into principal components. The analysis produced 11 principal components, with three to eight items loading most strongly against each one. Two adjustments were made at this stage:

- One component comprising eight items was separated into two scales. These items concerned the level of student emotional engagement and sense of belonging at school, such as "I like being at school" and "I get a feeling of satisfaction from what I do in class". There is a clear relationship between these items, and similar items have been grouped together in prior research (see Rotermund 2010). Nevertheless, other literature supports a separation between a sense of belonging in the school environment, which has more of a social quality, and a sense of intellectual satisfaction in school work (Taylor & Parsons 2011, p. 20). While these scales are closely related, it seems plausible that a student may score highly on one but not the other.

- One component involves only two items, "I like to think of new ways to do things" and "I am good at coming up with new ideas" and relates to the concept of creativity. The use of two items to measure creativity, while not ideal, is supported by a number of researchers who have developed shorter inventories for measuring non-cognitive skills (see for example the discussion by Gosling et al, 2003, on the development and application of a ten-item inventory for measuring the Big Five domains). All other scales have three or more items.

The highest loadings for each component are reported in Table 1 with Cronbach Alpha reliability estimates at the end of the table.

- I can think of many ways to reach my current goals;
- There are lots of ways around any problem that I am facing now.

Table 1 Results of principal component analysis for ISCY Student Survey with construct labels

	Purpose	Behvioural engagement	Cognitive engagement	Emotional engagement	Conscientiousness	Belonging	Hope	Self-efficacy	Collaboration	Communication	Creativity	Self-Management
Working hard in school matters for success in the workforce	0.88											
What we learn in class is necessary for success in the future	0.80											
School teaches me valuable skills	0.74											
My classes give me useful preparation for what I plan to do in life	0.70											
Skipped a class without permission		0.85										
Been absent from school for a day without permission		0.82										
Been in trouble with a teacher because of your behaviour		0.47										
Arrived late at school		0.66										
I get into trouble frequently at school		0.27										
In class, I try to work as hard as possible			0.83									
In class, I put in my best effort			0.81									
In class, I keep working even if the material is difficult			0.79									
School is often a waste of time				0.31								
I get a feeling of satisfaction from what I do in class				-0.39								
High level of interest in school work				-0.31								
I find most school work boring				0.56								
Hours of homework					0.45							
I always try to do my best					0.88							
I always get work in on time					0.80							
I persevere with a job until it is done					0.74							
I am a hard working student					0.70							
I feel safe at school						-0.64						

I will leave this school with good memories						-0.61						
Happy with life at school						-0.66						
I like being at school						-0.65						
I am confident of finding a good job when I finish my studies							-0.50					
Happy with future							-0.53					
There is little that can prevent me from reaching my goals							-0.68					
Right now I see myself as being pretty successful as a student								-0.52				
I can think of many ways to reach my current goals								-0.75				
There are lots of ways around any problem that I am facing now								-0.79				
I am confident of doing well in school								-0.53				
I understand how others are feeling									0.66			
I get along well with others									0.66			
I work well in groups									0.65			
I treat others fairly									0.55			
I take time to help others									0.49			
I express ideas clearly in oral presentations										-0.71		
I express ideas clearly in written text										-0.61		
I am good at getting ideas across in discussions										-0.74		
I am good at leading others										-0.60		
I like to think of new ways to do things											-0.67	
I am good at coming up with new ideas											-0.63	
I am easily distracted in class												0.68
I tend to be lazy												0.77
I tend to leave things to the last minute												0.78
Cronbach's Alpha	0.81	0.70	0.82	0.71	0.69	0.74	0.71	0.78	0.77	0.74	0.68	0.70

It is important to note that the goal here was not to use the PCA to validate the existing constructs (such as the Big Five) of 21st Century skills and student engagement and dispositions, but rather to evaluate the degree to which sets of items used in the ISCY student survey and drawn from larger inventories assess the same constructs as those used in longer, established measures. Construct validity can be defined in terms of the degree to which a construct shows theoretically predicted patterns of correlations with other related and unrelated constructs, and the results of the PCA are broadly consistent. The reliabilities of the twelve scales were tested using Cronbach's Alpha, though it should be stated that good fit indices for items which are designed to measure broad domains may not always generate high alphas. Some researchers point to the misleading place of alphas when calculated on scales with smaller numbers of items (e.g. Kline, 2000; Wood & Hampson, 2005). This said, nearly all scales returned a good alpha estimate, with most returning strong values. The test was also conducted for each scale for each of the individual cities, with good or strong alphas returned for each scale.

3. Method for deriving scale scores

Once the twelve scales had been identified from the PCA and conceptual mapping, the method used to construct the scales from the identified items was the same as that employed in the scaling of the American Human Development Index (see Social Science Research Council, 2014). The Human Development Index (HDI) is a summary measure of key dimensions of human development and is set on a scale of 0 to 10. One of the advantages of using this approach to scaling is that the results can be compared using a consistent scale which provides a simple means for communicating results, as well as providing robust measures for analysis.

To calculate each scale using the HDI method, the minimum and maximum values were identified for each underlying scale item. Performance in each dimension is expressed as a value between 0 and 10 by applying the following general formula:

$$\text{Item value} = \frac{\text{actual score} - \text{minimum value}}{\text{maximum value} - \text{minimum value}} \text{X10}$$

Each scale is calculated by taking the average of the component items transformed using the above formula. Since all components range from 0 to 10, each derived scale also varies from 0 to 10, with 10 representing the highest level of skill, engagement or disposition. An example is provided based on the items classified as part of the 'conscientiousness' scale.

Example: calculating the *Conscientiousness Index*

The Conscientiousness Index is made up of five items:

1. Hours of homework
2. I always try to do my best
3. I always get work in on time
4. I persevere with a job until it is done
5. I am a hard working student

The Index is derived by calculating the values for each scale item using the following method where a student has responded with the values of 3, 2, 3, 2, and 3 to the 5 items:

$$\text{Item 1} = \frac{\text{actual score} - \text{minimum value}}{\text{maximum value} - \text{minimum value}} \quad \frac{3-1}{4-1} \quad X10 \quad = 6.67$$

$$\text{Item 2} = \frac{\text{actual score} - \text{minimum value}}{\text{maximum value} - \text{minimum value}} \quad \frac{2-1}{5-1} \quad X10 \quad = 2.50$$

$$\text{Item 3} = \frac{\text{actual score} - \text{minimum value}}{\text{maximum value} - \text{minimum value}} \quad \frac{3-1}{5-1} \quad X10 \quad = 5.00$$

$$\text{Item 4} = \frac{\text{actual score} - \text{minimum value}}{\text{maximum value} - \text{minimum value}} \quad \frac{2-1}{4-1} \quad X10 \quad = 3.33$$

$$\text{Item 5} = \frac{\text{actual score} - \text{minimum value}}{\text{maximum value} - \text{minimum value}} \quad \frac{3-1}{4-1} \quad X10 \quad = 6.67$$

The Index is calculated by taking the simple average of the five item scores. Since all five components range from 0 to 10, the Index itself also varies from 0 to 10, with 10 representing the highest level of self-efficacy. Using the example the result would be:

Mean (item 1, item 2, item3, item4, item5) = Mean (6.67+2.50+5.00+3.33+6.67) = 4.83

The final set of constructs with their means and standard deviations for all students are reported in Table 2.

Table 2 Final list of scale constructs with means and standard deviations

Scale	N	Minimum	Maximum	Mean	Standard Deviation
Behavioural Engagement	26720	0	10	7.9	2.0
Belonging	26772	0	10	6.6	1.8
Collaboration	25866	0	10	7.1	1.5
Creativity	25766	0	10	6.3	2.0
Effort	26399	0	10	6.0	2.5
Interest	26769	0	10	5.7	1.8
Hope	26529	0	10	6.6	1.9
Purpose	26667	0	10	6.6	2.0
Self-efficacy	25860	0	10	6.4	1.9
Self-control	25817	0	10	4.1	2.1
Communication	25843	0	10	6.2	1.8
Conscientiousness	26757	0	10	6.3	1.7

4. Missing values

For each of the scales, a majority of students had data for all the sub-items as shown in Table 3.

Table 3 Percentage of students with responses to all items, by scale (%)

	% students with all items		% students with all items
Behavioural Engagement	93.1	**Hope**	92.4
Belonging	93.2	**Purpose**	92.9
Collaboration	90.1	**Self-efficacy**	90.1
Creativity	89.7	**Self-control**	89.9
Effort	91.9	**Communication**	90.0
Interest	93.2	**Conscientiousness**	93.2

Cases that had missing values for all 49 scale items were removed from analysis. The number of cases removed for each city, and the adjusted number of cases, are listed in Table 4.

Table 4 Number of missing cases for all scale items

City	Original *n*	Missing all	%	Adjusted *n*
Melbourne	4,781	123	2.6%	**4,658**
Bergen	2,329	140	6.0%	**2,189**
Montreal	4,119	323	7.8%	**3,796**
Ghent	2,354	48	2.0%	**2,306**
Hong Kong	6,315	371	5.9%	**5,944**
Barcelona	2,128	78	3.7%	**2,050**
Wroclaw	2,556	134	5.2%	**2,422**
Santa Barbara	792	52	6.6%	**740**
Sacramento	2544	239	9.4%	**2,305**
Total	24,582	1217	5.0%	**23,365**

Where a student was missing a single item on a scale, a score was imputed for the missing item. This value represented the median score on that item for students whose score on the remaining items for that scale was equivalent to the score for the student for whom the item was missing.

Where more than one item was missing for a scale, the student was assigned a missing value for that scale.

The ISCY Framework of 21st Century skills, dispositions and engagement

The twelve scales and their component items were analysed conceptually to assess their face validity as measures of relevant constructs. Most of the twelve scales and their component items aligned with skills and mindsets identified in other surveys and models including PISA (sense of belonging, behavioural engagement), the Education Longitudinal Study of 2002 (behavioural engagement, cognitive engagement, emotional engagement), the Gallup Student Poll (hope, belonging), the Big Five (conscientiousness, openness, perseverance) and the UCCCSR student survey (belonging, self-efficacy, hope purpose). Where the alignment of ISCY components with existing scales was not self-evident, the taxonomy of 21st century skills (Figure 1) and other literature was used to identify the constructs measured by ISCY. These constructs were then framed diagrammatically.

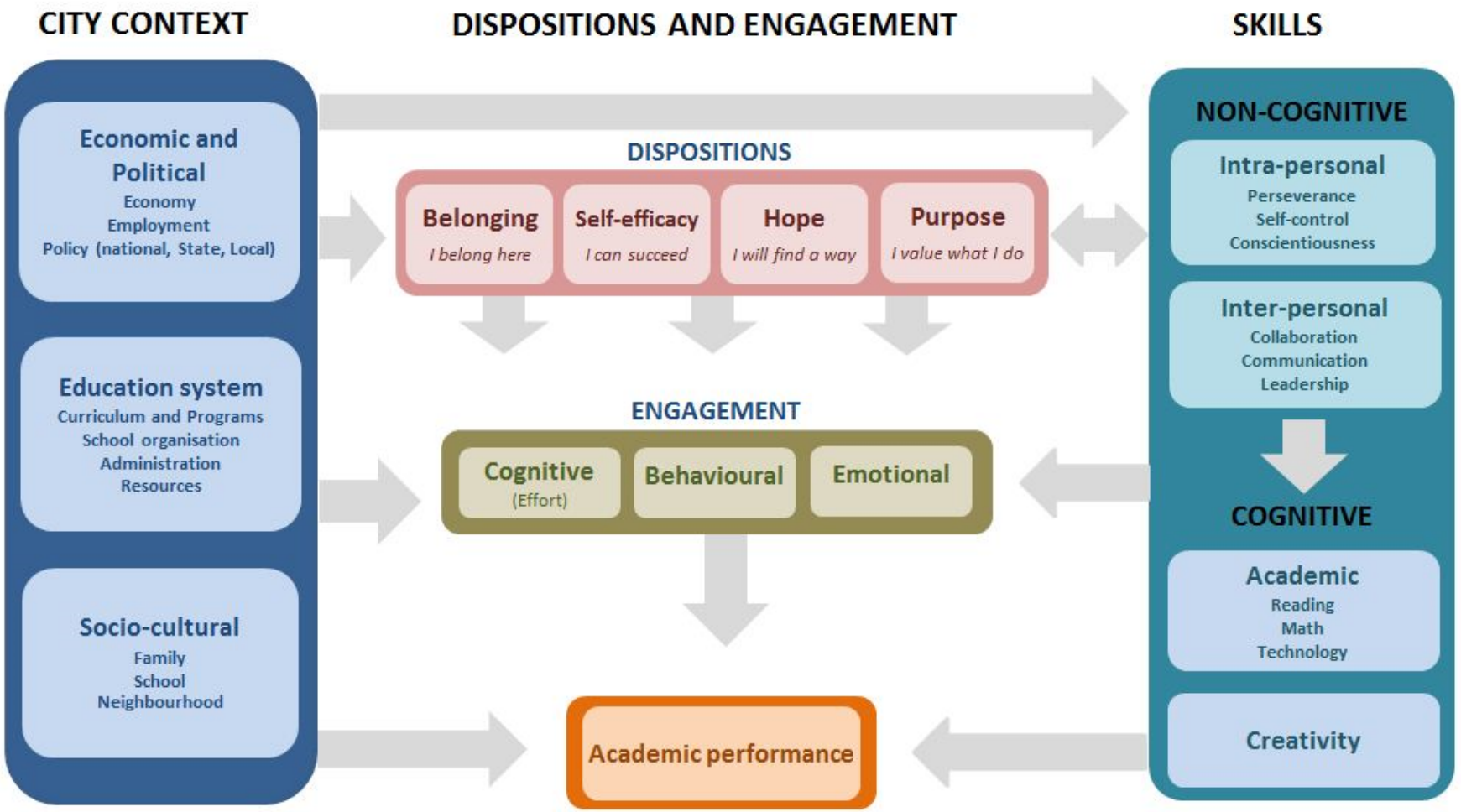
Figure 3 presents an outline of the ISCY framework for 21st Century skills, dispositions and engagement, based on this conceptual and empirical mapping. ISCY aims to explore how system-level factors in each city interact with school-level and student-level factors, to shape educational outcomes in each of the 12 cities. The city context can influence student outcomes directly and indirectly, including through mediating factors at the school and student level. The framework shows how the various 21st century skills, dispositions and engagement measured in ISCY may be situated as potential mediating factors between contextual and system factors, and student performance. Analysis of these ISCY measures must therefore be situated within contextual and system factors, and linked to the outcomes for students that systems aim to achieve.

Shaped and influenced by the city context (socio-cultural, economic and political, and education system), are four *dispositions:* belonging (I belong here), self-efficacy (I can succeed), hope (I will find a way) and purpose (I value what I do). These dispositions are positioned as influences on *engagement* (cognitive, behavioural and emotional), as well as on the *skills* (non-cognitive interpersonal and intra-personal, and cognitive). The skills in conjunction with dispositions and engagement mediate the effects of city context and ultimately influence *academic performance*.

The ISCY framework represents a hypothetical framework for how 21st century skills, dispositions and engagement influence educational success. Further analysis on the relationship between the twelve ISCY scales will test these assumptions, and identify how the skills, and measures of engagement and dispositions interact in shaping academic performance. This could be done with SEM that not only measures the constructs, but identifies the structural relationship among them and their relationship to academic performance.

Analysis across ISCY cities will help identify the education systems in which these skills are best supported, and the types of learners who are most likely to develop them.

Figure 3 **ISCY Framework for 21st century skills, dispositions and engagement, showing relationship to city context and academic performance**



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