Equipping teachers with tools to assess and teach general capabilities

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Dr Claire Scoular is a research fellow at ACER, and the Assessment Research Centre at The University of Melbourne. Her expertise is embedded in the application of psychological measurement and establishment of good assessment practices. Claire is interested in the assessment of 21st-century skills, and she provides technical expertise on a number of research projects in developing both online and offline assessments of social and cognitive skills. In addition, she has held an advisory role on 21st-century skills policy through consultancies with organisations such as World Bank, the Brookings Institution, and several ministries of education. At the University of Melbourne, Claire's PhD identified a measurement methodology, including scoring protocols and task templates, for assessing collaboration in online automated environments. She is passionate about the improvement of assessment practices in education, and is contributing to the Centre for Global Education Monitoring at ACER to develop tools and methodologies to enable countries to report and monitor learning progress in alignment with the United Nation's Sustainable Development Goal for Education. Much of Claire's work focuses on system strengthening in developing countries primarily through capacity building in test development, data analysis and assessment practices.

Abstract

There is wide recognition that students need to be equipped with appropriate social and cognitive skills demanded by society and the workforce. The unresolved question is how to do this. Many education systems globally are addressing this demand by including skills such as critical thinking, problem-solving, collaboration, and creativity into curriculum documents or supplementary materials. However, there is little research to guide educators in teaching such skills at school level. The need to develop practical solutions for assessing and teaching social and cognitive skills, broadly classified under the umbrella '21st-century skills' or 'general capabilities', is ever increasing. An integrated approach to teaching and assessing the skills across domain areas is necessary for sustainability. Traditional methods of assessment are not sufficient to capture the complexity of how general capabilities are applied in real-world settings, and innovative methods need to be sought and validated. Teachers require professional development, resources and tools to be effective.

This presentation outlines a study undertaken by the Centre for Assessment Reform and Innovation (CARI) at ACER to develop an assessment framework and a set of proof-of-concept tasks for measuring and monitoring the skills in the classroom. Through a combination of curriculum-focused assessment tools, learning progressions, and professional development, the agenda is to equip teachers to integrate teaching and assessing of general capabilities into their classroom. The assessment tools involve complex problem-solving tasks in which students need to demonstrate collaboration, critical thinking, creativity, information literacy, and communication skills. Learning progressions have been proposed for each of the skills to support identification of levels of proficiency and monitoring of student growth. This paper presents the work of the project so far and outlines plans for validation of the assessment framework, tools and learning progressions.

Introduction

Gonski et al. (2018) have called for Australian education to increase its focus on teaching general capabilities. Over the past five or so years, the focus around general capabilities has substantially shifted from the question of why we should be assessing and teaching the skills to how we can do so. Many schools or systems are adopting an agenda for integrating, teaching and assessing general capabilities but get into difficulty when it comes to identifying supporting resources. With different perspectives and little concrete evidence, educators are understandably uncertain about which perspective to adopt. Unfortunately, we are in a holding pattern. Schools may not be in a position to take a risk in adopting one approach over another without evidence of its effectiveness and researchers can't provide evidence of effective approaches until they can collect sufficient data from which to test.

Many teachers recognise the value of teaching general capabilities and are open and enthusiastic, but have found that they have not been adequately prepared to teach these skills and consequently lack confidence in implementing lessons or strategies that focus on them (Scoular & Care, 2017). From jurisdiction to jurisdiction, there are wide variations in terminology, approach and aspiration, and evidence of what is working is sparse. There is a lack of viable and robust assessment tools especially in the context of K–12 classrooms (Voogt & Roblin, 2012). Teachers may be uncertain of the expected outcomes in comparison to traditional lessons and this is reasonable given that there is a lack of research evidence concerning this, and there are no specifications of learning outcomes that are aligned with available assessments.

To address these issues, the Centre for Assessment Reform and Innovation (CARI) at ACER has developed an assessment framework for measuring and monitoring the skills in the classroom. Through a combination of curriculum-orientated assessment tools, learning progressions, and professional development, the agenda is to equip teachers to integrate teaching and assessing of general capabilities into their classroom.

Assessment framework

Our approach is premised on the fact that, in real-world settings, general capabilities are used in combination and that measuring them as isolated skills is not valid. When solving a complex problem in real life, critical thinking skills are not employed on their own, they are supported by the application of other social and cognitive skills such as collaboration, information literacy to research and obtain information, and creativity to arrive at novel and workable solutions.

Five skills were selected for inclusion in this study: collaboration, critical thinking, creative thinking, information literacy (research skills), and communication. Collaboration refers to the capacity of an individual to effectively participate in a team, and encompasses attributes such as perseverance, contributing to

team knowledge, valuing contributions of others and resolving differences. Also important to note that a collaborative activity should be one where participants are engaged in active discourse, not merely division of labour, to accomplish a task. Critical thinking refers to the cognitive process of critically evaluating information and arguments, seeing patterns and connections, constructing meaningful knowledge, and applying it in the real world. It encompasses the subject's ability to draw on the synthesis of the information presented to design a course of action to investigate the problem, and evaluate the effectiveness of the strategy adopted. Creative thinking is the capacity to generate many different kinds of ideas, manipulate ideas in unusual ways and make unconventional connections in order to outline novel possibilities that have the potential to elegantly meet a given purpose. Information literacy, with particular reference to research skills refers to the ability of individuals to use information and communication technologies (ICT) appropriately to access, manage and evaluate information to develop new understandings. Finally, communication refers to the capacity to effectively present one's idea to a target audience, with well-thought through organisation, clarity in content or ideas and effective delivery.

There has been a focus in the literature of teaching general capabilities using problem-based or inquiry-based learning (Hmelo-Silver, 2004) – most likely because problem-solving is one of the most frequently mentioned 'in demand' skills and features consistently across frameworks. Complex problem-solving refers to 'the capacities to solve novel, ill-defined problems in complex, real world settings' (World Economic Forum, 2016). Throughout the problem-solving process, students need to employ a multitude of cognitive and social skills broadly classified under the umbrella of 21st-century skills or general capabilities to define the problem and plan and execute strategies in order to arrive at a solution to address it. Complex problem-solving provides a sufficiently rich and extended activity for students to employ the range of general capabilities we are interested in measuring. Therefore, each of the skills presented in this study are contextualised in complex problem-solving activities. Primarily positioned as the context for students to work collaboratively with their classmates to come up with feasible solutions, the problem tasks are designed to give students the opportunity and time to engage and demonstrate the general capabilities. By nature, 21st-century learning activities are often open-ended, involve unbounded sets of information, and there may be ongoing redefinition of the goal of the task. It is important that students develop skills to establish and adapt goals according to available information, seek out relevant and valid information for the task, and continually monitor their own progress.

The assessment framework is presented in Figure 1. This framework forms a theoretical basis and guides a structured approach in the design of problem tasks, location of assessment points and identification of indicators for the skills being measured. Assessing a few skill strands simultaneously in complex problem-solving seems fairly feasible given that existing frameworks on collaborative problem-solving (Griffin & Care, 2015), creative problem-solving (Feldhusen & Goh, 1995) and information problem-solving (Brand-Gruwel, Wopereis, & Walraven, 2009) share similar problem-solving heuristics first proposed by Polya (1957). The procedural steps outlined by Polya are presented on the far left of Figure 1, and the assessment tasks in this study are designed around the same stages of process. Problem-solvers typically need to first understand and define the problem and then plan, therefore in the assessment task at these stages they are presented with the problem and provided an opportunity to generate possibilities to solve the problem. The next step of the process is to act on the plan therefore, in the assessment tasks, they are asked to implement a strategy or approach from the possibilities generated. Finally, students need to reflect and communicate so, in the assessment tasks, students are expected to evaluate the solution to the problem and communicate their solution effectively.

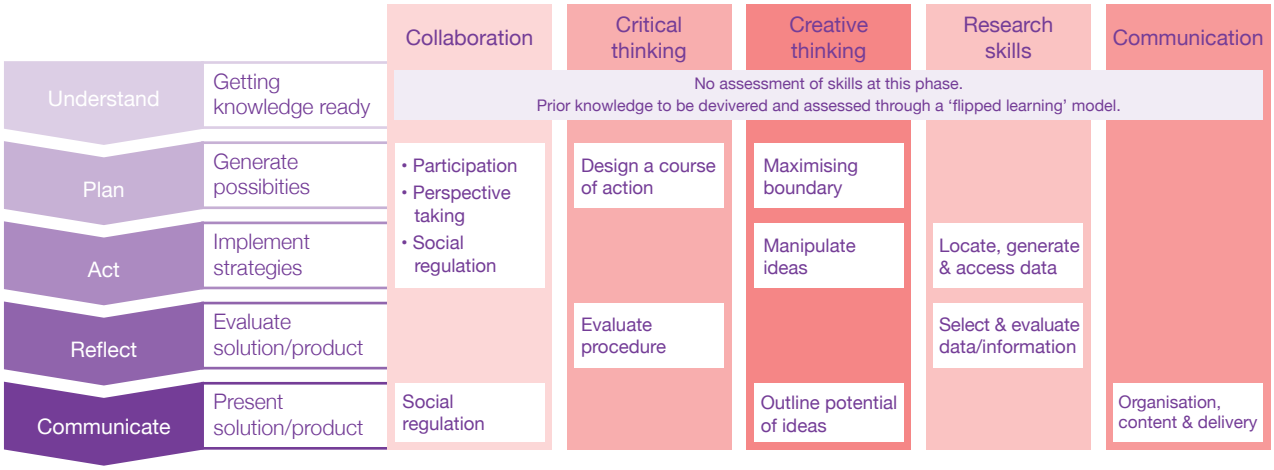

Figure 1 The assessment framework

Learning progressions

To support teachers to teach and assess these skills, we need a clear idea of how students demonstrate these skills, and how they progress over time. Current educational assessment reform calls for assessments to be centered on evidence of progress and growth (Gonski et al., 2018; Masters, 2013). Providing information on student performance at a single point in time is not as useful as presenting a continuous pathway of learning, since by its very definition learning requires progress. Learning progressions can provide crucial information to teachers, not just about student proficiency, but in identifying what students need to learn next to increase proficiency. They can also support the monitoring of student progress across grades, which traditional grade-based benchmarks don't always allow for.

Most efforts in the development of research-based learning progressions have been limited to areas such as literacy, numeracy and in science (Black, Wilson, & Yao, 2011). However, these could prove valuable in understanding and supporting skill development of the general capabilities. In this study, a theoretical progression has been developed for each of the skills. The study builds upon previously-established learning progressions on collaboration in the ATC21S project (Griffin & Care, 2015), critical thinking (ACARA, 2013; New Pedagogies for Deep Learning Global Partnership, 2014) creative thinking (Anderson, 2016), information literacy in the ICILS study (Fraillon, Schulz, & Ainley, 2013) and communication (Kerby & Romine, 2009). Empirical evidence from the assessment tasks is intended to provide validation of these progressions. Table 1 presents an extract from the learning progression of critical thinking.

Table 1 Viable progressions in critical thinking skills

Elements	Low	Medium	High
Identifying patterns and making connections	Learners can see simple patterns and connections.	Learners can make connections between significant ideas, issues, thinking etc.	Learners are skilled in making connections, identifying patterns and seeing relationships and navigate a sea of knowledge in an interconnected world.
Knowledge construction	Learners struggle to engage in meaningful knowledge construction but are still guessing their approach to tasks.	Learners find different points/pathways into learning, building on their existing knowledge and beliefs and can analyse/ construct knowledge one discipline at a time.	Learners' knowledge construction is insightful, connected and interdisciplinary and involves interpretation, analysis synthesis and evaluation.
Apply logic and reasoning	Identify the thinking used to solve problems in given situations.	Assess whether there is adequate reasoning and evidence to justify a claim, conclusion or outcome.	Analyse reasoning used in finding and applying solutions, and in choice of resources.
Draw conclusions an design a course of action	Share their thinking about possible courses of action.	Draw on prior knowledge and use evidence when choosing a course of action or drawing a conclusion.	Use logical and abstract thinking to analyse and synthesise complex information to informat a course of action.
Evaluate procedures and outcomes	Check whether they are satisfied with the outcome or tasks or actions.	Evaluate the effectiveness of ideas, products, performances, methods and courses of action against given criteria.	Evaluate the effectiveness of ideas, products and performances and implement courses of action to achieve desired outcomes against criteria they have identified.

ACARA, 2013; New Pedagogies for Deep Learning, 2014

Assessment tools

To date, two assessment tasks have been developed, and another two designed for assessing the general capabilities as outlined in the assessment framework. One developed task has been designed for Year 8 students and is situated in a humanities context, the other is designed for Year 5 and is situated in a science, technology, engineering, arts and mathematics (STEAM) context. Development of tasks across Years 5 and 8 should provide evidence of the maturation of the skills, and should allow for monitoring of student growth across the grades. An integrated approach to teaching and assessing the skills across domain areas is necessary for sustainability. Therefore, the problem-based tasks were contexualised in both humanities and STEAM domains. Development of tasks across different subject domains should also allow identification of potential transferability of the skills across contexts.

Figure 2 presents two activities from the Year 8 humanities task in which the students have to work out how best to settle refugees in their local community. In session 1, students are introduced to the problem in groups of three. The need to demonstrate collaboration, critical thinking and creativity to generate a list of possible solutions, debate the most creative (yet plausible) ideas, and negotiate and assign roles going forward to enable differentiated access to resources.

Template for students to identify ideas that will support smooth resettlement

Smooth resettlement of refugees in a local community involves a concerted effort by various stakeholders. What do you think these concerted efforts might look like?
Be as creative as you can. Try to come up with eight different ideas

	Brainstorm a list of suggestions	Checklist to assess the creativity of your ideas
1	Enter text here	Is the idea … • unusual or original • effective and coherent • able to meet the purpose • a well-thought through experimentation (evidence of attempting to try out a new idea with clear approach to its experimentation) • aesthetically pleasing or elegant in its approach. Overall, there area … • lots of different ideas or elements • few ideas or elements but they have many possibilities • considers multiple perspectives instead of from a single narrow view.
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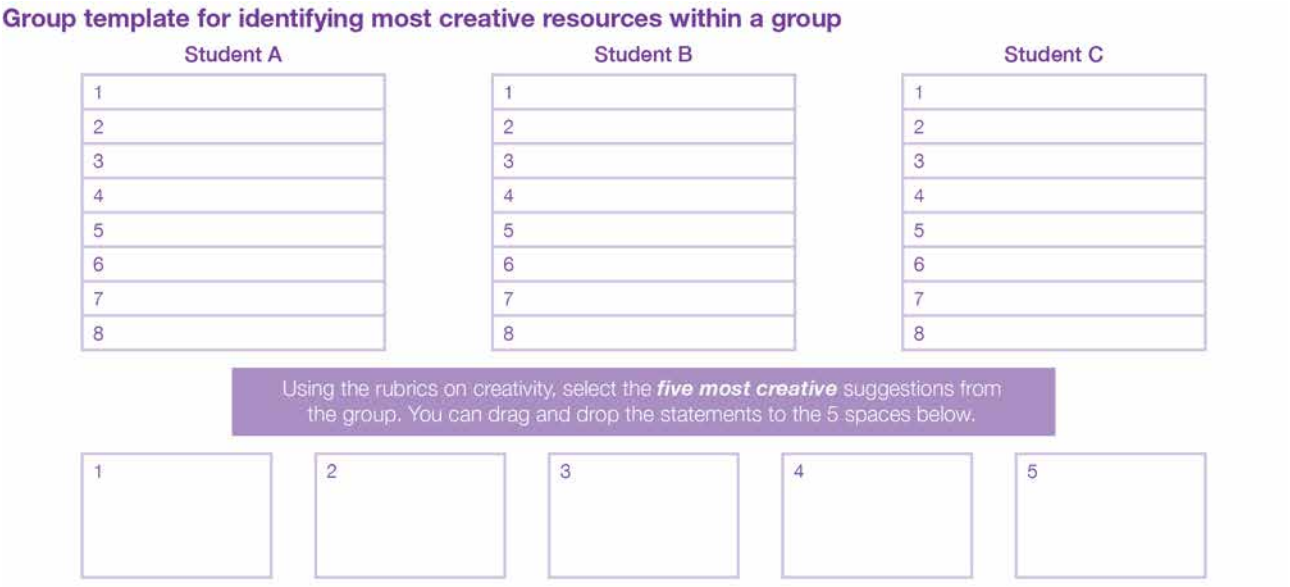

Figure 2 Screenshots from humanities Year 8 task, refugee settlement

In this study, the assessment tasks are delivered via Google Classroom, because it offers a low cost platform on which to try the proof of concept, is readily available to schools and is familiar to many teachers and students. Students complete the tasks in the online environment which allows for responses to be recorded automatically. Eventually a future system would generate reports for teachers that they can triangulate with their own observations, and use of the learning progressions to build a picture about their students' proficiency across the general capabilities. Through the use of classroom-based problem tasks set in a variety of contexts, the study focuses on observing student behaviour, interaction and examining the thinking process behind their proposed solutions as they engage with the tasks, with the aim to accurately locate student skill levels on the learning progressions.

Work has already begun in trialling the two classroom-based assessments in Australian schools. Sufficient data will have been collected by mid 2018 to allow for analysis. Early analysis of the trial data is enabling the researchers to refine the delivery and resourcing, which supports the task and associated scoring protocols, so as to ensure valid, accurate and well-targeted assessment of the general capabilities it requires students to demonstrate.

While the use of complex tasks that measure multiple skills is highly valid, the scoring of the outcomes from the assessment are equally complex. Different parts of the overall task require particular skills. To represent this complexity, we have adopted a Q-matrix approach. The Q-matrix is a table that specifies which skills are required to successfully complete each part of a task, in which the task components are listed in the rows and the skills are listed in the columns. To add to the complexity, the sources of data from the task components may differ too. For example, a computer log file of how many of the research resources were accessed and for how long might supply measures relevant to assessing research skills, whereas the quality of a students' self-reflection about their collaboration in a group might come from the teacher using a scoring rubric. Once sufficient response data have been gathered, the next phase of the project will involve investigating the use of different scoring models to adequately represent each skill.

Limitations of the study

The tasks that have been developed represent a proof-of-concept and are, therefore, not as fully developed as assessment tasks for rigorous assessment would be. Also, the number of measures that can be derived per skill across each task is limited and causes a paucity of data. However, the eventual design is that students would, over the course of an academic year, complete several general capability assessment tasks in different subject areas. This would provide sufficient measurement points per skill, based on the assumption that the skills that are manifested within each task regardless of the subject area in which they are applied.

Conclusion

It is acknowledged that the sorts of 21st-century skills and general capabilities increasingly expected of school graduates and employees can manifest themselves in an enormous range of expressions, contexts and applications that are beyond the scope of a small suite of classroom tasks to definitively assess. Nevertheless, it is important work to find well-considered and reliable ways teachers can elicit, isolate and measure such seemingly nebulous skills in some form, if only so as to demystify the notion that such skills can't really be taught – and assessed – in the first place. Once this has been achieved, and using correctly-tuned, teacher-friendly assessment methods, it is hoped that schools will continue a propagation of the CARI project's approach so as to embed 21st-century skills more comprehensively in the curriculum and the classroom.

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