Thinking skills instructional strategies: Teaching students with disability to be better thinkers

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Abstract

Thinking is a learnable skill that has been emphasised in curricula internationally. Research has shown that it is a key component of success academically and that students benefit from explicit instruction in thinking to build skills to learn and access all areas of the curriculum (Diamond & Lee, 2011; Rueda, Checa, & Cómbita, 2012). However, there are few resources available to teach thinking skills to students with disability. The aim of this study was to develop a measure of thinking skills that would provide teachers with an integrated system of assessment, reporting, planning, and instructional advice. It followed a previously established methodological approach to create judgement-based assessments reported against criterion-referenced learning progressions (Coles-Janess & Griffin, 2009; Strickland, Woods, & Pavlovic, 2016; Woods & Griffin, 2013).

This paper describes a phase of the research in which teachers collaborated to propose and review a bank of thinking skills instructional advice for students with disability. The study took place in Victoria, Australia. Participants (n = 16) were leading teachers with experience teaching thinking skills to students with disability from specialist settings for school-age students (5 to 20 years) or mainstream primary schools. In a full-day workshop, teachers, in pairs, were provided with a case study and a partially completed individual learning plan (ILP) for one de-identified student representing one of eight learning levels of a thinking skills progression. Included in the partially completed ILPs were strategies assembled from a review of evidence-based instructional strategies for thinking skills that were matched to the case study student's level of learning. The teachers reviewed and drafted learning goals and strategies. These reflections were collected in the form of annotated ILPs which were analysed for applicability and appropriateness for students in both mainstream and specialist settings. Next, the resulting intervention strategies were piloted with teachers from a mainstream primary school and a specialist setting to further establish the suitability of the proposed teaching strategies for use in the classroom. Ultimately, the aim of this phase of the study was to develop intervention strategies to further teacher understanding of how to teach the skills of thinking.

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Introduction

Questioning the purpose of education and evaluating the relevance of curriculum is a key component of improving learning (Scardamalia, Bransford, Kozma, & Quellmalz, 2012). A debate at the forefront of this questioning critiques the relative importance of students acquiring information and participating in learning processes (Csapó, Ainley, Bennett, Latour, & Law, 2012). Research has revealed that components of thinking skills such as executive functioning (EF) and working memory are predictors of school success (Diamond & Lee, 2011; Rueda et al., 2012). EF and working memory skills such as inhibition, flexibility and keeping goals in mind (Zelazo, Blair, & Willoughby, 2016) make up vital components of the ability to think and learn. The importance of such skills has been recognised by governments internationally with implementation in curricula, assessment, and instructional strategies (Darling-Hammond, 2012). However, many students with disability who have core deficits in thinking skills often lack instruction to support its development, as there is a dearth of knowledge of how such skills develop in students with disability (Bae, Chiang, & Hickson, 2015) and targeted resources to support instruction (Delinda, 2006). Nonetheless, with the right instruction, students with disability at all levels of learning can learn to think (Wehmeyer, 2007). There should, therefore, be no impediments to prevent students with disability improving their thinking skills provided they are given thoughtful and appropriate support and instruction.

The term "students with disability" in this study referred to school-age students (5 to 20 years) who qualified for funding in the Program for Students with Disabilities (Victorian Department of Education and Training, 2018) in Victoria, Australia, where this study was situated. *The Convention on the Rights of Persons with Disabilities* declared that it is the responsibility of signatories, which included Australia, to foster an effective inclusive education system to facilitate equal access for all children to a quality education (UN, 2006). This means educators must be trained in the use of resources, technology, and strategies that support students with disability (UN, 2006). However, many teachers feel unprepared to teach students with disability due to lack of resources and insufficient pre-service training (Senate Standing Committee on Education and Employment, 2016). Therefore, this phase of the study investigated whether practical intervention strategies could be developed to teach students with disability the foundational skills of thinking.

Thinking Skills Learning Progression

The research drew on materials that had been previously developed using procedures described by Griffin (1993, 2007) to create judgement-based assessments reported against a criterion-referenced learning progression (Coles-Janess & Griffin, 2009; Strickland et al., 2016; Woods & Griffin, 2013). A learning progression defines a skill such as thinking in terms of increasing levels of proficiency identified by sets of quality criteria. Learning progressions provide a description of where a student is currently working and where s/he needs to go next to build skills and understanding (Heritage, 2008). The progression used in this study drew on expert knowledge of specialist teachers to write assessment

items which were subjected to a large-scale trial in 53 schools. The resulting learning progression contained eight levels of proficiency that mapped students' progress following a Piagetian (1954) course of development. Development starts with sensorimotor engagement with the environment, to using trial and error and following single-step instructions to explore outcomes, to being able to identify strategies associated with likelihood of success or failure. As students improve their skills and understanding, they progress from recognising patterns and categories that could guide their choice of action, to identifying causal relationships and then transferring previously successful strategies to solve new problems. The higher levels on the skills progression then describe students who could engage with increasingly complex tasks, explain their reasoning and generalise rules and, at the highest level, demonstrate their ability to experiment, modify and extend strategies to think about problems and justify their choices. Each level on the progression was described by a set of indicative skills and laid bare a chain of qualitative transformations (Vygotsky, 1929/1993) as students progress through thinking skills competency. Table 1 shows an example of two adjacent levels on the progression.

Table 1

Levels 3 and 4 of the Thinking Skills Learning Progression

Level	Extended description
4. Students are learning to recognise and repeat patterns or categories and initiate familiar tasks with support.	At this level, students may be learning to repeat a pattern of two objects, colours, pictures, or sounds. They may be able to make a choice from two options according to relevant cues while ignoring irrelevant ones with support. As they work through this level, students may start to initiate tasks and use prompts to undertake a familiar task. They may also learn to apply strategies suggested by another to navigate an unfamiliar activity or object and to request help when experiencing difficulty with an activity or task. Students may begin to demonstrate understanding of another person's point of view by referring to an appropriate or common topic in an interaction.
3. Students are starting to attempt new activities and learning to recognise whether a strategy or outcome was successful or unsuccessful.	At this level, students are beginning to be aware of success or failure by recognising direct causal connections. Students may begin to demonstrate awareness of success or failure and repeat a previously successful action to achieve an expected or preferred outcome. As they work through this level, students are attempting new activities or tasks or engaging with new objects with support. They may also be learning to signal for or seek help from an appropriate person.

Method

Workshop Participants

Participants (n = 16) of a full-day workshop to draft intervention strategies based on a thinking skills progression were leading teachers who had experience teaching thinking skills to students with disability. The teachers were provided with plain language statement forms and consent forms to comply with the ethical requirements of the University of Melbourne and the Victorian Department of Education and Training. The teachers were from two mainstream primary schools, one specialist school for students with mild intellectual disability, three for students with moderate to severe intellectual disabilities, one for students with autism spectrum disorder (ASD), one for students with

physical disability and/or significant health impairment and four for students with mild to severe intellectual disability. The specialist schools were for school age students (5 to 20 years) and the teachers had a mix of experience in both junior and senior classes.

Materials

Eight students representing each of the eight levels of learning on the thinking skills progression were chosen from a previous large-scale trial of assessment items that underpinned the development of the learning progression. The researcher wrote a case study and a partially completed individual learning plan (ILPs) for each of the eight students based on the data collected from the trial. Each student was de-identified in the case study by changing personal information such as age and gender to ensure that ethical considerations were met as per University of Melbourne and Victorian Department of Education and Training guidelines. The level of detail provided by the assessment items was deemed sufficient to infer what the students had mastered in terms of the construct of thinking skills (Wilson, Gochyyev, & Scalise, 2016) for practical application in the classroom.

The ILP contained information about each case study student's present level of learning and long-term goals for the student. In Victoria, Australia, where the study took place, ILPs are recommended for all students who receive additional funding to support their education (Victorian Department of Education and Training, 2018). Thus, it was assumed that the teachers who attended the workshop, as experienced teachers of students with disability, would be familiar with the use and interpretation of ILPs.

To prepare a pool of draft intervention strategies as a resource for workshop participants, evidence-based practice for teaching thinking skills was investigated. Within the literature, several themes were evident. One theme was the effectiveness of systematic, explicit, and direct instruction in conjunction with targeted, purposeful feedback (e.g., Gersten et al., 2009; Hattie, 2009; Hessels & Hessels-Schlatter, 2013; Korinek & deFur, 2016; Smith, Sáez, & Doabler, 2016; Spooner, Knight, Browder, & Smith, 2012). Strategies to address motivation through reinforcement and formative assessment were also found to be effective (Dignath, Buettner, & Langfeldt, 2008; Hessels & Hessels-Schlatter, 2013; Marzano, 2007). Another recommended strategy was the use of 'think alouds' and modelling (Gersten et al., 2009; Hattie, 2009; Hessels & Hessels-Schlatter, 2013; Korinek & deFur, 2016; Smith et al., 2016). Visual means to represent information such as graphic organizers were also recommended in the literature (Douglas & Charles, 2011; Gersten et al., 2009; Spencer, Evmenova, Boon, & Hayes-Harris, 2014). Finally, behavioural interventions such as fading or simultaneous prompting were endorsed (Spencer et al., 2014). Based on such suggestions, sets of evidence-based intervention strategies were drafted and mapped to the eight levels of learning on the thinking skills learning progression. These were written as a handout, in preparation for teachers to review.

Workshop Activities and Results

The workshop used the expert judgement of the 16 participating teachers by drawing from their knowledge and experience to develop intervention strategies that would be practical in a school setting. The teachers were divided into eight pairs and each pair was given a package of information about one of the eight case study students. The package included a case study, a partially completed ILP, and an expanded version of the thinking skills learning progression. They also received a learning readiness report for the student (Assessment Research Centre [ARC], 2018). The learning readiness report shows the student's position on a hierarchically arranged sequence of levels, each defined by a short "nutshell" description. On the reverse side of the report, an extended statement similar in format and detail to the information shown in Table 1, but tailored to the student's level of proficiency, was provided (ARC, 2018).

First, the pairs of teachers drafted goals for their case study student to achieve in the short-term. They wrote these in a section for targets to achieve in the short-term which were left blank on the partially completed ILP for their assigned student. Being able to draft short-term goals is integral to providing a basis from which to plan instructional strategies (Jung, Gomez, Baird, & Keramidas, 2008). In addition, guiding the teacher's ability to see what the student needs to learn next to progress is one of the central purposes of the learning progression (Heritage, 2008). Table 2 shows an example of one pair of teacher's drafted goals for a student working at Level 4 compared to those predicted from a previous analysis of data from 864 students from 53 schools.

Table 2

Goals Drafted for a Student Working at Level 4 on the Thinking Skills Progression

Teacher Goals	Predicted Goals
• Systematically working through ways to complete new/unfamiliar task • Transfer consolidated skills to new activities with minimal support • Generalise successful strategies to new or unfamiliar activities	• Attempting strategies suggested by another to navigate an unfamiliar activity or object • Repeating a previously successful action to achieve an expected or preferred outcome

In the left column are goals drafted by teachers after 30 minutes of deliberation, and on the right are learning targets predicted by an empirical analysis of data that used partial credit item response modelling (Masters, 1982) to establish the relative difficulty of skills. There are differences in terms of context or content, however, the underlying target skills match. This provided one indication that teachers understood the use of the learning progression to draft appropriate learning targets for students. A similarly close relationship was noted for each level on the progression.

Next, teachers were given 60 minutes to draft instructional strategies to progress their case study student from his/her present level of learning. The teachers wrote the intervention strategies in a section that was left blank on the partially completed ILP for their case study student. Their ability to write intervention strategies for each level of learning as defined by the progression indicated their

understanding of the qualitative transitions that occur between levels. Table 3 presents examples of intervention strategies written by teachers for students working at Levels 3 and 4.

Table 3

Examples of Intervention Strategies Drafted by Teachers

Level	Examples of intervention strategies proposed by teachers
Level 3	• Provide opportunities for him to work with a peer mentor, who already has skill embedded • Use visual supports to enable him to follow instructions independently • Model tasks for him/her to complete (e.g. phrase to say/ action to complete)
Level 4	• Use wait time/ processing time • Video modelling – modifying video of peers completing activity successfully • Making the correct selection from a choice board with highly motivating pictures and correct responses – choice comprehension

The examples shown in Table 3 illustrate that the teachers recognised the increasing independence of students as they transitioned from the sorts of skills represented at Level 3 on the progression to those exemplified by Level 4. In Level 3, students need more support to think through tasks whereas Level 4 describes students who are increasingly expected to initiate their own actions independently. In Piagetian terms, such students are progressing from a pre-operational stage of acquiring information and using trial and error to a concrete-operational stage of beginning to apply background knowledge to inform their actions (Inhelder & Piaget, 1958). A clear delineation can be seen of the expectations teachers have of their students at the two levels and the teaching adjustments they would make accordingly.

Next, the pairs of teachers were given a handout with evidence-based intervention strategies drawn from research matched to the level that their case study was working. The teachers compared them with their own draft recommendations and made suggestions to improve their utility. Teachers were asked to keep in mind the students they teach and to consider whether the intervention strategies were applicable in terms of level of ability as well as the constraints of day-to-day teaching. Further, they considered whether teachers with various levels of experience and in different settings were likely to understand and implement the instructional strategies. The teachers made three main modifications to the intervention strategies that had been drawn from research. One, they changed wording to remove jargon or make them more "teacher friendly". Two, the teachers added specific and descriptive examples to make the strategies more concrete and easy to implement in classrooms. Three, they adjusted interventions that were too challenging in terms of content or complexity to better suit the ability of the student (with the underlying target skill remaining the same). Between 9 and 21 strategies per level of learning in the thinking skills progression resulted from this process.

Following the workshop, the developed intervention strategies were piloted with a separate group of teachers who had not participated in the workshop. A teacher from a mainstream secondary school, a principal of a mainstream primary school, and four teachers from a specialist school, with combined experience in junior, middle, and senior classes participated in piloting. The format used to pilot each

intervention is shown in Figure 1. The intervention strategies were written in the left column of a survey sheet and teachers rated each strategy from 0 to 2 in the right column, based on their judgement of frequency of use of the strategy.

Level 3: Strategies and advice for teachers of students working at this level.	**2** = Use often and for most or all students **1** = Use sometimes or for some students **0** = Would not use this strategy at all
Provide clear and consistent expectations of participation (e.g., provide your student with visual guides to help him or her understand what is expected for different activities and tasks).	☐ **2** ☐ **1** ☐ **0**

Figure 1. Example of an intervention strategy to be piloted.

The results of the piloting study were positive. Two thirds of the strategies were endorsed by the teachers who piloted them as strategies they would use often and for most of their students One third of the strategies were rated as suitable for using with some but not all of their students, or some but not all of the time. The difference between these two groups of strategies was the extent to which they could be seamlessly implemented into day-to-day classroom practice as well as their complexity in terms of ease of comprehension and planning. The teacher from a secondary mainstream setting was the only teacher who gave a rating of zero to any of the strategies. She spoke about the challenges and constraints of implementing interventions for students with disability in a mainstream secondary setting with multiple teachers and classrooms. Thus, this may have reflected barriers imposed by the classroom and school context rather than a rejection of the strategies themselves. Further, there was consistency of judgement between teachers about strategies associated with the first three levels on the progression, but some difference of opinion about the strategies associated with more demanding skills. This could be explained by the complexity of skills represented at higher levels of proficiency on the progression, and the difficulties of teaching complex skills in varied settings particularly as students move to secondary settings (De Vroey, Struyf, & Petry, 2016).

The results of the piloting process, in combination with the results of the workshops were used to create a final list of suggested instructional strategies that could be reported for each level of proficiency. Thus, this phase of the study was able to fulfil its aim of developing intervention strategies to target thinking skills for students with disability working within the levels of learning defined by the thinking skills progression.

Discussion

The research described in this paper was associated with a broader study that aimed to develop an assessment of thinking skills for use by teachers of students with disability. The purpose of this phase of the study was to develop a pool of teaching strategies for students at different levels of proficiency as identified by the assessment. The results of this phase of the study established practical thinking

skills teaching interventions for students with disability. Teachers with expertise in teaching students with disability were able to write goals for a student based on information from the learning progression. There was unanimous agreement that they could write intervention strategies based on these goals. More importantly, they were able to see the transitions between levels and write interventions accordingly. There was less clear agreement about the application of the intervention strategies in schools. In the workshop, six teachers indicated that the level of support given to teachers, as well as the needs of the student, may be factors that could affect their implementation. However, most of the teachers in the workshop and in the piloting study responded that the intervention strategies could be used in all settings with all students. Such results indicated that practical resources could be applied by all teachers in all schools to teach thinking. This holds implications for teacher understanding and practical application as thinking skills has tended to be described in general terms with little explicit teaching instruction (Petersen, 2015). Moreover, research has indicated that teachers, particularly beginning teachers, do not know what it looks like or how to teach it (Hessels & Hessels-Schlatter, 2013).

Conclusion

While these initial results were positive, there is no doubt that more research is warranted. Further iterations of research could include investigating the use of the intervention strategies across different school and classroom contexts, as well as examining what other resources (e.g., concrete examples) could provide more support for teachers and learners. Of particular importance, research is needed to establish the impact of these teaching strategies on longer term learning outcomes for students with disability. It is possible to identify ways to teach thinking skills to all students with disability in all settings, given the appropriate resources and support. The goal is to provide thinking skills instruction to students with disability, skills that are foundational to accessing the general curriculum (Diamond & Lee, 2011; Rueda et al., 2012) to ensure that all students can achieve their learning potential.

Acknowledgement

This work was supported by an Australian Research Council Linkage Grant [LP14100163] in partnership with the University of Melbourne and the Victorian Department of Education and Training.

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