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ORIGINAL ARTICLE

Lessons in financial literacy task design: authentic, imaginable, useful

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Abstract As part of ongoing design-based research exploring financial literacy teaching and learning, 10 tasks termed "financial dilemmas" were trialled by 14 teachers and more than 300 year 5 and 6 students in four government primary schools in urban Darwin. Drawing on data related to three tasks—*Catching the bus*, *Laser Tag* and *Buying bread*—this article explores insights into problem context and task design principles. The findings highlight that fit to circumstance, challenge yet accessibility and pedagogical architecture are important task design principles. Further, tasks involving unfamiliar, novel and imaginable problem contexts, while pedagogically demanding for teachers, can be considered useful by students and have the potential to broaden their horizons.

Keywords Realistic mathematics · Numeracy · Task design · Financial literacy · Problem solving

Background

Preparing citizens who can confidently rise to the demands of everyday life beyond school is an important dimension of education. An example of an educational need that is as topical as it is important is whether school leavers are well equipped to apply what they have learned in the classroom when they face real-world problems and decisions involving money. As many such problems involve a level of mathematics, there is a need for mathematics education to engage students in financial problem-solving experiences that will orient them to being critically informed in the decisions that they make. Since the global financial crisis, there has been increased interest in financial literacy levels and financial literacy education by governments, researchers and educators around the world. Much of this interest has emphasised conventional priorities including strengthening the

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way that opportunities to teach and learn about finance are positioned in the school curriculum (Organisation for Economic Cooperation and Development (OECD) 2012a) and the development of financial literacy education programs. In Australia, "Money and financial mathematics" features within the "Number and algebra" content strand of the Australian Curriculum: Mathematics (ACARA 2015). Further, the government has invested heavily in policy initiatives and the development of *MoneySmart Teaching* (ASIC 2016), a collection of "one-size-fits all" teaching and learning resources intended to meet the financial literacy learning needs of what is assumed to be a broad and homogeneous audience of teachers and students.

While educational research exploring financial literacy teaching and learning is an emerging and interdisciplinary field, a growing number of authors are questioning this dominant approach to financial literacy education by arguing that lessons related to money should respect that learners come from diverse family backgrounds, cater to local conditions and imbue social justice. For example, Pinto and Coulson (2011) argue that financial literacy education programs tend to assume that all individuals come to financial life on an equal playing field and ignore the diverse circumstances which cause people to experience money in very different ways. They suggest that without attention to social justice issues, financial literacy education is reduced to replicating inequities and continuing to marginalise already vulnerable low socioeconomic populations. Pinto (2012) subsequently argues that the development of financial literacy curricula that challenge conventional public narratives around money may provide ways for teachers to critically address socioeconomic disparity. Lucey and Tanase (2012) describe a need to empower socially underrepresented children and youth through "teaching behaviours and strategies that inform recognition and understanding of social [and] financial injustice" (p. 9) while emphasising that understanding and applying mathematics are important to achieving this goal. In short, there are tensions between the dominant approach to financial literacy education and the arguments of educational experts seeking to challenge what it means to be financially literate and how financial literacy education is conceptualised.

Meanwhile, standardised assessments tend to be relied upon for insights into the extent to which students are equipped to apply their financial literacy learning throughout their lives. The 2012 OECD Programme for International Student Assessment (PISA) assessed two literacies that are relevant to the research reported in this article: mathematical literacy (termed numeracy in Australia) and financial literacy. For the purpose of PISA, mathematical literacy is defined as

> … an individual's capacity to formulate, employ and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena. It assists individuals in recognising the role that mathematics plays in the world and to make the well-founded judgements and decisions…
>
> (OECD 2013, p. 25)

and financial literacy is defined as

> knowledge and understanding of financial concepts and the skills, motivation and confidence to apply such knowledge and understanding in order to make effective

> decisions across a range of financial contexts, to improve the financial well-being of individuals and society and to enable participation in economic life.
>
> (OECD 2012b, p. 12–13)

The OECD argues that the PISA mathematical literacy assessment framework is intended to "encourage an approach to teaching and learning mathematics that: gives strong emphasis to the processes associated with confronting a problem in a real-world context; transforms the problem into one amenable to mathematical treatment; makes use of the relevant mathematical knowledge to solve it; and evaluates the solution in the original problem context" (Thomson, et al. 2013, p. 16). The mathematical literacy assessment defines four real-world contexts: personal, societal, occupational and scientific (Thomson et al. 2013). The recent inclusion of a financial literacy assessment in the PISA signals increasing concern among member governments about the growing complexity of the financial marketplace and the level of financial literacy needed by citizens to navigate this landscape. The financial literacy assessment defines a slightly nuanced set of four real-world contexts: education and work, home and family, individual and societal.

The PISA mathematical and financial literacy results reveal insights into Australian 15-year-old students' performance compared with their international peers and are suggestive of opportunities for improvement in teaching and learning. The picture is somewhat sobering. While mean mathematical literacy scores remain above the OECD average, they have been in constant decline since 2003 (Thomson et al. 2013). One in five students are failing to meet the international proficiency baseline of level 2, the level of mathematical literacy indicative of competencies required to actively participate in real-life situations (Thomson et al. 2013). Two in five students scored below Australia's nationally agreed baseline for mathematical literacy of level 3 (Thomson et al. 2013). And while Australia was among the top 5 of 18 countries and economies that completed the financial literacy assessment, a strong relationship between student socioeconomic background and financial literacy scores was noted. Students in metropolitan schools achieved more highly than students in provincial and remote schools, and non-Indigenous students significantly outperformed their Indigenous counterparts (Thomson 2014). Outcomes such as these substantiate the call by Gates and Jorgensen (2009) for socially just mathematics education that might confront the various structures that perpetuate disadvantage and begin to redress the gap in educational attainment between the affluent and the marginalised.

Problem context is an important part of PISA. For the purposes of the research reported in this article, context is defined as the aspects of the real world in which a mathematical problem is embedded (Stacey 2015). Related constructs include context familiarity and level of context use. Context familiarity is typically referred to as the extent to which a given problem context reflects students' everyday experiences (Salgado 2016). The idea of levels of context use in a mathematical problem was suggested by de Lange (1979). Drawing on de Lange's work, Salgado (2016) has sought to clarify how three levels of context use—zero, first and second orders—are defined. Zero-order use of context provides for direct actions or inferences to be made from the instructions given in a mathematics problem, but the context is not used to interpret mathematical results or arguments (Salgado 2016). First-order use of context allows for relevant information, variables or relationships to be identified and/or selected for the mathematical formulation

of a problem, with the context also providing for the adequateness of mathematical results to be determined (Salgado 2016). Second-order use of context allows for relevant variables, relationships or assumptions to be defined and/or retrieved for the mathematical formulation of a problem, with the context being used to judge the adequateness of mathematical results and arguments in relation to the original problem (Salgado 2016). Essentially, as the level of context use increases, so too does the importance of being able to imagine aspects of the real world and the potential role of mathematics within it. Level of context use has implications for teaching, learning and assessment.

The influence of problem context, context familiarity and level of context use on students' learning and performance is somewhat contested. Stacey (2015, p. 15) argues that "several broad aspects of problems in context are likely to affect an equitable assessment of mathematical literacy: reading demands, the cultural and individual familiarity of the contexts and students' interest in the context". Salgado (2016) cautiously argues that the higher the level of context use, the greater the impact on student performance seems to be. Stacey (2015) notes the value in assessing students' capacity to solve mathematical problems with second-order use of context, as such mathematical problems are more authentic to the sorts of encounters with mathematics that students might expect in the real world. Related to this is the need for challenging mathematics lessons that give students opportunities to learn through such problem-solving experiences.

Task designers and teachers face a number of complex issues. The first issue is that the ways and means by which students engage with a problem context can be the source of problem-solving difficulties. Several researchers have found that when more familiar contexts are presented, students tend to bring personal information into their solution arguments rather than using a mathematical argument (Boaler 1994; Gravemeijer 1994; Salgado and Stacey 2014). In this case, students run away with the problem context and ignore the demand to do mathematics. By contrast, students can sometimes offer mathematical solutions based on precise calculations, but these make no sense when interpreted against the problem context (Van den Heuvel-Panhuizen 2005). In this case, students ignore the problem context altogether. The second issue is that tasks in context have the potential to exacerbate disadvantage by alienating and excluding those already at the margins (Sullivan et al. 2003). For example, Jorgensen and Sullivan (2010) argue that while particular contexts may be realistic for some students, they are well outside the everyday experiences of those living in remote aboriginal communities.

These issues seem to be particularly pronounced when the context is money-related—meaning that the choice of problem context can impact students' financial literacy learning. Jorgensen et al. (2014) argue that "children equipped with the right habitus are able to gain an advantage in school" (p. 223). To the extent that financial literacy education is typically focused on individual wealth accumulation, it has the potential to privilege some while marginalising others (Lucey et al. 2015). The experience of financial hardship seems to limit students' motivation and ability to connect with typically middle-class problem contexts (Sawatzki 2014). For example, when presented with tasks about gym membership and movie ticket pricing, disadvantaged students openly questioned their teachers as to the authenticity of the problem context (Sawatzki 2014). Financial problem contexts can also distract students with social rather than mathematical lines of thinking (Sawatzki 2013). For example, when presented with a financial dilemma where a couple can save money by ensuring that their small, more fuel-efficient car is used by the person travelling the greater distance each week, students found ways to save money without having to do mathematics;

i.e. they suggested walking to work, riding a bike and even selling the couple's large car. Realistic Mathematics Education (RME) argues that these issues might be overcome through problem contexts that are imaginable (Van den Heuvel-Panhuizen 2005). Regardless, the onus is on teachers to judge the "mathematical suitability, interest or relevance to the students, potential motivational impact, and the possibility of negative effects or tendency to exclude some students" before using a task in context (Sullivan et al. 2003, p. 108). This means adopting culturally responsive practices that seek to align classroom tasks and pedagogies with the diverse identities, experiences, values and norms that students bring to their learning (Vale et al. 2016). The challenge in doing so should not be underestimated—in many schools, teachers may have so little knowledge and experience of the family and community contexts in which their students live that they unable to give students sufficient agency through the lessons that they plan (MacFarlane et al. 2007).

Using real-world contexts is essential for PISA but raises some important issues (Stacey 2015). PISA results offer information about learning outcomes, not explanations about how teaching and learning take place. De Lange (2007) has called for the influence of problem context in mathematics teaching and learning to be studied systematically so that empirical evidence for or against its impact on student achievement might be gathered. This suggests a clear need for educational research exploring the reactions of teachers and students to challenging contextualised learning tasks in real classrooms. An important question, and the focus of the research reported in this article, is whether it is preferable to design tasks based on familiar problem contexts that might resonate with students or to choose problem contexts that are unfamiliar, novel and imaginable in the hope that the latter might expand students' horizons and capacities.

Relevant literature

This study was critically informed by academic research related to numeracy and task design principles, of which a brief appraisal is provided in the following.

Goos et al.'s (2011) model for numeracy in the twenty-first century has been used to support if not enhance pre-service and practising teachers' numeracy teaching and learning across the curriculum. The model describes five elements that contribute to numeracy: mathematical knowledge, dispositions, tools, a critical orientation and context. Of particular relevance to this study, context refers to the situated nature of numeracy and the need to develop students' capacity to use mathematical knowledge in and beyond the classroom. In its visual form, the model places context at the centre of numeracy teaching and learning. In this way, it pays tribute to the importance of creating and/or selecting meaningful real-world contexts to motivating students and showing them the usefulness of mathematics to making sense of the world.

Finding meaningful contexts in which to situate mathematics teaching and learning is by no means straightforward. The issue is particularly complicated when financial contexts are being considered, since a student's observations and experiences with money seem to influence the way that they think and feel about financial problem solving—sometimes helpfully, sometimes not (Sawatzki 2013, 2014). Because task designers typically work at distance from the teachers and students that they are creating for, they inevitably face complex decisions that require assumptions to be made. While a number of characteristics of high-quality contexts have been identified

(Meyer et al. 2001) and are helpful to bear in mind, they serve to highlight the complex challenge facing financial literacy task designers. Those characteristics most relevant to the research reported in this article include that a context should support students in making the transition from a problem to its mathematical content; be real or at least imaginable; be sensitive to cultural, gender and racial norms; and not exclude any group of students (Meyer et al. 2001). Attempting to apply these criteria means grappling with context familiarity. The broader the intended target audience of a task, the more complex this question becomes. It can be incredibly difficult to distinguish between what is real world and, therefore, familiar for the task designer and what might be real world and, therefore, familiar for the teachers and students for whom a task is being created. Then again, if schools and classrooms are to be sites for beckoning the unknown and expanding students' horizons, finding appropriate financial contexts within which teaching and learning might be productively situated is critical.

Blue et al. (2014, 2015) argue that there is a need for targeted financial literacy education that appeals to local conditions, is sensitive to cultural norms and is inclusive rather than exclusive. This places importance on the role of site-based knowledge and skilful teacher practice (Kemmis et al. 2014). Taking this argument one step further, it makes sense that judging what problem contexts might be familiar and engaging for students should become easier when task designers collaborate with teachers because initially, at least, both parties bring different expertise to the table. The most talented task designers are creative educationalists whose subject matter and pedagogical knowledge (Hill et al. 2008) culminate in rich stimulus for student learning. Teachers are experts in their students' local conditions, family backgrounds, characteristics and interests. It makes sense, therefore, that there might be real benefits in task designers and teachers coming together through educational research so as to critically inform each other's work, if not establish principles of task design that might be made explicit and shared (Schoenfeld 2009). This might equip teachers to do more task design work.

Geiger et al. (2014) identified five numeracy task design principles:

1. The need for fit to circumstance
2. The need for tasks to be challenging yet accessible
3. The need to be transparent in relation to expected outcomes
4. The need to provide students with opportunities to make decisions
5. The importance of iterative cycles of design and improvement

Geiger (2016) has refined this list by distinguishing challenge from challenging yet accessible and suggesting the importance of complementary pedagogies or what he described in the associated conference presentation as pedagogical architecture. This is consistent with other notable contributors to the field who argue that tasks come to life through teacher actions (e.g. Anthony and Walshaw 2009; Sullivan et al. 2013; Sullivan et al. 2009). While each of the previous principles informed this study of numeracy tasks in financial contexts, fit to circumstance, challenge yet accessibility and pedagogical architecture provided substantive theoretical framing.

Fit to circumstance is described as referring to various conditions and constraints including curriculum and resources. However, the phrase might be more broadly interpreted to involve the need to create and/or select problem contexts that give sensitive consideration to the sociocultural context within which teaching and

learning will take place. This means seeking to understand not only students' local context, but their family backgrounds, characteristics and interests so as to design tasks that are experientially real as well as socially and mathematically meaningful.

To achieve challenge yet accessibility is not easy. It relies on predicting students' zone of proximal development (Vygotsky 1978) and successfully posing tasks that might stimulate interest, cognitive activation and sustained efforts to problem solve (Clarke et al. 2014; Henningsen and Stein 1997). Accessibility refers to how students relate to the problem context and identify what is required of them if they are to achieve expected learning outcomes. The extent to which a task might be considered accessible can depend on a range of factors. Students are the ultimate judge whether a problem is appealing enough to attempt to solve it, and they make this judgement based on the level of difficulty that they perceive in the problem, their interest in it and the importance that they ascribe to it (Borasi 1986). Essentially, getting the problem context, the level of challenge and the level of accessibility right will generate opportunities to think deeply about and discover mathematics—activities that are critical to mathematics learning.

Pedagogical architecture refers to the pedagogical expertise, decisions and actions necessary to bring a task to life. Sullivan et al. (2013) argue that teachers face a number of considerations and challenges as they "seek to take a task and build a coherent lesson around it" (p. 71)—meaning even a quality task is not sufficient to guarantee student learning.

Designing, trialling, studying and refining challenging contextualised learning tasks have been an important part of the Encouraging Persistence Maintaining Challenge (EPMC) project.[1] This article reports a snapshot of the EPMC project that explored the teaching of money and financial mathematics through challenging contextualised learning tasks termed "financial dilemmas". The research questions guiding this aspect of the project were as follows:

- What role (if any) does the choice of problem context play in mathematics teaching and learning?
- When working with unfamiliar problem contexts, do particular pedagogies seem to enhance task accessibility?
- What are the implications for theory and practice?

The research design

The research context

Since previous research highlighted the need for tasks based on realistic financial contexts that might better resonate with the everyday experiences of students from a low socio-economic background (Sawatzki 2014), schools servicing working class communities were sought to participate. Urban Darwin was chosen for its unique economic and sociocultural profile. Darwin is Australia's main service centre for a wide range of primary

[1] The EPMC project is funded through an Australian Research Council Discovery Project (DP110101027). The views expressed are those of the author. The project acknowledges the generous participation of the project schools.

Table 1 Myschool data describing each school community

	Total enrolments	ICSEA value	Indigenous students (%)	Language background other than English (%)
School A	433	912	26	14
School B	397	983	9	2
School C	407	995	10	14
School D	270	935	24	45

industries including mining, offshore oil and gas production, pastoralism and tropical horticulture. The Port of Darwin is the main outlet for Australia's live cattle export trade into South East Asia. The Darwin workforce also consists of high numbers of public sector and Defence Force personnel.

The Index of Community Socio-educational Advantage (ICSEA), created by the Australian Curriculum, Assessment and Reporting Authority (ACARA), was used to understand the socioeconomic profile of potential school communities. An ICSEA value below the Australian average of 1000 was a qualifying criterion to participate.

Data were collected from 14 teachers and more than 300 year 5 and 6 students in four government primary schools. Table 1 consists of *myschool* data available at the time of the educational intervention and data collection. It describes each school's size and student characteristics (socioeconomic background, identifying as being indigenous and being from a language background other than English).

These figures serve in some way to describe the diverse, often challenging communities within which the teacher participants work.

The educational intervention

Being design-based research (Anderson and Shattuck 2012), the study focused on the design and testing of an educational intervention. The intervention consisted of a series of 10 challenging contextualised learning tasks referred to as financial dilemmas, a particular lesson structure that has been argued to enhance mathematics learning (see Sullivan et al. 2014; Lappan et al. 2006) and associated pedagogies. Each financial dilemma was designed to be the focus of one 60–90-min mathematics lesson, with enabling, consolidating and extending versions of each task being available (Sullivan et al. 2009). I brainstormed and created the 10 financial dilemmas in Melbourne. Problem contexts included ordering take-away food (fish and chips and pizzas), going to the movies, buying children's football memberships and starting an indoor netball team.

Financial dilemmas feature social and mathematical dimensions, involve multiple solutions and invite students to share and explain their reasoning. These task characteristics are critical for creating awareness of alternative possibilities and stimulating higher-order thinking. This is arguably essential if students are to learn the importance of identifying and critically evaluating multiple options as part of a problem-solving process that leads to informed financial decision making. Financial dilemmas involve problem contexts that 10–12-year-old children might be familiar with and/or interested in and/or able to imagine.

Three of the 10 financial dilemmas, *Catching the bus*, *Laser Tag* and *Buying bread*, are presented in the following.

Catching the bus

Ticket prices for bus travel in Darwin are presented in the following table:

Ticket options	Adult	Concession	Description
Single (paper ticket)	$3	$1.25	Unlimited bus travel for 3 hours from validation.
Daily (paper ticket)	$7	$2	Unlimited bus travel until the last bus service of the day.
Flexi trip (Tap & Ride)	$20	$7.50	10 single, 3 hour trips are pre-loaded to the card.
Weekly (Tap & Ride)	$20	$7.50	Unlimited bus travel for 7 days from the day of the first validation.

Adapted from http://www.transport.nt.gov.au/

Bonny will be catching the bus to get to and from Darwin Middle School next year. She will need to buy paper bus tickets or a "Tap & Ride" card. As a student, she is entitled to a concession fare.

a. If Bonny catches the bus to and from school every day, what is the best ticket option for her? Explain your thinking.
b. In Terms 2&3, Bonny will have netball training on the school netball courts from 4pm each Tuesday and Thursday, and her mum can pick her up from there on her way home from work. How will this affect what bus ticket Bonny should buy? Explain your thinking.

Laser Tag

Jack likes to play Laser Tag. How would you advise Jack about the price deals at KJS compared with Zone 3? Explain your thinking.

	KJS Prices	**Zone 3 Prices**
Casual visits	$10 per person for 1 game $25 per person for 3 games	$12 per person for 1 game $8 per additional game
Family passes (can be used by all members of the immediate family)		$100 membership fee entitles the user to pay only $2 per game
Gold card (can be used by all members of the immediate family)	$400 for unlimited games for 1 year	

Buying bread

Baker's Delight has a loyalty card. For every $6 spent on bread, customers receive a stamp on their card. After five stamps, the customer can choose a free loaf of bread. Mum spends the following amounts in five separate visits: $6.50, $8.00, $9.50, $7.00, $11.00.

a. What do you think about Mum's spending at Baker's Delight? Explain your thinking.

Every effort was made to anticipate, if not ensure, that the tasks would be appropriately realistic, challenging and accessible to students. In an unrelated visit to Darwin, I toured the shopping precincts seeking to understand local life and collect ideas for tasks. In my preliminary interactions with the teacher participants, I asked questions about students' family backgrounds, characteristics and interests. For example, the price table presented in *Catching the bus* was adapted from the Northern Territory Department of Transport website. I not only used Google Maps to check the proximity of Darwin Middle School (the destination referred to in the problem context) to the participating primary schools, but also encouraged the teacher participants to change this detail if they felt that it was appropriate to do so. *Laser Tag* was designed to be a follow-up lesson to *Catching the bus*. I researched pricing at KJS and Zone 3—both of which are real entertainment venues in Darwin. The *Buying bread* task was based on the Baker's Delight loyalty card, and I checked that this program was in-use in Darwin. I also used Google to check for Baker's Delight stores operating close to each of the participating schools.

Catching the bus and *Laser Tag* require students to evaluate price tables where value for money depends on service usage. Reading information from tables, charts and graphs requires mathematical literacy, and there are many OECD PISA items testing this (Stacey 2015). The purpose of these tasks is for students to apply literacy and numeracy to making sense of tabulated data. This is an important aspect of financial literacy, with the knowledge, skills and capabilities learned being transferable to a range of real-world contexts—i.e. fees and interest rate tables, mobile phone plans and health insurance comparators. Further, as many people pay "up-front" for purchases that they do not end up using to the fullest advantage (i.e. gym memberships), it was also intended that students would discover and discuss the importance of being realistic about likely service usage over time and the point at which paying up-front becomes worthwhile compared with paying as you go.

Buying bread was designed to promote multiplicative thinking alongside discussion about business marketing and customer loyalty programs. An important social dimension is whether price is an indicator of quality. It was anticipated that students would likely benefit from a role play showcasing the stamp system at Baker's Delight—that is, stamps are most effectively accrued when customers spend as close to multiples of $6 as possible.

Preliminary feedback on the 10 tasks was sought from five numeracy leaders who have been involved in previous iterations of the EPMC project. These colleagues teach in outer urban and rural schools in Victoria and Tasmania. They trialled the tasks with year 5 and 6 students in their respective schools and/or suggested modifications. The intention was that the financial dilemmas had undergone some quality controlling prior to being included in the intervention.

At the outset of the Darwin study, a pre-intervention teacher professional learning day was held. The program gave teachers the opportunity to see and experience the teaching approach being suggested through a modelled lesson and various other simulation activities. The teachers were also given a teacher participant handbook that provided an easy-to-read synopsis of the research informing the educational intervention; guidance in implementing the three phase launch, explore and summary lesson structure (Lappan et al. 2006); and an overview of the rationale and pedagogical considerations related to each task. For example, in order to bring the financial dilemmas to life, the teacher participants were encouraged to

build an efficient but strong lesson introduction, giving students just enough support to begin problem solving. It was also suggested that the teachers help students to see the relevance of each task to everyday life beyond school (Mandell and Klein 2007), use role play and concrete materials (i.e. notes and coins) to activate students' imaginations and explain the importance of both social and mathematical thinking to informed financial problem solving and decision making (Sawatzki 2014). The teachers were also encouraged to emphasise problem-solving tools and strategies that might be helpful, including drawing tables and/or pictures (Goos et al. 2011). It was recommended that teachers provide time for individual thinking and problem solving before small-group collaboration where students might share and discuss their problem solving approaches and solutions (Smith and Stein 2011). This was intended to lead to critical whole-class discussion where a range of options (mathematical workings and explanations) could be recorded and open, sometimes provocative questions posed to stimulate different ways of thinking (Walker 2014). A post-intervention teacher professional learning day was held 4 months later at the close of the research program.

The data sources

The findings reported in this article are based on quantitative and qualitative teacher and student data. The 14 teacher participants were asked to complete pre- and post-intervention surveys online. Particular items and the teacher participants' responses to these are discussed in the next section. Twelve of the 14 teacher participants also participated in a 1 hour focus group discussion as part of the post-intervention teacher professional learning day. There were five points for discussion: the perceived appeal of the various problem contexts, students' engagement with the social and mathematical dimensions of the tasks, the level of challenge, the lesson structure and the pedagogies used. The teacher participants were encouraged to share their views and experiences in interaction with each other with minimal interruption from me as the researcher. Each of the 12 teacher participants was recorded as contributing to the conversation in some way over the course of the hour.

More than 300 year 5 and 6 student participants also completed pre- and post-intervention surveys online. Twenty-eight students from the cohort (seven groups of four students drawn from each of the four participating schools) participated in 20-min focus group discussions where they shared insights into their experiences learning through the 10 financial dilemmas. Specifically, the students were asked the following questions:

- What words would you use to describe these lessons?
- Which lesson was your favourite? What did you like about it?
- Was there a task that you thought was too easy? What made this task easy?
- Was there a task that you found particularly challenging? What made this task hard?

To assist their memories, the students were given a booklet of the tasks to refer to.

Teacher and student data were compared and contrasted to compile a critical and complete research story about the participants' experiences of teaching and learning through the intervention. The task design principles identified by Geiger et al. (2014) served as categories to guide data analysis. In the next section, *Catching the bus*, *Laser Tag* and *Buying bread* are referred to in order to substantiate particular findings and

arguments about the various problem contexts and each task's fit to circumstance and level of challenge yet accessibility as well as the pedagogical architecture required to bring the tasks to life.

Findings

With reference to the research questions, the findings are presented in Table 2 and discussed in two parts: insights from teachers and insights from students.

Insights from teachers

The teacher post-intervention survey asked participants to respond to a number of brief statements by indicating the extent to which they agreed on a five-point Likert scale (strongly disagree, disagree, neither agree nor disagree, agree, strongly agree). The statements were designed to reveal the perceived influence of student background on engagement with the problem contexts included in the educational intervention. Two teacher participants did not complete the post-intervention survey.

Most of the teacher participants agreed or strongly agreed that their students' contributions to class discussion seemed to reflect students' everyday financial realities. All but one also agreed or strongly agreed that students confidently shared stories of their observations and experiences with money—meaning that the problem contexts gave students something to say. Two thirds agreed that students' contributions revealed an orientation to prudent, if not frugal, financial decision making. Given that an ICSEA value below the Australian average of 1000 was a qualifying criterion to participate in this study, this finding implies that the experience of financial hardship may instil in children cautious financial values. The final statement in particular relates to the importance that the teachers placed on task accessibility and fit to circumstance. All of the teacher participants agreed or strongly agreed

Table 2 Teachers' responses to statements about the educational intervention: post-intervention

Item	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
My students made insightful comments about money that seemed to reflect their everyday financial realities.	0	0	2	9	1	12
My students confidently shared stories of their observations and experiences with money.	0	0	1	10	1	12
My students' contributions to class discussion generally revealed an orientation to prudent, if not frugal, financial decision making.	0	1	3	8	0	12
The success of each lesson varied depending on students' prior knowledge of (or familiarity with) the problem context.	0	0	0	10	2	12

that the success of each lesson varied depending on their students' prior knowledge of (or familiarity with) the problem context. In these ways, the teachers considered fit to circumstance and accessibility to be important task design principles.

During the teacher focus group discussion, the teachers elaborated on these sentiments. They emphasised the view that the problem contexts needed to be authentically situated within the realms of students' everyday observations and experiences in order to be accessible. According to the teachers, particular tasks were more "effective", "engaging" and "fun" because they met this criterion. A teacher from school B reported that the success of each lesson seemed to hinge on the students' family backgrounds. She cited this as an important factor which affected the extent to which her students were able to access and relate to the various financial contexts posed. A teacher from school A concurred and spoke about *Catching the bus* as highlighting this point. The conversation that followed revealed a number of ways and means by which I misjudged the local context in designing this task. First, I assumed that students from a low socioeconomic background would be familiar with the public transport system. Second, I assumed that students might be thinking about catching the bus to middle school in the future. Third, while the price table was adapted from the Northern Territory Department of Transport website, I assumed that student passengers would be eligible for concession fares. In these ways, I created a financial literacy task based on middle-class understandings that apply in middle class, metropolitan Melbourne—not working class, urban Darwin. I did not realise that in the Northern Territory, school students are fully subsidised and so travel on buses for free. At the post-intervention teacher professional learning day, the teachers reported that very few families are reliant on public transportation to get to school—students are typically driven, ride a bike or walk to school. The teachers were concerned by this task's fit to circumstance. Another thing the teachers did not seem to like about this task was the literacy demands. A teacher from school A scolded, "Suddenly our maths lessons turned into literacy lessons".

On the post-intervention teacher survey, teachers were asked, "If you believe that students' financial and/or cultural backgrounds influenced their responses to the financial dilemmas, can you please give two stories or examples from your lessons to support your view". Again, the intention was to elicit insights into the various problem contexts' fit to circumstance and accessibility. One teacher reported that his/her students commented that the price of bread at Baker's Delight was "a waste of money" and that they would prefer to shop at their local supermarket where bread can be purchased at a fraction of the cost. The teacher wrote

> Some of the students—one in particular from a single parent family where her mother works three jobs to maintain their home—flatly refused to engage with this task. It took a lot of prompting from me.

Further highlighting the potential impact of low socioeconomic background on financial literacy task engagement, the teacher continued by writing the following:

> Many of the students stated they did not pay to go the movies and were surprised by the prices of the tickets and food. They would have preferred to watch a DVD at home…and purchase supermarket snacks.

This feedback was also raised during the teacher focus group discussion where a teacher from school C explained that her students developed a social argument that mum is spending too much money at Baker's Delight. This teacher believed that her students' perceptions of value for money became a distraction to the mathematical dimension of *Buying bread*. A teacher from school A agreed and explained that the students who routinely go shopping with their parents, including to the local Baker's Delight, found this task far more accessible than those who tended to stay at home. He described that those who tended to stay at home, "… didn't care about the task. It was a lot harder to engage them". These reports highlight the risks associated with one-size-fits-all tasks, particularly in sites where hardship is the everyday financial reality.

The teachers were asked if there were particular pedagogies that they used that seemed to help make *Catching the bus* and *Buying bread* more accessible to their students. In response, the teachers reported that role play and visual imagery were useful to introduce students to unfamiliar problem contexts and enhance task accessibility. A teacher from school A reported explaining to her students the benefits to understanding the public transport system if you ever venture outside the Northern Territory, perhaps on a family holiday. A teacher from school B spoke about recounting to her students a personal experience catching the bus. Others from school C who co-teach in a large open classroom spoke about the power of role play in bringing this particular financial dilemma to life. A teacher from school D described drawing a picture mapping the route between school and home to represent the scenario and his belief that this modelled a useful problem-solving strategy. In these ways, the teachers identified and utilised appropriate pedagogies to activate students' imaginations. While the teachers inferred that this was difficult work and seemed unlikely to use *Catching the bus* again in the future, they also acknowledged that the lesson served to expose students to an unfamiliar financial context.

As part of the initial professional learning day, role play was showcased when modelling *Buying bread*. Teachers were encouraged to explicitly instruct students that any transaction between $6 and $11.99 would receive one stamp only, transactions between $12 and $17.99 would receive two stamps and so on…. This pedagogy was also recommended in the teacher participant handbook. Again, those from school C who were co-teaching in a large open classroom reported that an entertaining enactment of the problem context seemed to help their students to access the task. A teacher from school D again reported drawing pictures on the whiteboard, this time depicting the story of mum shopping at Baker's Delight and collecting stamps. In this way, he modelled a problem-solving tool that students might use in future mathematics lessons. This teacher commented that while his students had some difficulties accessing *Buying bread*, he felt that the mathematical dimension of the task was worthwhile. He expressed an intention to use the task again in the future but modify the problem context to involve a loyalty card for buying hot pies at the school canteen. The ability to recognise useful task features and the confidence to identify ways that a problem context might be adapted to improve fit to circumstance and accessibility are considered productive teacher learning outcomes of the educational intervention.

Insights from students

More than 300 year 5 and 6 student participants also completed pre- and post-intervention surveys online: of these, 28 participated in focus group discussions. The

student post-intervention survey included the question: "A woman named Carly wrote the maths tasks about money you have been working on. What is one thing you would like Carly to know about her lessons?" The intention was to collect initial insights from students anonymously and that these responses would shape the questions posed at the subsequent focus group discussions. There were 102 responses to this question, of which 80 were retained as having answered the question by making positive, neutral or negative comments. Responses like "I do not know" were excluded. Sixty-five of the comments were positive in that they used words like "good" (22 occurrences), "help/helped/helpful" (20 occurrences) and fun (15 occurrences) to describe the lessons. Only three students gave feedback that suggested that they viewed the lessons negatively: these students specified that the tasks were too hard. Examples of comments related to fit to circumstance and challenge yet accessibility that were identified to explore further during student focus group discussions include the following:

> I think Carly's lessons are good because some [have] been challenging and they've all made me think.
>
> Really good for when people grow up and help students with their lives.
>
> I like the way you chose the places.
>
> [They] helped me to understand more about money.
>
> They helped me talk to my mum about school.

Through the student focus group discussions, students revealed more meaningful insights not only how they viewed and experienced the tasks, but also what they valued in the series of mathematics lessons. These findings are highlighted through the students' accounts of the 10 tasks, with a particular focus on *Catching the bus* and *Laser tag* in the following. When asked what words they would use to describe the 10 tasks, "challenging", "interesting", "enjoyable", "exciting" and fun were common responses. Only one student described the lessons in negative terms, stating they were "boring". The response that the tasks were deemed challenging was somewhat unsurprising since an important aim of the EPMC project has been to help students to view challenge and persistence as productive to learning. More interesting was that when asked to elaborate upon these sorts of responses, the students made comments that described what they saw as positive task attributes—being based on realistic financial contexts that aligned with their everyday observations and experiences with money (fit to circumstance), being challenging and being useful. One student from school B explained why she felt that these things were important saying, "In life, not everything's gonna come easy. It's good to figure out hard things so then you know what to do when you grow up".

The students also seemed to see merit in learning to apply mathematics through problem-solving experiences. A student from school B explained, "This was a different way of learning. I figured out how to learn through that way". This finding is further underlined by the following two contributions to the student focus group discussion at school C:

> This is a new way to learn maths…you had to decide what maths to do with that task…
>
> I think [these tasks] helped my learning. Because you worked on skills that you already had, but they made you put them all together. So technically it's a new skill. Putting them together and using all of them at the same time.

Implicit in these remarks is that the process of learning through problem solving was also valued by students.

While students seemed to prefer tasks that were immediately relevant to their everyday observations and experiences with money (fit to circumstance), they also valued learning about unfamiliar problem contexts that they deemed useful to their lives beyond school. This finding is a fascinating paradox to the teacher data. For example, despite the issues and concerns reported by the teacher participants, several students across the four participating schools nominated *Catching the bus* as their favourite task. These students seemed to see merit in learning about bus ticketing and appreciated being challenged by the literacy and numeracy demands of the task. Several students explained that learning to read, interpret and make decisions with reference to the price table was valuable. A student from school C offered the insight, "When you grow up, if you have to catch a bus, it's really useful". A student from school B commented, "I think I learned more about literacy than money". He was among students from schools B and C that reported learning the meaning of the term "concession" through *Catching the bus*.

Similarly, while students who attended the school that was located in closest proximity to Darwin's *Laser Tag* centres (school B) recounted experiences visiting the two entertainment venues and were animated in their praise for the task, those who attended the school that was located furthest away from any such entertainment venue (school C) still enjoyed and saw merit in it. A boy from school C described laser tag as his favourite task. While he admitted having never played the game before, to him, the context was imaginable and the requirement to read and interpret a table comparing pricing at two different centres was useful.

Conclusion and implications

The Darwin study contributes to our understanding how teachers and students react to challenging contextualised learning tasks in real classrooms, enabling us to determine how teachers might build students' capacities in readiness for standardised test events such as PISA, but more importantly the demands of everyday life beyond school.

The findings confirm that the choice of problem context influences the demands on teachers and students. While the teacher and student participants reported that problem contexts that are authentically situated within the realms of students' everyday observations and experiences were more immediately relevant and accessible, students also valued learning about unfamiliar, novel and imaginable problem contexts where they deemed the tasks to be useful to their lives beyond school. The examples of *Catching the bus*, *Laser Tag* and *Buying bread* demonstrate this point. Because students could imagine themselves using public transport in the future, they found *Catching the bus* to be useful. Because students saw merit in learning to read and interpret tabulated pricing

information, *Catching the bus* and laser tag were also viewed as useful. By contrast, because some students could not see themselves ever paying a premium for bread, questions about the problem context's fit to circumstance distracted from the intended mathematics learning associated with the task. This suggests a need to modify the problem context for local conditions. In these ways, the extent to which a problem context might be considered authentic to local conditions would seem to be a critical but elusive aspect of the task design principles that Geiger et al. (2014) describe as fit to circumstance and challenge yet accessibility.

Judging the authenticity of problem contexts is a complex pursuit. Even tasks that evolve from educational research involving collaboration between task designers and teachers are likely to require modification prior to implementation. Due to their local knowledge, including knowledge of students' family backgrounds, characteristics and interests, teachers are best placed to create and/or select and/or modify challenging contextualised learning tasks. In doing so, there is a need to consider whether quality teaching and learning mean working comfortably with the familiar or somewhat uncomfortably with the unknown. Working with unfamiliar problem contexts is inevitably more pedagogically demanding for teachers. However, the findings suggest that any pedagogical architecture teachers put in place will likely be valued by students. To this end, imagination has a legitimate place in mathematics classrooms. A strong lesson introduction involving pedagogies such as role play and/or visual imagery (drawing pictures) can enhance task accessibility and make mathematics more meaningful, fun and useful for students.

While set in north Australia, the Darwin study provides insights and implications for other communities—both in Australia and overseas. It shows that one-size-fits-all tasks are fraught and knowing students is central to creating and/or selecting tasks that will promote financial literacy learning. The findings signal a need for teacher professional learning in task design principles and pedagogy. Such opportunities are particularly important for teachers working in low socioeconomic areas, where conventional financial literacy education is most likely to be disconnected from students' everyday financial realities, if not marginalising. In the case of students living in financial hardship, it is important that financial contexts for mathematics teaching and learning are drawn from and connect meaningfully with students' observations and experiences with money.

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