

Pricing: Exploring the Intersection Between Values, Maths, Finance, and Entrepreneurship

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In this paper, I explore data collected from more than 300 Year 5 and 6 students in four government primary schools in urban Darwin. Students were asked to respond to real-world problem contexts involving fundraising as an example of an enterprise activity. The findings reveal that familiarity with the problem context, personal values, and language and literacy skills influenced students' decisions how to price goods for sale. It is argued that contextualised learning tasks that require students to apply mathematical, financial, and entrepreneurial thinking can provide insights into students' family backgrounds, personal values, and learning needs while guiding and informing culturally responsive teaching.

Policy and Curriculum Background

Over the past decade, policymakers have become increasingly interested in the potential for school education to prepare enterprising, financially literate graduates. This goal has been the focus of various initiatives and reports by the Organisation for Economic Cooperation and Development (OECD) and its member governments. For example, the European Commission and the OECD developed Entrepreneurship360, an online platform intended to promote an “entrepreneurial mindset” through primary and secondary education (Lakeus, 2015). In Australia, the Office of the Chief Scientist recently released a report arguing a need for educational pathways to instil commercial and financial acumen so that Science, Technology, Engineering and Mathematics (STEM) research and innovation might become a source of national competitive advantage and economic growth (Spike Innovation for the Office of the Chief Scientist, 2015). Such statements imply a necessary intersection between STEM and commerce teaching and learning through enterprise and entrepreneurship education.

Enterprise and entrepreneurship education are not new – but there is renewed enthusiasm for their importance at the policy level given that global markets are challenging to navigate. Enterprise education is typically conceptualised as being about identifying and creating new business opportunities, predominantly for self-employment (Fayolle & Gailly, 2008). Many primary and secondary schools enact this approach by involving students in planning market stalls for profit and fundraising. By contrast, entrepreneurship education is framed as developing personal attitudes and attributes that foster creativity, initiative and risk-taking while critically and sensitively attending to possible social and environmental considerations (Fayolle & Gailly, 2008). Both enterprise and entrepreneurship education are intended to cultivate a repertoire of skills, including critical and creative thinking, communication and interpersonal skills, problem-solving, digital literacy and financial literacy (Foundation for Young Australians, 2016). These learning outcomes are notable in the Australian Curriculum in the articulation of both learning area content and the seven general capabilities.

On the one hand, enterprise and entrepreneurship education would seem an ideal solution to steel school leavers for tough labour markets. Yet while STEM and entrepreneurship are referred to as educational priorities, teachers face the challenging task of reading and interpreting substantive curriculum documentation to develop meaningful

learning programs that might engage students. There is also the tension that teachers' and students' work is evaluated by standardised assessments, the results of which are relied upon to evaluate the extent to which students are equipped to apply their learning. This suggests a need for educational research that examines student responses to real world problem contexts as well as the explanations they give for these responses. Research of this nature has the potential to guide and inform teaching and learning.

Literature Review

Perhaps one of the most important aims of school mathematics is to prepare students to apply the learned content to the real world (Verschaffel, de Corte, & Laure, 1994). The research reported in this article was critically informed by academic literature related to three particular factors that have been found to influence students' approaches to real world mathematical problem-solving tasks: the choice of problem context, including the extent to which students are familiar with it; personal values; and language and literacy skills.

The choice of problem context and how students interpret and engage with it can also influence their performance on problem-solving tasks. Whether a problem context being familiar helps or hinders student learning and assessment performance is contentious. Neuroscience has shown there is a strong relationship between processes underlying episodic memory and the ability to solve open-ended problems (Sheldon, McAndrews, & Moscovitch, 2011). So, when faced with a problem context that is familiar, a problem solver is more readily able to identify the problem space and retrieve information that is relevant and useful (Sheldon et al., 2011). This explains why problem contexts that are familiar to students can make for fun, engaging lessons – students typically contribute to their classroom learning with confidence when they have experiential knowledge to share. This is not to say that such contributions will always be productive. Problem contexts that are familiar have also been found to lead students to misinterpret, overlook or ignore the intended relevance and meaning of a task (Van den Heuvel-Panhuizen, 2005). Boaler (1994) found that girls were more likely to apply common sense as well as mathematical knowledge when faced with a fashion-related question that was considered more familiar and real to them. While the students became engaged and involved with the problem context, they underachieved on this question. Cognitive psychology offers insights why. Problem contexts provide data that are intended to activate mathematical thinking, but these data can operate in ways that cue different facts, concepts, processes, prior experiences and semantic knowledge (Tulving, 1985). Further, the salience of these cues can vary from problem-solver to problem-solver (Kaplan & Simon, 1990).

Students bring to their learning knowledge and understanding filtered through their social and cultural lenses (Vale, Atweh, Averill, & Skourdumbis, 2016). Personal values – the convictions which one finds important (Seah, 2016) – have also been found to influence students' responses to worded mathematical problems. In previous iterations of the research reported in this article, personal values learned within the home were found to shape students' responses to real world mathematical problems involving money, both in interview and classroom settings (Sawatzki, 2015). This makes sense since values have been found to be influential in the formation and development of attitudinal and behavioural tendencies, including financial behaviour (Homer & Kahle, 1988).

A growing body of research is showing that language and literacy skills and worded mathematical problem-solving skills are interrelated, not only during the primary school years but in early adolescence too (Kyttala & Bjorn, 2014; Vilenius-Tuohimaa, Aunola, &

Nurmi, 2008). Pimperton and Nation (2010) argued that mathematics assessments that place high demands on verbal ability and linguistic comprehension serve to underestimate the underlying mathematical abilities of students who tend to experience comprehension difficulties.

To explore the influence of the above factors on students' interpretation of and responses to real world problem contexts involving enterprise and entrepreneurship, data were collected from 14 teachers and more than 300 Year 5 and 6 students in four government primary schools in urban Darwin. The findings reported in this article are based on quantitative and qualitative student data collected via online surveys and face-to-face discussion groups.

The research questions were:

- What factors seem to influence students' responses to real world problem contexts involving fundraising as an example of an enterprise activity?
- What are the insights and implications for schools and teachers?

The Research Context and Methods

The study reported in this article was part of an ongoing educational design research project. As schools servicing students from diverse and low socioeconomic backgrounds were sought to participate, 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 1,000 was a qualifying criterion to participate. Table 1 consists of My School data to describe each school's size and student characteristics (socioeconomic background, identifying as being Indigenous, and being from a language background other than English).

Table 1
My School 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%

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

Students were asked to complete two surveys online: one before and one after they had completed a series of 10 lessons exploring "financial dilemmas" over the course of Term 2 (see Sawatzki, 2016). The pre-intervention survey was open for one week in April and consisted of three multiple choice items seeking to find out about students' learning preferences and seven financial literacy assessment items. It was completed by 331 students. The post-intervention survey was open for one week in August. While it was similar to the pre-intervention survey, one item was modified, a new financial literacy assessment item was added, and two open-ended questions about learning through challenging problem-solving tasks were included. It was completed by 302 students. The

attrition from pre- to post-intervention is mostly explained by student absences and turnover across the four participating schools. The pre- and post-intervention survey data were analysed in preparation for the student focus group discussions, the intention being that preliminary findings might guide and inform the choice of issues and questions to be explored further.

Twenty-eight students (seven groups of four students drawn from each of the four participating schools) participated in 20-minute focus group discussions where they shared insights into their observations and experiences with money in their family and community life, as well as their learning through the series of 10 lessons.

This article explores insights into students' emerging capacities to apply mathematical, financial and entrepreneurial thinking to real world problem contexts involving fundraising. In the section that follows, findings related to two financial literacy assessment items that were included as part of the student surveys and a financial dilemma that was presented as part of the student focus group discussions are presented and analysed.

Findings and Discussion

The findings are presented in two parts: insights from the student survey data and insights from the student discussion group data.

Insights from the Student Survey Data

Seven financial literacy assessment items were included on the pre-intervention student survey. These were developed in the style of the National Assessment Program – Literacy and Numeracy (NAPLAN) items. Table 2 presents Item 7. This item requires students to employ a simple mathematical operation: divide the total cost (\$6) by the number of items (12). Performing such a calculation is well within the expectations of the upper primary years of the Australian Curriculum: Mathematics. The options presented provide two loss-making, a break-even, and a profit response. The intention was to give the students a range within which a solution was situated. While not referred to in the problem, the cost per cupcake is otherwise known as the break-even price. This economics and business concept is typically explored in the upper primary years of the Australian Curriculum: Humanities and Social Sciences. While the survey was completed online and students were allowed to use a calculator, they were encouraged to use pen and paper to note their working.

Table 2

Item 7: It Costs \$6 to Make 12 Cupcakes. What is the Cost per Cupcake?

Option	Pre-intervention ($n = 331$)		Post-intervention ($n = 302$)	
	No.	%	No.	%
30c	46	14	24	8
40c	35	10	33	11
50c	198	60	200	66
60c	46	14	41	14
No response	6	2	4	1

Pre-intervention, 325 students completed this item and 60% responded correctly. Post-intervention, 298 students completed this item and 66% responded correctly. On both

occasions, there was a very low no-response rate. While there was a notable improvement in students' performance on this item, the number of students unable to achieve success is interesting when you consider that mathematical problem-solving of this nature is essential to complete simple everyday financial transactions. For example, a visit to the supermarket presents a similar scenario: Should I pay 50c per lemon, or buy a bag of five for \$2?

An additional, related financial literacy assessment item was included in the post-intervention student survey. Table 3 presents Item 7b, which requires students to reason that money is able to be raised when the price per cupcake is higher than the cost per cupcake. Such reasoning, which relies on a correct response to Item 7, implies an understanding of profit – an economics and business concept that is generally explored through the upper primary years of the Australian Curriculum: Humanities and Social Sciences. The decision to link Item 7 and Item 7b in this way, while not typical, meant that one problem context was able to be leveraged in two ways, thereby limiting the language and literacy demands associated with the assessment. Again, the options presented provide two loss-making, a break-even and a profit response.

Table 3

Item 7b: If Grade 6 Wants to Make and Sell Cupcakes to Raise Money for an end of Year Party, How Much Should They Charge per Cupcake?

Option	Post-intervention ($n = 302$)	
	No.	%
30c	8	2
40c	18	6
50c	124	41
60c	108	36
No response	44	14

Post-intervention, 258 students completed this item. Most students (41%) nominated the break-even price and a little less (36%) nominated the profit-making price. Note the relatively high no-response rate – 14% of the sample did not even attempt this question. The fact that students struggled with this item is particularly interesting given that the four participating schools reported Year 5 and 6 students being involved in kitchen garden programs that included growing, preparing, and marketing fresh produce and home-made goods and/or other fundraising initiatives. In fact, the problem context – a cake sale to raise money for an end of year party – was selected since upper primary students routinely organise fundraising activities like this as they plan and budget for Year 6 graduation celebrations. At various times over the course of the study, the teachers described these practical initiatives as being rich in experiential learning related to entrepreneurship.

Students' responses to these items signalled a need to explore what influences students as they consider problem contexts related to pricing and profit. Might the high error and non-response rates be explained by miscalculation, or other factors? This was done through the student focus group discussions.

Insights from the Student Discussion Group Data

As part of the student focus group discussions, the following financial dilemma was presented:

Year 6 would like to raise money to donate to the RSPCA. The teacher has suggested making lolly bags to sell at school. Each lolly bag will cost \$2 to make. What price should Year 6 sell the lolly bags for? Justify your thinking.

Note the shift in the terminology used to pose the question. In Item 7b, the word “charge” was used and here the word “price” was used. This was intended to bring the inquiry into sharper focus.

In each focus group discussion, the researcher introduced the task by saying, “I’ve got a problem here and there’s probably more than one answer. I’m interested in your thinking.” Students were then given time to read the task and pose questions. A range of questions were raised, examples of which include:

How much money do they need to raise?

How many students are there?

Is there a budget?

These early reactions signal that while some students were familiar with the problem context inquisitive as to the possibilities associated with it, they seemed to draw on experiential knowledge in ways that were not immediately relevant to the task at hand or helpful to the problem-solving process. To re-focus students on the financial dilemma and initiate quiet problem-solving time, the researcher asked, “So, how much do you think we should sell these lolly bags for?” On occasions, the researcher reframed the question, “What price should we charge?”

Transcripts of the student discussion group audio recordings were analysed and student responses assigned to one of three categories: loss-making responses, break-even responses, and profit-making responses.

Students who gave loss-making and break-even responses were price-conscious and preoccupied with providing value for money to the market. Three students from School C agreed to sell the lolly bags for \$1.50, giving the following explanations:

Because \$2 is a lot to be spending on a lolly bag.

I’d probably do \$1.50. So, it’s not so expensive.

In the shops, you’ll find lolly bags are normally \$1.50. I reckon \$2 is too much.

In these examples, students seem to draw on their observations and experiences with similar products in the market to judge a price point they believe purchasers will reasonably tolerate. They infer a need for the price point to be competitive. Similarly, two students, one at School A and one at School B, determined that the price should be \$1.50. Their explanations revealed an emerging understanding of demand and supply theory. For example, one commented, “If the price is lower, more people might buy them. Then they’ll make more money.” A price that would enable more children to participate in purchasing lolly bags reveals sensitivity to others’ financial circumstances and suggests these children value inclusion. However, with a price point below break-even, their reasoning was flawed by capitalist standards. Further, in these examples, the students seem to confuse what is meant by “cost” and what is meant by “price”. There is no evidence that they understood the meaning of “profit” – a concept that is central to any enterprise activity.

Break-even responses (to price the lolly bags at \$2) were justified in similar ways. As one student from School A explained, “It’s not too expensive or too cheap. Plus, that’s what it costs to make the lolly bag.” This particular response seems to be motivated to avoid financial gain – a goal that is contrary to that specified by the problem context. Again, being conscious of what might be a fair price to ask other students in the school

community to pay again reveals sensitivity to others' financial circumstances and suggests these children value inclusion.

Students who gave profit-making responses revealed more sophisticated understandings of the problem context. They applied reasoning that was purely mathematical, financial and entrepreneurial. These students competently and confidently used the term "profit" in their explanations, as shown by this interaction between the researcher and students from School B:

- Gen: You can't sell it for \$2 because you need to make a profit. And the profit is the money that will go to the RSPCA.
- George: I reckon around \$2.50 or \$3.00.
- Gen: Yeah.
- I: Just explain to me, how do you know about this word "profit"? That's a nice word you've used there.
- Gen: For a field day at our school, we were making chutney...
- George: And rosella jam... And we needed to make a profit out of it so we were adding up how much it cost and deciding what the profit should be. How much profit we'd get. And then what the price should be.

Here, the students reference prior learning through their school kitchen garden program. George clearly distinguishes between cost, price and profit. It seems that these students' mathematics learning was situated within an enterprise initiative where concepts in mathematics, economics and business were meaningfully explored. Further, to the extent that students' vocabulary was added to, language and literacy learning outcomes were achieved. For these students from School B, what was learned in their school kitchen garden program was able to be transferred to the lolly bags task - a similar real-world context. By contrast, students from School A who were also regularly involved in a kitchen garden program did not mention profit or engage in conversation like this.

Conclusion and Implications

In the first instance, students were presented with two assessment items based on real world problem contexts involving fundraising as an example of an enterprise activity. While 66% of students were able to calculate the cost per cupcake, only 36% of students nominated a sale price that would enable a profit to be made.

Subsequent student focus group discussion data revealed that students' responses to a similar task were influenced by their familiarity with the problem context, personal values, and language and literacy skills. Students who gave loss-making and break-even responses to the lolly bags problem were price-conscious and preoccupied with providing value for money to the market. They seemed motivated that the price per lolly bag be affordable for the majority of students, rather than "too expensive". These considerations reveal sensitivity to others' financial circumstances and show the students value inclusion. This is likely due to social and cultural norms within their families and school communities. Interestingly, there seemed to be a gap in these students' language and literacy skills in terms of important understandings that underpin the mathematical calculations and reasoning necessitated by the problem context (i.e., "cost," "price", and "profit").

By contrast, students who gave profit-making responses applied reasoning that was purely mathematical, financial, and entrepreneurial. They were not distracted by social and

cultural sensitivities. They interpreted that the price per lolly bag must be higher than the cost to make one and were more likely to use the term “profit” to explain their thinking.

There are several insights and implications for schools and teachers. These findings highlight that problem contexts of this nature are in fact values-laden and interdisciplinary. Not only did the problem contexts appeal to students’ personal values, there were implicit language and literacy demands that meant students were required to apply mathematics alongside economics and business. This suggests a need for teachers to select tasks and pedagogies that meaningfully connect learning areas and general capabilities through real world problem contexts that allow for exploration, conversation and discovery. Further, the findings highlight the importance of adopting culturally responsive teaching practices that seek to align classroom tasks and pedagogies with the diverse identities, experiences, values and norms students bring to their learning (Vale et al., 2016). Inevitably, there is a need for professional learning that orients teachers to work in this way.

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