The Australian Curriculum Mathematics: A Move Forward or Back to the Future?

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ABSTRACT

The release of the Australian Curriculum: Mathematics has generated considerable debate in the education community. Some educators warn that this debate has centred on mathematical content and skills, setting the conditions for a "back to basics" movement in line with the political rhetoric that accompanied the national curriculum development. However, the Shape of the Australian Curriculum: Mathematics document contains a commitment to provide a futures-oriented curriculum. This article provides a critical analysis of the released curriculum document in the light these claims. It questions whether the direction taken in the curriculum demonstrates a futuristic view of mathematics education. It considers whether the document is aligned with a national focus on education for citizenship, identified in past government declarations on education as the basis for the development of the national curriculum, and the role of technology in teaching mathematics based on decades of theorising and research in this area.

KEYWORDS
Mathematics curriculum; national curriculum; curriculum development; curriculum problems; curriculum evaluation; technological change

Attempts at national collaboration and standardisation of school education among States and Territories in Australia date back over 40 years (Marsh, 1994; Reid, 2005). Previous attempts were led by federal governments of different parties (Labor or Coalition) and have taken different forms (sharing curriculum resources, setting standards and profiles, nationwide testing, developing national curricula). Undeniably, one major obstacle to the success of such collaborations is the federal system of government in Australia, which grants the States and the Territories full constitutional jurisdiction for decisions affecting schools and the Federal Government the responsibility of funding schools through the national taxation system. The regularly re-emerging debate about States' rights and Federal ambitions coupled with party politics and ideological rifts between neoliberal and progressive agendas have had a decisive role in frustrating previous attempts of national collaboration in education. However, as Reid (2005) argued, there are other serious lessons from such failures that should be heeded. Reid noted three reasons for which previous attempts at a national curriculum had failed, among which was that previous attempts for national collaborations have "failed to develop a rigorous theoretical base" (p. 20) to present an alternative to current curricula developed by the different jurisdictions.

Arguably, the motivations behind previous attempts at national collaboration have been varied. In general, they were mainly technical in nature (Kennedy, 2009; Reid, 2005). They included efficiency in the use of resources, the movement of students from one region in Australia to another, and reducing the difference in student performance between the different States and Territories. Kennedy (2009) argued that claims that a national curriculum might meet these needs remain untested. Luke (2010) put it: "the national curriculum ... remains a solution seeking robust demonstration of an educational problem" (p. 59). Of particular relevance here is the observation that the different mathematics curricula across Australia already enjoy significant overlap, if not uniformity. Here we argue that perhaps three of the most crucial differences that give rise to difficulties in student movement and differential performance levels are the different starting age of students in grade 1, the positioning of grade 7 in either primary or secondary school and the exit qualifications in grade 12. These concerns are not addressed by a national curriculum as such. However, more importantly, such technical motivations, as Kenney points out, “do not provide an exciting and futuristic rationale for having a national curriculum in the 21st century” (p. 7).

This paper examines the *Australian Curriculum: Mathematics* published in 2011 in the light of the point raised by Reid (2005). In particular, we will examine the conceptualisation of the curriculum and the formulation of content and raise the question whether it represents a vision for mathematics education that is likely to guide school practices to meet the needs of students in a rapidly changing world marked by rapid change, but also by uncertainty and complexity (Skovsmose, 2009).

Curriculum for the future?

As Apple (1979) argues, developing any curriculum is a political activity through and through. It legitimates what knowledge and skills are valued in society and whose voices are represented. The curriculum a society produces is a representation of its traditions and history, a reflection of its cultural identification. A curriculum is necessarily a reflection of accumulated knowledge from years of practice and research in education and the related disciplines. It is also a reflection of the dominant political values of the day. However, it also a vision of what we desire a society to be and what students might need to know and be able to do in their lives as citizens of the future. A national curriculum is as much about the identity of a nation as it is a vision for what are worthwhile capacities for it young people to meet and shape their personal and communal future (Kennedy, 2009). In summary, curriculum development has the two faces of Janus, one face looking to the past and one looking to the future.

A guiding document behind the current attempts to develop the Australian National Curriculum is the *Melbourne Declaration by State and Federal Ministers of Education* (Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA), 2008). The *Melbourne Declaration* identifies some of the significant ways in which the world has changed during the past two decades. These changes, which impact on the way people live, work and interact with each other, include globalisation, the rise of Asian economies, changes in workplace laws, environmental issues and rapid and continuing advances in technologies (MCEETYA, 2008, pp. 4-5). We might add complexity, risk and uncertainly. The *Shape of the Australian Curriculum: Mathematics* (National Curriculum Board, 2009) acknowledges these changes and concludes by asserting that

> Education must not only respond to these remarkable changes but also, as far as possible, anticipate the conditions in which young Australians will need to function as individuals, citizens and workers when they complete their schooling. (p. 6)

Notwithstanding the difficulty of predicting the further needs of young Australians in an age of uncertainty, the Shape statement goes on to point to one implication of such changes and the need to focus on the future needs of students.

> Young people will need a wide and adaptive set of knowledge, understanding and skills to meet the changing expectations of society and to contribute to the creation of a more productive, sustainable and just society. (p. 6)

It is not clear what are the “knowledge, understandings and skills” referred to here, nor how they relate to the disciplinary knowledge, understanding and skills common in many curriculum documents around the world. Nor is it clear how they are intended to be used to structure the various subject curricula to be developed, whether they are intended to inform the pedagogies employed by teachers or their assessment practices.

In 2001, the Australian Council of Deans of Education (ACDE) issued a statement outlining a vision of education for the future. They argued that the traditional construction of education as serving the economic development both for the individual and society is of limited value to the construction of curricula that are likely to be useful for students in the future. They argued that the dividing line between work life and cultural live was gradually disappearing and in the new times, learning was taking a new role and a new shape.

> And, for the learning which is now required, the old education simply won’t do. The new economy requires new persons: persons who can work flexibly with changing technologies; persons who can work effectively in the new relationship-focused commercial environment; and people who are able to work within an open organisational culture and across diverse cultural settings. (p. 33)

For our purposes here, the ACDE report put forward several propositions that argued for the need to “shape the future environment of learning” (p. 2). In particular, Proposition 4 discussed the new “basics” versus the “old basics” and the demand for interdisciplinary approaches to knowledge generation. Proposition 5 discussed the role of technology in the new environments of learning. We will consider these two themes respectively in our reflection on the *Australian Curriculum: Mathematics* as a vision for the future of educating young Australians for the 21st Century.

Old Basics or towards New Basics?

Behind any attempt to develop a curriculum there are views, albeit often implicit, about the nature of the knowledge (including concepts, procedures and processes) that are valued for development with students. If mathematics is seen as a fixed body of knowledge, hardwired in the mind (Lakoff & N´u˜nez, 2000), or discovered by human ingenuity from many cultures and eras, then this knowledge is universal and objective, and the focus of the curriculum would be on mathematical content to be achieved by the student. Curricular decisions would then be reduced to questions of sequencing that are mathematically justified and appropriate to the developmental stage of the student. The curriculum that is most useful for the teacher would be one that identifies mathematical content (concept and procedures) with possibly a list of competencies that the students need to demonstrate in each content area. Consistent with this view of mathematics, the traditional content fields of mathematics are seen as a natural way to present this content to the teacher and consequently to the student – albeit with attempts to make explicit some connections between them.

This view of mathematics has been systematically challenged from a wide variety of perspectives. Movements such as Ethnomathematics (D’Ambrosio, 1985; Powell & Frankenstein**,** 1997) are based on the identification of different mathematics developed within different cultural and social groups. From this perspective, school mathematics and academic mathematics are but two of the different possible mathematics that have been developed and used. Further, this perspective raises questions as to which mathematic is appropriate in what context and for which students. Similarly, from a critical mathematics perspective (Frankenstein, 1983; Skovsmose, 1994), mathematics is seen as a means of understanding the world and a means of formatting the world (Skovsmose, 2009). Consistent with this perspective is valuing mathematics not for its beauty and elegance, but for its power to make aspects of the world explicit to the user of mathematics. Since it is not possible to understand aspects of the world in a value free manner, mathematics from this perspective is not value-free and universally objective. It not only raises questions of power and privilege in society, but in itself is open to questions in its power as well as its limitations. Similarly, within this tradition, the social justice perspective of mathematics education (Gutstein, 2006) highlights the nature of mathematics as a tool to "read the world and write the world". The focus here is on the mathematics competency needed not only to participate in the world but to change it. In turn this focus necessarily raises question of ethics (Atweh & Brady, 2009).

The critique of the traditional view of mathematics as a fixed universal and value-free school subject has been raised from the above perspectives, which some may consider still at the margins of mathematics education literature. It has also been raised, however, by many mathematics educators within the mainstream literature. Romberg (1992), in a response to Apple's critique of the USA *Curriculum and Evaluation Standards for School Mathematics* (National Council of Teachers of Mathematics, 1989), argued that the view of mathematics as a fixed body of knowledge and skills to be mastered in order to solve problems that have unique solutions should be abandoned. Instead he called for a mathematics centred on applications and modelling stemming from the real lives of the students. Such activities, he argued, necessarily raise the need to make judgements on the models developed and hence bring in questions of values and interdisciplinary knowledge. Further, he argued that such mathematics is more fitting to the needs of students, because "the world has changed and schools need to change" (p. 433).

In this article, we take the stance that mathematics, seen as a way to make sense of the world and to act in the world, has implications for both the rationale and the organisation of the curriculum.

Rationale: To start with, we note that this view of mathematics in line with the second national goal of education identified by the *Melbourne Declaration* (MCEETYA, 2008) that "All young Australians become … active and informed citizens" (p. 1). As Popkewitz (2004) argues, however, active citizenship is a problematic construct that needs to be interrogated. Borrowing the terminology from Down, Ditchburn and Lee (2007), the role of mathematics education as it relates to active citizenship can be at three levels. Mathematics education can contribute to the ability of students to function as effective citizens in the world. The authors call this a *conforming* ideal. This is consistent with the dominant justification of mathematics as developing skills and knowledge useful for preparation for work. However, mathematics can also be used to enable students to understand how the world works (or does not work) in order to change some aspects of their world. This, which the authors refer to as *reforming*. Mathematics, has an additional capacity. It can be used to create the world in a new way. The authors call this the *transforming* capacity. This focus on mathematics education is consistent with the critical mathematics and the social justice approaches discussed above. It is also in line with Biesta (2010) who identified three different types of purposes for education: qualification, socialisation and subjectification.

Arguably, developing the capacity of students to master the language, concepts and processes of school mathematics, and even its formality, is a contribution to students' development towards informed citizenship. As Ernest (2002) argued, empowerment of students in and through mathematics necessarily includes *mathematical empowerment* which consists of the ability to critically read and produce mathematical texts as well as pose their own problems and solve problems. However, the decontexualised knowledge of school mathematics is not sufficient guarantee that it will contribute to development of informed citizenship. Seen from this perspective, the development of an appreciation of mathematics for its beauty and elegance, and developing mathematics that is useful for careers and jobs and further study, are seen as secondary to the development of mathematics that has the capacity to transform aspects of the life of the students, both as current and future citizens. Further, privileging of abstract and formal knowledge over contextualised knowledge becomes problematic. As Christie (2005) argues, “current times require the consideration of both universalistic, abstract knowledges and particularistic, contextualised knowledges” (p. 244).

Atweh and Brady (2009) argued that mathematics can only contribute effectively to student responsibility as informed citizens if it engages with the world of the students. Perhaps every teacher of mathematics at one time or another has faced the question from a distressed student “but why are we studying this”. Perhaps not surprisingly the usual answer - that you need this for future jobs - leaves many students unconvinced. Here we argue that the usefulness of mathematics should not only be demonstrated by using examples from the real world of the student as applications of the decontexualised mathematics studied. Rather, mathematics knowledge itself should be developed through such engagement with authentic activities. The development of mathematical knowledge through real-world activities demonstrates the usefulness of mathematics at the same time as engaging students. Further, this engagement of mathematics with the life of the student should be an engagement not only with the physical world and the economic world, but also with the social world. It should be an engagement not only with the world as the student will experience it as an adult, but also with their current world. It should aim at developing an understanding not only of mathematics but also of the world. Finally, such engagement should aim not only at *reading the world*, but also, whenever possible, at *transforming the world* – even to a small degree.

Organisation: The Curriculum Standing Committee of National Educational Professional Associations, consisting of representatives of the Australia’s peak educational professional associations asserted that “current practices may impede the achievement of the learning envisioned in national goals of schooling statement and proposes new ways to develop, package and deliver the curriculum that will produce a greater alignment between schooling practices and the national goals of schooling” (Cole, 2008, p. 3). The reference to practices is to the traditional “silos” in which the different school subjects are presented and, we may add, to the traditional fields in which the different subjects are organised. These practices also include the traditional focus on content knowledge and processes of the specific subject. The statement goes on to argue the national goal identified above necessitates the use of “problems that require in-depth consideration and the synthesis of information from a number of different disciplinary perspectives” (p. 5). This interdisciplinary approach to dealing with authentic problems is not achieved by practices that develop distinct knowledge bases, albeit with references made from one subject to another.

Interdisciplinary approaches to education take different forms. For example, the International Baccalaureate contains specific subjects required by all graduating students; the Big Picture Schools[1] have a project based curriculum that takes into consideration the life interests of the students and structure the school subjects around these projects; the Singapore A level curriculum contains a six month multidisciplinary subject; The New Basics reform in Queensland contain Rich Tasks that require students to demonstrate student learning across different subject areas (Department of Education and Training, 2004).

Naturally the philosophies behind all these examples differ. The intention here is to illustrate how it is possible for interdisciplinary approaches to be incorporated within the different subjects demarcated by ACARA as well. Dealing with real-world authentic problems (or modelling activities as suggested by Romberg, 1992,) in mathematics education

[1] For further information see http://www.bigpicture.org.au/

necessitate dealing with knowledge generated in other school subjects. Perhaps we need to point out in this context that not all activities in the expanding area of research and pedagogy called modelling satisfy the type of activities we are calling for here. Many practices in modelling seem to use real world phenomena to develop mathematical models and then manipulate the model mathematically to generate more mathematics. There may be value in doing this, but rarely are models used to critically understand the phenomenon being modelled or the assumption and limitations of the model are made problematical, presumably since these are seen to belong to other school subjects. The curriculum that is aligned with the National Goal of developing informed citizens should encourage teachers to deal with issues that fall outside their traditional areas of expertise. In some cases, this can be accomplished through collaboration with other teachers.

Similarly, questions can be raised as to whether a content-based organisation of the curriculum may not be the best way to encourage development of practices that meet the national goals of education in Australia and achieve education that is appropriate to meet the needs of students in the 21st Century. Content-based curriculum at best can reinforce practices that develop decontextualised mathematical knowledge that makes sense only within the field of mathematics itself. The ACDE report (2001) argued that education for the New Times requires less focus on knowledge development and more on the capability of knowledge use. They put it as follows: “It’s not just things you know which matter but also things you can do. Insofar as knowledge is one element of capability, it has to be relevant to doing, rather than knowing for its own sake. Capability is also a matter of selecting relevant knowledge” (p. 86). Further, Reid (2005) adds that developing capabilities are not restricted to schools’ experiences but should be seen as a lifelong endeavour.

It is worth mentioning here that the *Australian Curriculum: Mathematics* presents four Proficiency strands adapted from the report to the National Research Council, (Kilpatrick, Swafford, & Findell, 2001). Of the five strands identified in the US model, four were used in the National Curriculum Mathematics and renamed as *Understanding*, *Fluency*, *Problem Solving* and *Reasoning*. Likewise, the curriculum identifies general capabilities first identified in the Melbourne Declaration as characteristic of a world class curriculum that would develop “general capabilities that underpin flexible and analytical thinking, a capacity to work with others and an ability to move across subject disciplines to develop new expertise” (p. 13). The *Australian Curriculum: Mathematics* itself asserts that these capabilities identify “the skills, behaviours and attributes that students need to succeed in life and work in the twenty-first century”. However, their implementation in the main body of the curriculum as elaborations of the content show a heavy focus on what could be considered as the first two proficiencies of understanding and fluencies and, to a much lower level, on reasoning and problem solving. Similarly the lack of deep and meaningful analysis of the General Capabilities in the curriculum raises questions about the serious value given to them and whether they are seen as natural by-products of the implementation of the curriculum rather than as useful tools for is design.

New roles for technology?

Earlier we referred to the *Melbourne Declaration* on educational goals for young Australians (MCEETYA, 2008) as a source guiding the development of the Australian Curriculum. The Melbourne Declaration noted that “rapid and continuing advances in information and communication technologies (ICT) are changing the ways people share, use, develop and process information and technology”. A similar emphasis on changing futures is evident in the ACDE statement (2001) on new learning, in which Proposition 5 states that “technology will become central to all learning” (p. 99). However, both of these sources reflect a view of ICT as generic information management tools rather than applications that are specific to particular learning areas, a point acknowledged in the initial shaping proposal for the Australian Curriculum that was released in 2008. The discipline-specific implications of ICT competence as a general capability were to be addressed through the curriculum for the relevant learning areas, of which mathematics is one example.

The Shape statement for the mathematics curriculum (National Curriculum Board, 2009) made it clear that technologies should be embedded in the curriculum "so that they are not seen as optional tools" (p. 12). Digital technologies were seen as offering new ways to learn and teach mathematics that would help to deepen students' mathematical understanding, make previously inaccessible mathematics accessible to students, and allow the use of realistic data to make mathematics more interesting to more students. These recommendations were, no doubt, informed by decades of research on the roles of digital technologies in mathematics education (see Hoyles & Lagrange, 2010, for a recent review of the field).

There have been a number of major shifts in thinking throughout this period of research. One is exemplified by a shift away from studies investigating the effects of technology use on students' mathematical achievement by comparing the performance of treatment (with-technology) and control (no-technology) groups of students. Such studies assumed that the two groups experience otherwise identical learning conditions, whereas more recent studies are interested in how technology fundamentally changes students' mathematical practices and even the nature of the mathematical knowledge they learn at school. A second shift is observed in the better understanding we now have of the institutional and curricular challenges of effective, large scale technology integration (Artigue, 2010). Simply adding technology to a mathematics curriculum still grounded in a culture of pencil-and-paper calculation is not enough to bring about change in complex educational systems. Again, these challenges are related to the fact that "technology both affects what is learnt and the form in which it is learnt" (Artigue, 2010, p. 472).

We argued earlier that views about the nature of knowledge inevitably influence curriculum development. We noted the curricular implications of seeing mathematics either as a fixed and universal body of knowledge or something that could be discovered, created, or used to understand or change the world. Each of these views also has implications for how one conceives the role of technology in learning mathematics. Olive and Makar (2010) argued this point as follows:

> If one considers mathematics to be a fixed body of knowledge to be learned, then the role of technology in this process would be primarily that of an efficiency tool, i.e. helping the learner to do the mathematics more efficiently. However, if we consider the technological tools as providing access to new understandings of relations, processes, and purposes, then the role of technology relates to a conceptual construction kit. (p. 138)

In the light of these ideas it becomes important to ask how mathematical knowledge and practices *change* when teachers and students use digital technologies for learning, and to what extent does the *Australian Curriculum: Mathematics* reflect these possibilities for change?

Theorising the role of technology in changing mathematical knowledge and practices: Researchers have developed many ways to explain how technology changes the teaching and learning landscape in mathematics classrooms. For our purposes, we will illustrate the possibilities using the frameworks developed by Goos, Galbraith, Renshaw, and Geiger (2000) and Pierce and Stacey (2010).

Goos et al. (2000) took the perspective that digital technologies are cultural tools that mediate learning and classroom social interactions, qualitatively transforming students' thinking. They proposed four metaphors to describe how technology can change teaching and learning roles. Technology can be a *master* if students and teachers lack sufficient knowledge and confidence in using it. Technology is a *servant* if used only as a fast, reliable replacement for pen –and-paper calculations without changing the nature of classroom activities. Technology is a *partner* when it provides access to new kinds of tasks or new ways of approaching existing tasks to develop understanding or mediate mathematical discussion. Technology becomes an *extension of self* when seamlessly integrated into the practices of the mathematics classroom to support mathematical reasoning, critique mathematical methods or models, or generate new questions for investigation.

Pierce and Stacey (2010) produced a pedagogical map that classified ways in which technology can transform teachers' mathematical practices. They claim that pedagogical opportunities arise at three levels:

- *tasks* set for students (using technology to improve speed, accuracy, access to a variety of mathematical representations; working with real data or simulated real life situations);
- *classroom interactions* (using technology to change the classroom social dynamics or the didactic contract);
- the *subject* being taught (using technology to provoke mathematical thinking, support new curriculum goals, or change the sequencing and treatment of mathematical topics).

Our first example comes from a study of the role of digital technologies in numeracy teaching in primary school classrooms (Geiger, Dole, & Goos, 2011). The teacher engaged her Year 5 class in an international web-based challenge in which students from schools in many countries documented how many steps they walked each day as recorded on a pedometer. Over a-two month period, students entered their number of steps per day into a spreadsheet provided by the teacher. Totals for the whole class each day were calculated and entered into the website interface. The website could then be interrogated in various ways: for example, to create a graph of daily entries, a progressive class average by week and month represented both numerically and graphically, and position rank in comparison with other participating schools. The aim was "walk" further than classes in other schools, with the "journey" represented along a pre-determined route from North America, passing through South America and Africa, and finishing in Europe. Here the spreadsheet was more than a tool, used in *servant* mode, for banking data before entering into the web interface. Instead, the teacher and students compared data summaries within the class and internationally, with classes in other schools. Students readily engaged in discussion about the meaning of "average", how far they each needed to walk to improve their average position in comparison to other classes (and how realistic was this goal), and what it would take to "walk" their class to the next destination on the global journey. The two forms of technology, spreadsheet and internet, were thus *partners* in providing new ways, not based on a textbook exercise or worksheets as is so often the case in mathematics classrooms, for students to learn about the concept of "average". From the teacher's point of view, the technology did more than introduce a *task* with real data and enable fast, accurate calculation; it also changed the nature of *classroom interactions* by giving students more autonomy to pose questions of interest to them.

The second example involves a secondary school class that was using a handheld CAS (computer algebra system) device in a mathematical modelling task (Geiger, Faragher, & Goos, 2010). The modelling process usually involves specifying the real world problem, formulating a mathematical representation of the problem while identifying any underlying assumptions that are being made, solving the mathematical problem, interpreting the solution in the light of the original context, identifying limitations of the model, and if necessary repeating this process until an acceptable resolution is obtained. Technology is most often used as a tool to assist with representing and solving the mathematical problem after the model is developed – for example, as a *servant* to produce a graph or to carry out calculations. However, Geiger et al. found that particular features of the handheld technology caused students to re-assess the assumptions they had made when formulating a mathematical model for monitoring the rate of production of carbon dioxide in the Darling River. Seeing the calculator display an "Undefined" error message made them realise they had made an invalid assumption about the mathematical representation they had chosen, and forced them to create a more sophisticated model that better reflected the real world data with which they were working. The teacher's actions were crucial here, in that he refrained from telling students where the error lay, and instead orchestrated a discussion about their underlying assumptions. Thus the technology was a *partner* provoking new understanding in all aspects of the modelling process, not only in the "solve" phase. Exploiting this pedagogical opportunity also allowed the teacher to capitalise on the way the calculator displayed an error message to provoke mathematical thinking, thus fulfilling *subject* level goals of promoting thinking about the mathematical modelling process rather than just practising skills.

The final example illustrates the potential for ubiquitous mobile technologies to stimulate inquiry in to real life situations as well as new forms of collaborative activities. Yerushalmy and Botzer (2011) report on mobile phone applications they have developed that allow teacher education students to video record and analyse phenomena of change or motion in their environment (at home, observing vehicles, sports, etc). Students send the video clip to the teacher and to colleagues in their group with a short description of the phenomenon and the pattern of change. They use one of the applications to sketch a graph representing this change mathematically. Students then use their phones to watch each other's video clips, read the descriptions and graphs, and send evaluative comments to the authors. This process continues as students comment on the work of others and refine their own work. Yerushalmy and Botzer claim this approach develops students' mathematical knowledge while engaging them in mathematical discussion both in and out of class time as they propose and defend conjectures and solutions. More interestingly, they argue that mobile phones have an advantage over mathematics-specific technologies because of their authenticity – they are already part of most students' daily out-of-school lives. In these circumstances one could imagine mobile phones, used in this way, becoming an *extension of students' mathematical selves*.

The implications for pedagogy are still unclear. Yerushalmy and Botzer note that more research is needed to address questions about the affordances of the *tasks*, how confortable teachers feel with new types of technology-mediated social *interactions*, and any tensions they may feel in achieving new *curriculum goals* using personal mobile technologies.

Curriculum content and proficiencies: How well does the *Australian Curriculum: Mathematics* reflect these technology-based possibilities? Despite the promise of the Shape statement, the current published version of the F-10 curriculum does little to promote a view of mathematics as understanding and acting on the world, or of technology as a "conceptual construction kit" (Olive & Makar, 2010, p. 138). An analysis of the content descriptions by year level and content sub-strand, searching for instances of the terms "technology", "technologies", "calculator", "computer", and "software" identified some instances of a *partner* role for technology, for example, in promoting new approaches to existing tasks for developing understanding. However, technology is largely viewed as a *servant* that speeds up, without really changing, the tasks of the mathematics classroom. From a pedagogical perspective, opportunities for using technology are mostly at the level of the *task* (improving speed and accuracy, linking mathematical representations, working with real data), with almost no acknowledgement that technology can, and should, change the nature of the *subject* itself, for example, by supporting curriculum goals that emphasise mathematical thinking or real world applications and modelling. These may not be surprising, given the relative lack of emphasis on the proficiency strands of problem solving and reasoning we noted earlier.

Conclusion

In this article we presented one possible reaction to the Australian Curriculum: Mathematics. We present this view with the hope of continuing the conversation on the national curriculum. We centred our position here on the expectation, reflected in the document itself and in the accompanying media releases and political talk, that the national curriculum would have a strong future orientation. We examined this claim based on the challenge provided by the Australian Deans of Education that education for the future would include a different formulation of what can be considered basics and a stronger and central role of technologies.

It seems to us that the rationale of the Australian Curriculum: Mathematics has identified a range of uses of mathematics to justify it position as a compulsory subject in the F-10 curriculum. Many of these are quite familiar to most teachers and parents. We noted, with some regret, however, that the curriculum fails to identify the development of active citizenship as the ultimate rationale for studying mathematics, and for that matter, all school learning as aspired by the Melbourne Declaration. Here we understand that preparation for active citizenship to include the ability to participate in work and managing daily demands of day to day life. However, it goes beyond them, towards using mathematics to understanding the social world critically and creatively, and to imagine a better world. Those of us who appreciate the power of mathematics in these terms, can only hope that teachers would be inspired and challenged by this potential of mathematics in spite of its absence from the official curriculum.

Likewise, we noted that the focus on content in the articulation of the curriculum would lead to privileging knowledge of content and basic skills at the expense of making sense of mathematics and its use for creative problem solving in real and complex world problems. Likewise, the identification of content into the traditional mathematical fields of mathematics may be convenient in a syllabus, but it does not lend itself to dealing with real world applications that often require cross disciplinary approaches. With the increasing focus on overall capacities in thinking about preparing students for future, it is left to teachers to see how the content can be used to develop the cross curriculum competencies, and the higher order proficiencies identified in the Australian Curriculum: Mathematics.

Finally, with respect to the use of technology in mathematics education, while the Australian Curriculum: Mathematics has mentioned the possible uses of a range of technologies in its articulation of content, the dominant view appears to be that technology is to be used to facilitate the traditional content and skills rather than affect the knowledge and possible learning that can occur where the use of technology becomes central. Undoubtedly, much more research and theorising are needed for the international community to come in terms with this difficult and still evolving area of thinking. However, it seems to us that in this, as well as in the above points, the Australian Curriculum: Mathematics fails to demonstrate its commitment to be a curriculum with an appropriate strong future orientation.

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