Opinion

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High-quality mathematics resources as public goods

James Russo
Monash University, Vic
<mr.james.russo@gmail.com>

When I began classroom teaching, I remember spending an hour a night sitting down in front of my computer googling for lesson plans and resources in mathematics. Sure, we had a couple of resource texts at my school, but, as a teacher passionate about maths education, you are always looking for something more interesting, more engaging, something to probe mathematical ideas more deeply—in short, something better. This googling was a pretty hit and miss exercise—and mainly miss. There is ample material available online, but sorting the wheat from the chaff, so to speak, is intensely time-consuming.

As I have gotten along in my career, I have joined some professional associations, and this has given me ready access to higher quality resources. I do not doubt that this has improved my professional knowledge and the quality of my lessons. I have reached the stage where I am contributing ideas of my own to practitioner journals, like *Teaching Children Mathematics* (TCM), the *Australian Primary Mathematics Classroom* (APMC) and *Prime Number* (PN). But the question still nags at me: What are teachers without access to such resources, or the time to develop their own, supposed to do? Some might be able to rely on their school numeracy coordinator, but again, this is likely to be hit and miss. These teachers may not have the patience to hunt the web for good resources, or be in a position financially to be able to join professional societies, particularly if mathematics is not their passion. We all know teachers are not particularly well paid, and these people may well have other priorities. They also lack any real incentive to turn a good lesson into a great lesson, because, despite recent efforts to the contrary, teaching is a profession that struggles to know how to measure, recognise and reward good practice.

So, why make it harder for teachers than it needs to be? Why not make all practitioner journals, such as TCM, APMC and PN, free to all teachers after a certain period of time has lapsed (perhaps two years)? Better still, why not email links to these materials directly to teachers' inboxes? Why not view high-quality mathematics resources as public goods freely available to all?

I offer three reasons in support of the proposition that high quality mathematics resources should be viewed as public goods.

First, once the labour has gone into conceptualising, developing, reviewing and digitally publishing a resource, the extra cost of any additional copy of the resource is almost zero. Although this has always been the case to an extent, the idea of educational resources as public goods has obviously been amplified significantly in the digital age. There is no longer any need to distribute a 'hard copy' of a resource, with its associated sourcing, copying and postal costs. In fact, the only cost to distributing a resource right now is the minuscule amount (a fraction of a cent) associated with digitally storing the resource in cyberspace, or on a personal computer. In my mind, there is only a net gain to society in distributing these high-quality resources further.

Second, and also as a direct consequence of the age in which we live, the availability of other free resources online continues to proliferate. We all know the quality is variable, and often at the lower-end of the scale. Typically these resources provide opportunities for drill and practice, but make no attempt to develop conceptual understanding, promote mathematical reasoning or represent mathematics as a meaningful and important pursuit. By contrast, the resources published in TCM, APMC and PN are consistently of a high standard, in no small part because of the rigorous peer review and editorial review processes put in place by the respective professional associations (the National Council for Teaching Mathematics, the Australian Association of Mathematics Teachers and the Mathematical Association of Victoria). However, high-quality resources are at

continued risk of being 'crowded out' by these lower quality resources. This process could be circumvented by directly emailing teachers high-quality resources, reducing both the search costs for teachers and the possibility that they are using sub-par resources in their classrooms.

Third, sites such as www.academia.edu and www.researchgate.net serve as hubs for academics to engage, and to share articles and ideas. However they are not necessarily current online destinations for teachers. By contrast, teacher-resource sites often have very little engagement with the academic community. By directly engaging with both teachers and academics, professional associations and their practitioner-journal products already serve as a meaningful forum for building connections between research and practice—a current competitive advantage if you like. Expanding the reach of this forum by bringing in more teachers only increases the overall social value of this network. At some point soon, if professional associations do not stay ahead of the game and make efforts to expand their reach, this role may well come to be filled by something else.

I understand that, on the surface, this proposal appears to have possible negative implications for professional membership, particularly if it is assumed that one of the main incentives to join such professional associations is to gain access to teaching resources like TCM, APMC and PN. However, I would be confident that teachers passionate about mathematics would still join professional associations. They would likely do so both to stay ahead of the game (assuming there was a time-lag between the release of free journal articles to professional association members and the release to the public at large), and out of pride. After all, by increasing the distribution of their resources, the organisations they belong to would have become even bigger players in the quest to improve the quality of mathematics education. If funding were to remain an issue, I am convinced there would be potential government or philanthropic support for such a venture.

Mathematical associations, such as the National Council for Teaching Mathematics, the Australian Association of Mathematics Teachers and the Mathematical Association of Victoria, that produce high-quality products like TCM, APMC and PN have done amazing work skilling up a huge number of teachers across the globe, myself included. I think it is time they started viewing their product as a true public good, so that every teacher is empowered to facilitate high-quality mathematics instruction for the children in their classrooms.