Teacher Agency and Professionalism in the Context of Online Mathematics Instructional Platforms

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Current trends in mathematics education emphasise student-centred learning; and internet-based pedagogies, such as online mathematics instructional platforms, go even further in reducing the role of the classroom teacher. In this paper I consider how teachers may exercise agency and professionalism in the context of online mathematics instruction. Whilst there is some evidence for the reduction of the teacher role, there is also considerable space for teachers to enact professional identities as teachers of mathematics. However, I suggest that care needs to be taken to ensure that there is a balance to the overall mathematics programme, including opportunity for teachers to make their own decisions and assessments regarding students' learning.

One might argue that the student-centred learning trend in mathematics education is now well established. This is evident in 'reform' mathematics (e.g., Ma & Singer-Gabella, 2011), inquiry learning (e.g., Hunter & Anthony, 2011), problem-solving focused mathematics (Ingram et al., 2020), and in many technologies enabled by the internet (Engelbrecht et al., 2020). Research in mathematics education certainly appears to push a student-centred agenda. However, I wish to trouble this orientation a little. Student-centred pedagogies are situated within a wider discourse of what Biesta calls "*learnification*" (Biesta, 2004, 2012); the "reduction of all that matters educationally to questions of learning" (Biesta, 2012, p. 36, italics in original). Learnification is problematic because it makes it difficult "to ask the crucial educational questions about *content, purpose* and *relationships*" (Biesta, 2012, p. 36, italics in original). Biesta argued, in contrast, that teaching matters and thus teachers should be allowed to teach. In this paper I follow Biesta in taking the position that teaching does indeed matter, as I look at the teachers' role in a student-centred mathematics pedagogy. Specifically, I consider the challenge to teacher professionalism and agency within the context of the increasing use of online mathematics instructional platforms (OMIPs) in primary schools.

Learnification, and the de-centreing of the teacher, has happened within a neoliberal educational context, in which education is a marketplace (O'Neill, 2011), and people are seen as being individually responsible for their own learning (Biesta, 2012). Aotearoa New Zealand, like many other Western countries, has adopted many aspects of neoliberal ideology into its education system (O'Neill, 2011); for example, the notion of school choice, professional development provision, and private operators being allowed to profit within public education (Thrupp et al., 2020). One example of the latter is the educational technology (Ed-tech) industry, whereby digital curriculum resources are sold to parents and schools (Wright & Peters, 2017). Particularly relevant to mathematics education, primary schools subscribe to dozens of different instructional platforms, or OMIPs (Darragh & Franke, 2021b), such as *Mathletics* (3P Learning, 2022), *Maths-whizz* (Whizz Education, 2022), or *Education Perfect* (Education Perfect, 2022). OMIPs promote a student-centred approach by emphasising personalised (or individualised) learning (Boninger et al., 2019). The idea is that every student has their own curriculum pathway designed for them (see also Engelbrecht et al., 2020) using algorithms embedded in the platform, in other words the "netflixing" of education (Roberts-Mahoney et al., 2016). It is certainly worth asking where the space for the teacher is in such platforms; rather than being a professional who makes decisions for their student, the teacher is relegated to a "coach" (Ideland, 2021) or "facilitator" (Biesta, 2012) of learning.

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Given this socio-political context, and particularly since distance learning during the COVID-19 pandemic has created perfect conditions for the rise of Ed-tech (Moore et al., 2021; Williamson et al., 2020), it is time to give attention to the teacher role when using technologies such as OMIPs.

Background

Digital technology in mathematics education is a massive and growing domain (Borba et al., 2017; Calder et al., 2018), and yet research predominantly addresses potential *benefits* to learning and teaching (Attard et al., 2020; Borba et al., 2017; Young, 2017) and is thus more concerned with measuring impact on learning (Reinhold et al., 2019; Robin & Kwak, 2018; Young, 2017) or how to encourage teacher uptake with technology (Bennison & Goos, 2010; Remillard, 2016; Utterberg et al., 2019). OMIPs, by contrast, have received less research attention, despite them being a growing phenomenon in Australasian schools (Darragh & Franke, 2021b; Day, 2014; Nicholas & Fletcher, 2017). OMIPs are subscription-based mathematics curricular platforms that are available for schools or parents to purchase. OMIPs operate globally yet adapt their curriculum to each local country context. Their features include games for learning (practising) mathematics, instructional videos, interactive digital objects, reward systems, embedded assessment, adaptive technology for individualized progression, and supplementary teacher resources. The majority of schools in Aotearoa New Zealand subscribe to at least one of more than a dozen different OMIPS (Darragh & Franke, 2021b), and many parents accessed them during distance learning during COVID-19 lockdowns (Darragh & Franke, 2021a). OMIPs support a neoliberal ideology due to their capitalist, competitive features (Darragh, 2021; Ideland, 2021; Macgilchrist, 2018) as well as their focus on the individual learner. OMIPs provide a good example of how the Ed-tech industry has considerably raised its marketing efforts since the onset of the COVID-19 pandemic (Moore et al., 2021; Williamson et al., 2020).

Within the field of media studies, critique of Ed-Tech centres on two main aspects: the personalisation of learning (Boninger et al., 2019; Knox et al., 2020; McRae, 2013; Roberts-Mahoney et al., 2016), and the use of data analytics (Knox et al., 2020; McRae, 2013). Along with personalisation of learning comes an implicit side-lining of the teacher. Some critique goes further to wonder whether Ed-tech may lead to the end of the teacher, at least as we know them today, and notes the potential "re-localization of power from teachers to ed-tech companies" (Ideland, 2021, p. 11). Others consider the reduction of the teacher role due to the invisible process in which a student's grade or next learning steps are assigned (Boninger et al., 2019). A concern of teachers is the lack of control they have over the learning assigned to their students by the computerised system (Utterberg Modén, 2021). Given this potential for teachers to become side-lined by the presence of the mathematics instructional platforms in their mathematics programme, the research question to frame this paper is:

> *How do teachers exercise agency and professionalism as mathematics teachers when using online mathematics instructional platforms?*

Methods

Conceptual Framework

To understand the data in this study, I use Holland and colleagues' (1998) concept of figured worlds. A figured world is "a socially and culturally constructed realm of interpretation in which particular characters and actors are recognized, significance is assigned to certain acts, and particular outcomes are valued over others" (Holland et al., 1998, p. 52). In the case of this study, the figured world is the mathematics classroom; and teachers and students are the

characters recognized in this world. A number of mathematics education researchers have used the concept of figured worlds (Esmonde & Langer-Osuna, 2013; Horn, 2008; Langer-Osuna & de Royston, 2017; Ma & Singer-Gabella, 2011), typically examining the figured world of the mathematics classroom and also the identities offered to students or teachers in these worlds.

Important to the concept of figured worlds is this notion of identity. "[I]dentities are hard-won standpoints that, however dependent upon social support and however vulnerable to change, make at least a modicum of self-direction possible. They are possibilities for mediating agency" (Holland et al., 1998, p. 4). It is the identity of the teacher character, in the context of the mathematics classroom figured world that I consider in this paper, together with attention to the agency enabled them when using OMIPs. I wish to understand the extent to which the teacher may take up the identity position of "professional" as a mathematics teacher in this OMIP context.

Clearly, it is also necessary to consider the meaning of "professional" here; this is a term likely to mean different things to different people, and certainly what it means to be a professional teacher has changed over time. Day and Smethem, (2009) advocate a "new professionalism in which teachers are entrusted to make wise, evidence informed and accountable judgements about their teaching and pupil progress" (p. 154). Key to this definition is that teachers are trusted to make teaching and assessment decisions and they experience agency in these teaching decisions (see also Adams, 2017). For the purpose of this paper, I operationalised the notion of professionalism as the teacher's perception of being able to make their own decisions regarding the teaching, learning, and assessment of mathematics.

Context

The research presented here is part of a wider study that examined OMIPs in Aotearoa New Zealand primary schools. Other data collected in the study included a survey of school leaders asking about their rationales for choosing to use OMIPs (Darragh & Franke, 2021) and a discursive analysis of the websites of the four most popular OMIPs (Darragh, 2021). In this paper I present data from a third data source – that of interviews with teachers in schools that use OMIPs.

Data Sources and Analysis

During 2019 and 2020, I interviewed 12 teachers from 5 different schools about their use of OMIPs. The interviews were semi-structured and the planned interview prompts included: "Please tell me about yourself as a mathematics teacher"; Tell me about teaching mathematics in your school; What sorts of resources are available to you to support your mathematics teaching? How do you use [the OMIP]? What are the benefits, drawbacks, uses, of the platform? How do you think using [the OMIP] limits or strengthens your mathematics teaching? Interviews typically lasted 40 to 60 minutes and were transcribed in full. These transcripts were sent back to the teachers for comment and/or correction. The participating teachers ranged in their years of experience, the school level they taught, and the particular OMIP they used in their classroom programme.

I followed Taylor and colleagues' (2015) approach to qualitative data analysis. Specifically, I begin by reading and re-reading the data. I created codes, using both inductive and deductive methods, and developed themes from these codes. Some of the broader (and overlapping) themes constructed during this analysis included: Teaching challenges and supports, Classroom organisation, Teaching beliefs/philosophies, Other digital resources, Assessment/surveillance, Engagement and motivation, Mathematics learning, Identity (generally as learner/teacher of mathematics), and sub-theme of Agency and professionalism. I wrote analytic memos about each theme and created propositions that I then checked via re-reading all the interview data again in order to nuance the theme using data coded in the other

themes as well. In the findings section below, I present two propositions based on the theme of agency and professionalism.

Findings

The interview data supported two contrasting findings regarding the use of OMIPs. First, OMIPs reduced teachers' agency and professionalism as a mathematics teacher; and second, despite this reduction, teachers maintained a level of professionalism and demonstrated agency in a number of ways. Due to constraints of space, here I present data from three teachers from one school, who each provided a range of responses related to their agency and professionalism. Whilst the data analysis was informed by the responses of all 12 teachers, I suggest it is more useful to give a deeper and contextualised look at the use of one OMIP, in one school.

The school was an intermediate school in central Auckland. The teachers, Holly, Giselle, and Peter (all pseudonyms) were in their first, second, and third years of teaching respectively. They taught to Years 7 and 8 (students typically aged 11 to 13). The OMIP used at the school was *Maths-whizz* (Whizz Education, 2022). Despite the fact grouping based on attainment (ability grouping) is typical in Aotearoa New Zealand schools (Anthony & Hunter, 2017), at this school mathematics was not taught in that way. Under the guidance of the mathematics curriculum leader, and an outside "coach" who delivered regular professional development in mathematics, teachers at this school used a combination of whole class mathematics discussions, called "number talks"; small group teaching in flexibly arranged groups to "workshop" an area of identified learning need; some rich mathematical tasks in small collaborative problem-solving groups; and independent work on *Maths-whizz*. This variety of mathematics teaching demonstrated the emphasis on having a 'balanced mathematics programme' that was commonly described by school leaders throughout the country in the wider survey data (Darragh & Franke, 2021b). Each of the three teachers interviewed mentioned all these different mathematics teaching approaches during their interviews. In the rest of this section, I present responses from the three teachers to illustrate the two propositions regarding agency and professionalism when using OMIPs for mathematics teaching.

OMIPs Reduce Teacher Agency and Professionalism

Two broad ways that OMIPs reduce teacher agency and professionalism emerged from the data. The first was evident in the lack of control over the platform's features and the second was a subtle undermining of the teacher role. The lack of control impacted on teaching decisions; for example, 'identifying' a "maths age" for the students:

> [They get given a maths age] and the annoying thing is they immediately compare it to their actual age and they say it says here I'm a maths age of 8 but I'm 11 and then sometimes it puts the brakes on a little bit which can be frustrating (Peter).

Clearly the OMIP "decision" to assign students a "maths age," according to embedded assessment algorithms, was not a decision Peter would have himself made. Peter also expressed his frustration at the restrictions in deciding content:

> … because I would like to be able to have all the kids on probability while we are teaching probability, but the system doesn't actually allow it. … [Usually] I can force the system to teach a particular topic for a week or two I think it is. [But for probability, only] some kids have it available. (Peter)

In this instance Peter was unable to align the content of the OMIP with what he was teaching in class at the time, because those students at a lower "maths age" were not permitted to learn probability, according to the OMIP. This limited Peter's ability to cohere different aspects of his programme together. Another complaint was that *Maths-whizz* taught in a way that did not match with his approach to teaching addition, for example:

> … in Maths-whizz there are little boxes under the answer and then those ones are where you put the carried number. But it is not clear and the kids get confused and they don't know how to use it and more often than not at the beginning of the year they come up quite low for their addition and subtraction and multiplication whereas they actually know it and that causes a problem. (Peter)

Here, evidently, not only was the teaching approach different, but it resulted in an assessment of the students' capability that would be different to Peter's assessment.

In contrast, Giselle did not find the platform limited her teaching beyond issues with logistics, such as when one student had log on difficulties. Holly, however, reflected more deeply about the impact of *Maths-whizz* on her professional teacher identity:

> … one of the effects it has made it sometimes maybe a bit out of touch with what the kids know that I know that is because I'm not making the most of it. So, I know you can go in and see exactly what each kid is doing and how they are doing with it. (Holly)

> Sometimes it makes me feel less competent almost as a maths teacher. For example, when the students make a reflection, they talk about what they learned from Maths-whizz … but there is nothing about all the stuff we did in class. (Holly)

From these quotes we can see that Holly felt undermined as a teacher by the *Maths-whizz* platform, both in the estimation of the students and in her own feeling of being 'out of touch' due to not completing the assessments with the students herself. It is worth noting two differences between Holly and her colleagues. First, the fact she had only been teaching for six months at the time of interview could have led to feelings of inadequacy. Second, Holly was the only person who arrived at the interview with notes for her interview responses (I sent an indication of the sorts of questions I would be asking prior to the interviews) and thus her responses may indicate a greater depth of reflection.

To summarise, there was some evidence of the reduction of the teacher role as suggested by the literature; including the lack of control over aspects of the platform (Utterberg Modén, 2021), taking assessment out of the teachers' hands (Boninger et al., 2019) and the sense of de-professionalism (Ideland, 2021). However, these impacts were minor incisions into these teachers' overall sense of agency and professionalism as mathematics teachers, as to be demonstrated next.

Teachers Maintain a Level of Professionalism and Demonstrate Agency

One reason the teachers were able to maintain their sense of professionalism is because the OMIP did not feature too prominently in their overall mathematics programmes. All three teachers expressed how flexible their mathematics programmes were, as can be seen in Giselle's response:

> [We were talking] as a class and from there I said right I am going to do a workshop on factors, I know it was a bit random but it linked in with yesterday's lesson because I noticed a few students going huh when I was doing factor stuff. So [I thought] okay we will do a workshop on it tomorrow and so the kids come down to the mat with me and the rest of them were working independently. (Giselle)

The other two teachers similarly referred to moments when they saw a learning need and were able to act on it by adjusting the planned programme to include a "workshop" lesson for those who opted in to it. In fact, *Maths-whizz* helped to create the space for this flexibility as it was easy for the teachers to assign *Maths-whizz* to the other students whenever this kind of change in plans occurred.

Another way that *Maths-whizz* afforded different kinds of learning and teaching was expressed by Holly: "… what I actually kind of like about Maths-whizz is I said here I feel freer to focus on specific aspects of maths and delve deeper into it." *Maths-whizz* allowed Holly to feel that the curriculum was "covered" and thus enabled space for explorative problem

solving. Holly also mentioned that *Maths-whizz* gave her confidence that both the high and lower attaining students were catered to:

> Yeah, I guess Maths-whizz in a sense because it is catering a lot more to their levels especially the extremely like one at the very bottom kind of thing and 3 at the very top. It is kind of hard to do a workshop for [just one or two students]. (Holly)

Giselle similarly expressed that *Maths-whizz* was "really helpful for their individual learning path."

To summarise, and in contrast to the first proposition, here we see evidence that these teachers maintained a sense of professionalism and agency when using the OMIP, and at times the OMIP allowed them space to make agentic teaching decisions that they might otherwise be unable to execute.

Discussion and Conclusions

Returning to the definition of professionalism in a teacher of mathematics, we may reconsider the findings to evaluate the extent to which teachers were able to exercise agency and professional identities. We might ask if these teachers were "entrusted to make wise, evidence informed and accountable judgements about their teaching and [student] progress" (Day & Smethem, 2009, p. 154). There appeared a mixture of freedom and constraint for the teachers regarding their mathematics teaching decision-making. The OMIP allowed them to feel confident that their high and low "ability" students were catered to, despite their concerns for this in the context of mixed-ability grouping required by the school. This confidence in turn enabled the teachers more freedom to explore other, perhaps richer, pedagogies. Yet there was a little less agency for the teachers regarding issues of assessment. *Maths-whizz* assigned a "maths age", which Peter felt constraining. Additionally, the assessment algorithm was hidden and prevented Holly from being "in touch" with her students' learning progress—a criticism of Ed-tech noted in the literature (Boninger et al., 2019). Key to these teachers maintaining professionalism as mathematics teachers was their particular school context, in which, for the most part, they were entrusted to run their own mathematics programmes while the OMIP was simply a small part of it.

Biesta's (2004) notion of learnification is evident in the teachers' responses. Their concern for individual student progress reflects Ed-tech industry priorities (Darragh, 2021; Wright & Peters, 2017) and neoliberal ideology (Ideland, 2021; O'Neill, 2011). Biesta's educational questions about content, purpose, and relationships might also be raised. It appears the OMIPs sometimes limited teachers' choice of *content*, exercised a dubious *purpose* in the assigning of "maths age", and could at times be undermining of the teacher-student *relationship*, as noted by Holly. Consequently, the OMIPs were not without risk to teacher agency and professionalism, despite these three teachers' mainly agentic responses.

There are a couple of limitations I would like to note here. First, the interviews were conducted prior to the COVID-19 pandemic and thus do not consider the impact that distance learning may have had on the use of OMIPs for these teachers—both during and after lockdowns. Second, the three teachers were volunteer participants who all worked at a school with considerable mathematics support and freedom. Some other interviewees had less support and less individual freedom to make decisions about their mathematics teaching in general, without even considering the impact of the OMIPs on this freedom. It is also fair to assume all volunteers for such interviews would have a certain level of professionalism in their mathematics teaching, those without are less likely to volunteer.

These limitations notwithstanding, it is worth celebrating the way in which teachers were able to exercise agency and professionalism as mathematics teachers within a neoliberal educational context and when using OMIPs in their classroom. The experiences of these

teachers also point to the importance of having a balanced mathematics programme that allows teachers freedom to experiment with a range of different pedagogies for the teaching of mathematics.

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