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An Examination of Teachers' Digital Practices during School Lockdowns

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Abstract: This paper provides insights into how mobile devices were used to support students' learning (mobile learning) during school lockdowns. It draws on teachers' views captured in surveys from two international projects. The first project tracks mainstream school teachers' pedagogical practices with mobile devices (mobile pedagogies) before, during and after the pandemic. The second project examines mobile pedagogies adopted by teachers of students with disabilities in the same period. Both projects use a validated survey instrument to examine practices through the lens of a sociocultural digital framework that highlights the distinctive mobile pedagogies of personalization, authenticity and collaboration. A subset of the data from across the projects is analysed. These data comprise survey responses from teachers (n=141) who reported on their adopted practices *during* school lockdowns. Findings provide an understanding of mobile pedagogies during this challenging period, particularly practices supporting student agency. Future research and professional learning directions are provided.

Introduction

During the COVID-19 pandemic, schools have periodically been required to close, requiring teachers to transition to remote teaching. In these scenarios, school students were required to learn from home for extended periods of time. Despite well-documented pre-pandemic scepticism over the use of mobile devices for supporting learning in schools (Burden, Schuck & Kearney, 2019), students typically used devices such as laptops, smartphones and tablet computers to access and mediate their off-campus learning during these enforced periods of remote teaching. These shifts in teaching modes often occurred with little warning, giving teachers limited time to prepare. The requirement for remote teaching prompted schools to expedite technology integration and compelled teachers to adopt digital pedagogical practices to support their students' learning (Eradze, Bardone & Dipace, 2021). Although teachers regarded the remote teaching periods as an opportunity to develop their digital competencies, many teachers struggled with the pedagogies underpinning their task designs and implementation (Ewing & Cooper, 2021) and often reverted to more traditional classroom communication, information delivery and management tasks (Trust & Whalen, 2021).

This paper scrutinises teachers' pedagogical practices with mobile devices (mobile pedagogies) during these remote teaching periods through the lens of a robust digital pedagogical framework called the iPAC Framework (Kearney, Schuck, Burden & Aubusson, 2012). This framework highlights three distinctive mobile pedagogies or *constructs*—personalization, authenticity and collaboration—hence the acronym 'iPAC' (see https://www.ipacmobilepedagogy.com). It is underpinned by a sociocultural perspective (Wertsch, 1991), acknowledging that learning is facilitated by social interactions between people (Vygotsky, 1978), is richly contextualised, and can be mediated by tools such as mobile devices and applications (Pachler, Bachmair & Cook, 2013). The framework recognizes that learning supported by the use of mobile devices (mobile learning, or m-learning) does not necessarily occur at a fixed place, pace or schedule, acknowledging the malleable boundaries of 'time and space' (or context) in m-learning. Instead, how learners generate their own learning contexts influences their experience of these three mobile pedagogical features. The framework has been developed and refined over the past decade (Kearney, Schuck & Burden, 2020) and currently comprises six *sub-constructs*: agency and customization (personalization); context and task (authenticity); conversation and co-creation (collaboration).

The researchers used a robust and validated survey instrument (Kearney et al., 2019) that was designed to examine teachers' adoption of these three pedagogies in a mobile learning task they had recently implemented with their students. The researchers provide a contemporary snapshot of the school teachers' mobile pedagogies by addressing the following research question: *How did teachers adopt personalized, authentic and collaborative mobile pedagogies during school lockdowns?*

The iPAC Framework has been used previously to inform research on m-learning in school education (e.g., Kearney et al., 2015; Yates, Starkey, Egerton & Flueggen, 2021), and survey methods have been used to interrogate practicing teachers' adoption of mobile pedagogies. For instance, Kearney et al. (2020) elicited the views of 385 Australian secondary school teachers about their use of mobile devices for student learning, with a particular focus on the practices of math and science teachers. There was little consideration given to learner-generated contexts. Students' self-pacing was a stronger feature of teachers' tasks in this study, and was rated highly, but other aspects of personalization were less evident. Online learning tasks that were more collaborative and networked were seldom mentioned, with low levels of genuine community-based activities. The main similarity between the two groups' practices was their tendency to use traditional, school-based classrooms to enact their m-learning tasks.

This paper adds to this literature base by examining teachers' mobile digital practices during school lockdowns. It includes an examination of the practices of both mainstream school teachers, and teachers of students with disabilities in specialist schools.

Study Design

Survey data is used from two ongoing international projects examining m-learning before, during and after the pandemic. In the first project, teachers' pedagogical practices with mobile devices (mobile pedagogies) are being investigated globally. The second project is conducted in Australia and the UK, examining mobile pedagogies adopted by teachers of students with disabilities. A subset of the teacher survey data from across project one (n=64) and project two (n=77) is analysed in this paper. These 141 teachers nominated a digital learning task in their survey that they implemented *during* school lockdowns.

Survey Method and Analysis

Both projects use a robust, validated survey instrument (Kearney et al., 2019) to examine teachers' mobile digital practices through the lens of the iPAC socio-cultural pedagogical framework. The 19-item core of the survey asks teacher participants to consider *one recently implemented task* that required their students to learn with mobile devices. These core items require teachers to consider the behaviour of students when undertaking their chosen task, in relation to the constructs of the iPAC Framework. Contextualised examples are given in each item to help survey participants interpret each item, but these examples are not included in Table 1 for brevity.

Teachers are initially asked to select the discipline area and cohort (e.g., literacy and upper primary) that is most relevant to their chosen task. This context is subsequently "piped through" by the Qualtrics survey software to be included *in the main stem* for all core iPAC items: "When my <cohort> student(s) use mobile devices to learn in this <discipline> activity, s/he: …." After completing these 19 core items, teachers are presented with 5 additional items (also not included in Table 1 for brevity) requiring them to consider their students' overall experience and enjoyment in their chosen m-learning activity. These extra 5 items were developed in our past project to cover elements of learning outcomes with respect to the overall perceptions of learning, enjoyment, understanding, and difficulty (Aubusson et al., 2014). The survey also elicits background data about the teachers, and further details about their nominated activity. One item asks if the teachers implemented the task during school lockdowns. Responses from teachers who ticked 'Yes' to this item (total of 141 teachers across both projects) were analysed for this paper.

Data from the core iPAC items were analyzed according to the three themes of personalization, authenticity and collaboration. In these items, and in the five items about overall learning and enjoyment, participants used a 5-point scale (1 = *strongly disagree* to 5 = *strongly agree*), where a score of 3 was neutral. The means and standard deviations for all measurement items and each iPAC sub-construct were calculated, as shown in Table 1 and Figure 1. A descriptor "high" indicates an average rating between 3 and 4 (out of 5), and "very high" for ratings above 4.

Teacher Participants

The first teacher cohort in this paper consists of 64 *mainstream school* teachers (from a total of 634) from project one who reported in their iPAC survey that they implemented their digital learning activity during a school lockdown period. These 64 teachers were mainly from Australia (68%) and Europe (22%). Most were experienced with using mobile devices in their teaching: 8% described themselves as very experienced; and 37%, as experienced. Only 17% of these teachers said they were inexperienced with using mobile devices in their teaching.

The second teacher cohort in this paper are 77 teachers (from a total of 126) from project two who reported in their iPAC survey that they implemented their digital learning activity during a school lockdown period. These *specialist teachers* of students with disabilities were all Australian (UK data is still being collected) and worked in specialist schools, or in support units within mainstream schools. The students of these 77 teachers had a range of disabilities. The most commonly reported were intellectual disabilities (21%) and autism (18%). Most of these participants were experienced with using mobile devices in their teaching: 13% described themselves as very experienced; and 64%, as experienced. Only 2% said they were inexperienced with using devices in their teaching.

The 64 *mainstream teachers* from project one, and the 77 *specialist teachers* from project two, who nominated a digital learning task in their iPAC survey that was implemented during a school lockdown, are referred to collectively as 'teacher participants' or 'teachers' for the remainder of this paper.

Nominated Activities

The majority (60%) of the 64 *mainstream teachers* from project one chose a digital learning activity completed by primary (elementary)-aged children – 41% with young children in Years K-3. One third of nominated tasks from this mainstream school teacher cohort was in the English discipline. Science (17%) and Maths (13%) were the next most frequently chosen disciplines in these teachers' tasks. Forty-four percent of these teachers reported that their students owned the mobile devices used in their nominated task. The frequency of classroom settings was somewhat surprising, given the remote teaching context. However, in Australia and other countries, schools were still open to children of essential workers, and some teachers were required to be on the school campus to care for these students.

There was a large proportion (59%) of *specialist teachers* from project two who also nominated a task completed by primary(elementary)-aged children. English/literacy was the most frequently chosen discipline in these teachers' tasks (63%). Other disciplines included Maths (11%), arts (7%) and Social Science (6%). Twenty-six percent of these teachers reported that their students owned their devices. The large majority of their nominated tasks were implemented using a tablet such as an iPad (63%). Other devices included laptops (27%) and smartphones (6%).

Findings

The findings reveal the teacher participants' views of their adopted mobile pedagogies in tasks designed for their students during the remote teaching periods. We firstly discuss the findings relating to each of the two cohorts of teachers—the mainstream and specialist teachers—before discussing differences and similarities. All statistical results for the iPAC items are presented in Table 1.

Practices of Mainstream Teachers

The ratings in the personalization construct were the highest means for the mainstream teachers (Mean (M)= 3.39 for agency, and M= 3.15 for customization). Their students were often choosing the place to complete their activity (item P1, M=3.52), had control over the task pacing (item P2 – see Table 1, M=3.47), and were able to tailor app settings for their individualised preferences (item P5, M=3.44). The co-creation sub-construct (collaboration construct) was also rated highly (M=3.52) by mainstream teachers. For instance, their students were often using their mobile devices to co-create and share digital content (item C4, M=3.41; item C5, M=3.77). However, the mean rating for the conversation sub-construct (collaboration construct) was the lowest in the survey for this cohort of teachers. Nevertheless, this cohort of mainstream teachers rated their students' overall learning favourably (M=3.88) and emphasised their students' enjoyment of m-learning tasks (M=4.08).

Practices of Specialist Teachers

The specialist teacher cohort also emphasised student agency (personalization construct) as a feature of their adopted mobile digital pedagogies, with the mean for this sub-construct being their highest rated iPAC dimension in the survey (M=3.14). They particularly highlighted students' self-pacing through tasks (item P2, M=3.69). Although students

Measure	Specialist Teachers		Mainstream Teachers		Difference in Means			
When my student(s) use mobile devices to learn in this activity, s/he:	Mean	Std. Dev	Mean	Std. Dev	Est.	S.E.	p-value	sig.
Collaboration (Conversation)	**2.16**	**0.83**	**2.92**	**0.97**	**-0.75**	**0.15**	**0.00**	**
C1.Communicated with others around them about work displayed on screen	3.18	1.16	3.19	1.31	-0.01	0.21	0.98	
C2.Communicated online with their friends/peers about the work	2.05	1.28	2.23	1.21	-0.18	0.21	0.39	
C3.Communicated online with people they don't know about their work	1.27	0.72	3.33	1.22	-2.06	0.17	0.00	**
Collaboration (Co-creation)	**2.26**	**1.16**	**3.52**	**0.98**	**-1.26**	**0.18**	**0.00**	**
C4.Worked together to create a digital product	1.94	1.36	3.41	1.33	-1.47	0.23	0.00	**
C5.Shared digital content	2.56	1.54	3.77	1.11	-1.21	0.22	0.00	**
C6.Contributed to existing digital content	2.29	1.46	3.38	1.27	-1.09	0.23	0.00	**
Personalization (Agency)	**3.14**	**1.01**	**3.39**	**0.95**	**-0.24**	**0.17**	**0.14**	
P1.Chose the place to do the activity	3.03	1.40	3.52	1.21	-0.49	0.22	0.03	*
P2.Determined the pace at which they did the activity	3.69	1.13	3.47	1.17	0.22	0.19	0.26	
P3.Decided what they wanted to learn	2.73	1.36	3.17	1.35	-0.44	0.23	0.05	
Personalization (Customization)	**2.80**	**1.10**	**3.15**	**1.09**	**-0.35**	**0.18**	**0.06**	
P4.Were guided by the app(s) based on their past use	2.90	1.32	2.97	1.37	-0.07	0.23	0.75	
P5.Tailored app(s) settings to their preferences	2.87	1.41	3.44	1.18	-0.57	0.22	0.01	*
P6.Received individualised information through the app(s) about themselves	2.64	1.55	3.05	1.39	-0.41	0.25	0.10	
Authenticity (Context)	**1.99**	**1.09**	**3.09**	**1.13**	**-1.10**	**0.19**	**0.00**	**
A1.Learned in a place suggested by the topic	2.06	1.32	3.19	1.31	-1.12	0.22	0.00	**
A2.Learned in a realistic, virtual space	1.94	1.30	2.88	1.34	-0.94	0.22	0.00	**
A3.Learned at a time suggested by the topic	1.96	1.30	3.20	1.35	-1.24	0.22	0.00	**
Authenticity (Task)	**2.26**	**0.96**	**3.19**	**1.00**	**-0.93**	**0.17**	**0.00**	**
A4.Worked like an expert	1.77	1.10	3.05	1.28	-1.28	0.20	0.00	**
A5.Participated in real-world activities	2.18	1.28	3.14	1.31	-0.96	0.22	0.00	**
A6.Learned serendipitously in an unplanned way	2.40	1.21	3.23	1.16	-0.83	0.20	0.00	**
A7.Engaged in activities related to everyday life	2.69	1.33	3.33	1.16	-0.64	0.21	0.00	**

**/* difference in means significant at .01/.05 level

Table 1. Summary of teachers' views of their m-learning tasks during school lockdowns (iPAC items. Examples excluded from each item for Table brevity.)

evidently enjoyed some autonomy over their choice of place to carry out their digital activities (item P1, M=3.03), these settings were rated less favourably as realistic places to learn, as suggested by the relatively low mean for item A1 (M=2.06). Indeed, specialist teachers' mean ratings for the context sub-construct (M=1.99) in the authenticity construct was the lowest in the survey. The mean teacher ratings for the conversation sub-construct was also relatively low (M=2.17), especially for online communication (M=2.05). Like the mainstream school teachers, these specialist teachers' mean ratings of their students' overall learning (M=3.61) and enjoyment (M=3.18) were high.

Similarities and Differences between Teacher Cohorts

Although the teaching contexts of the two cohorts are different, the findings highlight some interesting similarities. The items in the personalization construct showed few significant differences between mainstream and specialist teachers (see right column of Table 1). The student agency sub-construct, for example, was reported in a positive light in both sets of data, particularly students' control of task pacing. This result is somewhat expected in remote teaching scenarios, where many teachers prioritised asynchronous tasks, over synchronous teaching such as in zoom-based lectures (Kearney et al., 2022). Likewise, both groups of teachers were positive about their students' use of mobile devices to facilitate their overall learning and enjoyment in their tasks. Both cohorts had relatively low mean ratings for items in the conversation sub-construct, particularly online peer learning conversations (items C2 and C3).

There were however marked differences between the cohorts in all co-creation items (collaboration construct), and also all aspects of the authenticity construct, as depicted in Figure 1.

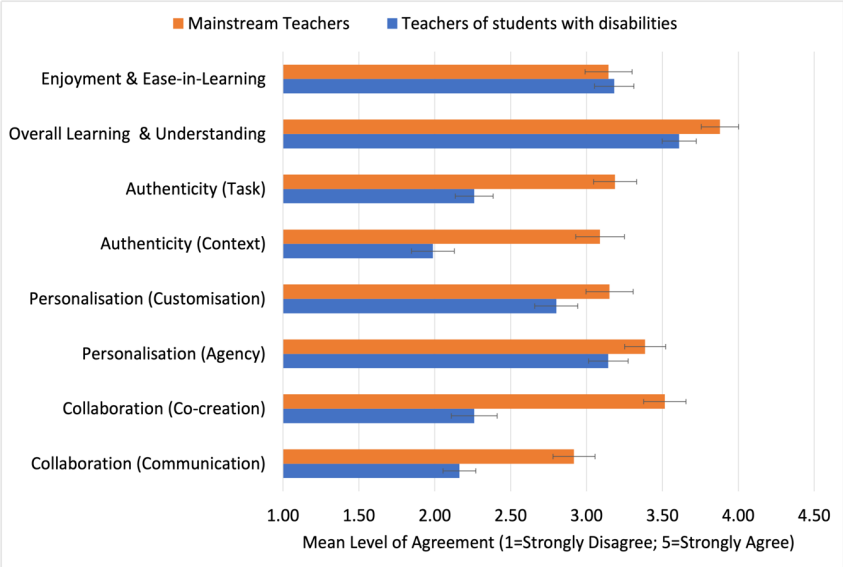

Figure 1: Comparison of teachers' mean ratings for *Overall Learning & Enjoyment*, and *iPAC* constructs.

Mainstream teachers' students were evidently receiving more opportunities to co-create and share digital content. They were also participating in more relevant m-learning tasks, real-life processes and meaningful learning contexts.

Discussion and Conclusions

The survey instrument used in the two research projects was designed to identify distinctive mobile pedagogies evident in digital learning tasks. These approaches are the three signature mobile pedagogies of personalization, authenticity and collaboration. Pedagogies reported in this paper need to be interpreted by stakeholders through the lens of their own unique teaching contexts, and also the context of remote teaching during school lockdowns. We acknowledge that the teaching contexts of the two cohorts examined in this paper are different in many ways. However, we believe that reporting on these two varied cohorts and their associated circumstances adds to the scope of the findings.

The evidence presented in this paper suggests that teachers from both cohorts were positive about students' overall learning and enjoyment from their m-learning tasks during remote teaching. Teachers were particularly

strategic in leveraging learner agency when implementing these activities. This may be an unintentional benefit of the lockdown experience as students were left to make more decisions by themselves without the direct overview of teachers. The mainstream school teachers exploited opportunities for students to use their devices to co-create and share digital products in their tasks, supporting some aspects of peer collaboration. Further research is needed to gauge how these positive developments might influence teachers' post-pandemic digital pedagogies. Listening to students' views is a critical part of this research agenda (Burke et al., 2021).

However, both teacher cohorts struggled to provide opportunities for students to use their devices to exploit important conversational aspects of mobile learning (Sharples et al., 2016), limiting peer learning opportunities during school lockdowns. This result aligns with other studies revealing the challenges and importance of peer interactions and collaborations during these periods (e.g. Bond, 2020). Further research could explore how students might mitigate these challenges to engage more collaboratively with peers in m-learning tasks. Research is also needed to explore why there were significant differences between the two teacher cohorts' ratings of authenticity. Approaches supporting authenticity are key to students' m-learning experiences (Kearney et al., 2020), and are especially important during remote teaching (Darling-Hammond & Hyler, 2020; Yates et al., 2021). Professional learning opportunities are needed to ensure that all students (in mainstream and specialist schools) can benefit from realistic tasks, contexts and processes to enhance students' relevant and meaningful digital learning. We recommend use of research-inspired resources, such as e-books, courses, video-based cases, app evaluation rubrics and diagnostic surveys for teachers, that we have designed and developed in our research projects (see mobilelearningtoolkit.com; ipacmobilepedagogy.com). Use of these resources will assist teachers' development of mobile pedagogies, especially approaches supporting collaboration and authenticity that were found to be lacking in our analysis of the two cohorts in this paper.

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