

Differentiated classroom learning, technologies and school improvement: What experience and research can tell us

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Abstract

One of the ways in which Australian schools are working to achieve differentiated classrooms and personalised learning for students is through the use of technologies. Promises of the integration of technologies into teaching and learning include that technologies enable teachers to be learner-focused, and students' respective interests and ways of learning are foremost in classroom practices. Virtual learning environments such as learning management systems, mobile technologies, online games, simulations and virtual worlds, are seen to offer students and teachers the capacity to personalise students' learning opportunities, and to put students in control

of the pace of their learning. More recently, technologies are also being seen to offer data about students' learning achievements and developmental requirements. This paper draws on education theories, research and emerging new practices, to explore how technologies can be used to customise and personalise students' learning, and to reflect on the implications of the evidence and practices presented, for school improvement.

Differentiating learning with technologies

Australian school principals suggest that teaching and learning with technologies affords educators opportunities to shift from teacher-centred to student-centred learning (Moyle, 2006). These views are consistent with those expressed by researchers in the United Kingdom (e.g. British Education Communications and Technology Agency (BECTA) and the National College for School Leadership, (NCSL) 2003; Hollingworth, Allen, Hutchings, Kuyok & Williams, 2008), in the United States of America (Dede, Honan & Peters, 2005), and across countries in the Organisation for Economic Co-operation and Development (OECD) (Fisher, 2010; OECD, 2006; 2012). Technologies are seen to be able to provide learners with a wider range of learning experiences beyond those offered in traditional classrooms (BECTA, 2003; Johnson, Adams & Haywood, 2011; Lelliot, 2002). Furthermore, students consistently report that they value the capacity for personalisation of their learning through the use of technologies, where they are in control of the pace and style of their learning (Moyle & Wijngaards, 2012; Project Tomorrow, 2012).

Differentiation and personalisation

The phrase 'differentiated classrooms' has gained traction over the past few decades, to describe approaches to teaching and learning that commence from students' knowledge, skills and abilities rather than from pre-determined programs of study. Differentiated learning approaches have been founded on theories such as those proposed by Dewey (1938/1963) and Bruner (1960), who both promoted approaches to learning built on students' interests, curiosity and experiences. Theorists of school students' learning styles in the 21st century, however, have extended these 20th century theories to propose new learning theories comprised of interrelated matrices of learning styles that are characterised by real and simulated active learning that is

co-designed and personalised to accommodate individual preferences based on diverse, tacit and situated experiences (Dieterle, Dede & Schrier 2007; Koehler & Mishra 2008; Mishra & Koehler, 2006). At the heart of differentiated education theories and practices though, is the placement of students' learning at the centre of organisational decision-making about the practices that occur within and beyond classrooms and schools.

Although slightly different, the concepts of 'differentiated classrooms' and 'personalised learning' are oftentimes used inter-changeably. A distinction that can be made though, is that 'personalised learning' is tailored specifically to each individual student's learning demands. 'Differentiated classrooms' can refer to the use of different teaching approaches for individuals or small groups of students within the same class, depending on their respective developmental stages and interests. Sir Ken Robinson (2010) talks about teachers having to make a paradigm shift to personalised learning which involves the process of shaping learning to individuals' requirements, recognising that each student inherently has different strengths and weaknesses, interests and ways of learning. Personalising learning also involves recognising that students in the one class and across a school can have differing world views. Personalised learning strategies then, place an emphasis on students' self-direction and self-reliance. Trust is placed in the learner to make thoughtful and meaningful choices about what they learn and how they will learn it (McCombs, 2012). Teachers assist students to make links between their informal experiences gained outside of school, with the formalised requirements of teaching and learning that occurs within schools.

Australian teachers today then, have a wide variety of environments or spaces available for use in teaching, and as a result they require a broad set of teaching and learning approaches upon which to draw. Indeed, the increasing availability of technologies to Australian school students, means schools no longer have to be only physical places. Now schools can use differentiated approaches to teaching, learning, student assessment and staff development using multiple environments that can consist of physical, online, and/or simulated learning places, or a mixture of all three environments. In physical and virtual ways then, schools can support students and staff to learn in ways previously not possible, and to practise different sorts of interpersonal relationships in various environments. Their learning can be differentiated and personally tailored to what they have to or want to know. Against

this backdrop, school improvement and the capacity-building of teachers and school leaders then, necessarily has to be multidimensional.

Students' views of differentiated learning with technologies

Several Australian and overseas studies have highlighted that students at all levels of education enjoy learning with technologies (cf Moyle & Owen, 2009; Li, 2007; Livingstone & Bober, 2005; Neal, 2005; Project Tomorrow, 2012). Project Tomorrow, a national US education non-profit group conducts annual, national online surveys of hundreds of thousands of primary and secondary school students, about their views of learning with technologies. The Project Tomorrow annual reports of findings indicate that US school students persistently indicate that they see one of the purposes of learning with technologies is to receive personalised learning opportunities that support different learning styles and developmental levels. Indeed over half (52 per cent) of the middle school respondents to the 2011 survey indicated that they like to use technologies to work at their own pace, and be in control of their own learning (Project Tomorrow, 2012). Australian students have reported similar views to their US peers (Moyle & Owens, 2009).

Project Tomorrow (2012) also reports that over the nine years they have been surveying students' views about their uses of technologies, that students' adoption of new technologies in their personal lives has often stimulated the use of the same or similar tools in schools. For example, in 2003 Project Tomorrow documented how students were using emails not only for communication purposes, but also as a storage vehicle for schoolwork. The students used their emails in order to have ready access to their documents, irrespective of whether they were at home or at school (Project Tomorrow, 2012). Now, teachers both regularly communicate with their students via email, and accept homework through email as well as through school portals.

Furthermore, 46 per cent of the US parents who completed the Project Tomorrow 2011 survey indicated that they agreed that mobile devices provide a way for personalising school education. This finding represents a 48 per cent increase compared to parents' views in 2009 (Project Tomorrow, 2012). In addition, 48 per cent of the parent respondents to the 2011 survey also saw mobile devices as a means for extending learning beyond the school day, compared to about a third of parents holding this view two years ago (Project Tomorrow 2012). A majority of the parent respondents (57 per cent), also placed a high value on their children's ability to use

their smartphone or tablet to video a classroom lesson or lab to review later at home (Project Tomorrow, 2012). These findings and the trends that Project Tomorrow have collected over almost a decade, provide insights into changing expectations of US school education, where teachers' pedagogies are increasingly expected to include the ability to use technologies to differentiate learning opportunities for their students.

In Australia, there is no similar annual survey conducted to that undertaken by Project Tomorrow, but given the similarities in Australian students' use of technologies to those of their US counterparts, it would be interesting to see if Australian students and their parents expressed similar views about the role of technologies in children's learning.

Using games to differentiate learning

One of the emerging ways for schools to cater for differentiated learning is through the use of games. The *New Horizon K-12 Report 2011*, predicts the time to adoption of games-based learning is two to three years (Johnson et al., 2011). Games have been used in school education for many years. In the 21st century, games can include single-player or small-group card and board games through to massively multiplayer online games and alternate or augmented reality games (Johnson et al., 2011). The potential of online games for learning that is intriguing researchers, however, lies in how online game designs can foster collaboration and engage students deeply in the process of their learning. The following short case study illustrates how the philosophy of differentiated learning through the use of games and technologies has gained traction in a US school, while at the same time, the students have met the demands of their external testing requirements.

The Institute of Play is a government school in New York City that has taken a unique approach to school organisation where teaching and learning occurs with technologies, and games are used as their primary mode of teaching and learning. The philosophy of games informs the work at the school. The reason the *Institute of Play* has adopted this particular approach to teaching and learning is that they see games as a way of building higher order thinking skills (such as systems thinking, problem solving, and working in teams), while at the same time fostering the key foundational skills of literacy and numeracy (Institute of Play, 2012a). Indeed the school reports above average achievement by their students on English and Maths standardised tests;

an average of 90 per cent attendance rate; and a 96 per cent student stability in retention rate (Krueger, 2012).

To inform their work, the school has brought together research about school education and game design (cf Ito, Baumer & Bittanti, 2009), and interdisciplinary partnerships with universities and not-for-profit agencies, to create game-based teaching and learning approaches, school strategies and systems (Institute of Play, 2012a; Institute of Play 2012b).

At the school, teachers and school leaders view the curriculum and assessment as interconnected. Learning is differentiated with the use of technologies as well as through the use of games, with the aim that feedback is immediate and ongoing. Assessments are embedded into the games, not disaggregated from them. The school leaders argue that games are designed to create a compelling complex space, in which the students have to learn and come to understand the game through self-directed exploration. Students participate in 'just-in-time' learning and use data to help them understand several aspects of their game play: the context of the game; how they are performing; on what they ought to work; and in what directions they should go next. The games are seen to create a reason for students to learn and do certain things. The students have to examine, assimilate and become proficient at skills and content areas relevant to playing specific games, and as such have to be strategic as well as informed (Institute of Play, 2012c). These characteristics of game playing also position students well for applying these skills in different contexts.

In addition, while the games are played in artificial spaces, they have rules to which the students must adhere, in order to be successful. The research informing the use of games at the school suggests that the games provide opportunities for the students to succeed, but at the same time, some of the game playing involves the students attempting to meet almost unachievable goals, which they regularly fail to reach (Institute of Play, 2012c). The students report, however, that they find those goals challenging, and rarely experience their failures as an obstacle to trying again and again. The school leaders observe that there is something about playing games that gives the students permission to take risks considered impossible in real life. The challenge of the game is constant, but there is a balance of just enough challenge to be motivating, and not too much to overwhelm the student. Indeed, the school argues that the play itself activates the characteristics of tenacity and persistence required for effective learning (Institute of Play, 2012c). To be successful, the students test out

their basic literacy and numeracy skills as well as their strategic and problem solving skills, and these experiences have seen them perform well on their external tests as well as on formative assessments.

‘Differentiated learning’, however, not only refers to constructing the means by which students can pursue their own learning paths, it also implies that teachers monitor students’ achievements against their respective individual learning goals, as well as those goals that are externally prescribed. Although not yet widespread, there are technologies that can offer teachers the means by which to support students to conceptualise and pursue their own learning paths, as well as to analyse what students are doing so that they can provide specific feedback to individual students.

Differentiated classrooms, personalised learning and learning analytics

Student assessments and the mapping of student progress can generate considerable data that teachers can use to inform the tracking of student performance. Two future technologies considered to have potential to assist teachers to differentiate classrooms and personalise learning are ‘personal learning environments’ and ‘learning analytics’ software (Johnson et al., 2011). Through the use of online tools these technologies can be used by teachers to assist them to monitor and guide students along their own learning paths. While currently neither of these technologies are commonly available in schools, there is sufficient interest in their potential for the *New Horizon K–12 Report 2011* to predict they will be part of schools’ suite of software tools in the coming four to five years (Johnson et al., 2011).

Personal learning environments are designed around each student’s learning goals, and have the capacity for customisation. They are student-designed spaces and encompass different types of content, including videos, apps, games, and social media tools. The components used in their personal learning environments are chosen by students to match their identified learning goals, personal learning styles and pace. While personal learning environments sit in the hands of students, various vendors are currently developing learning analytics software to analyse student performances and behaviours, and to provide that aggregated information to teachers. Learning analytics software brings together data gathering, data mining tools and analytic techniques to produce synthesised real-time information about aspects of students’ learning such as

reports about students' performances on both formative and summative assessments. Learning analytics software builds on the types of data generated by *Google Analytics* and other similar tools, to analyse the breadth and depth of information available from within learning environments (Johnson et al., 2011). An illustration of learning analytics software in practice can be found at the School of One, which is a middle years maths program run in three government schools in New York City. An algorithm is used that pairs teachers with students in ways that take into account the students individual learning styles, developmental stage and pace of learning. The learning analytic tools provide up-to-date data on students to create a personalised schedule for each student every day (School of One, 2012). The schedule links each student with the appropriate teacher at any point in the student's learning path.

These sorts of emerging software provide insights into what might be possible over the next five years. It would seem that the power of computing linked to data about students' own learning goals, attendance, learning preferences and assessments of performance, will soon enable teachers to provide each of their students with individualised guidance about what they do and do not know, and based on this information be able to provide personalised guidance to each of their students, on ways they may develop further. An emerging challenge for teachers and school principals though, is their ability to interpret and make meaning from the rich sources of data that are becoming available to them. Data interpretation will become an increasingly important capability in teachers' and school principals' toolkits.

Conclusion

Evidence and experiences suggest that students enjoy and engage in their learning when it includes technologies. Although it is difficult to directly link the improvement of schools through differentiating teaching and learning with technologies, there is an increasing pool of research that suggests that teaching and learning with technologies does afford teachers the ability to construct student-centred pedagogies.

To enable teachers and school principals to differentiate classrooms and personalise learning with technologies does, however, raise some challenges for school improvement. Differentiation of classrooms means students have choices about how they will achieve their own goals and those of the curriculum. It requires that teachers allow their students to study issues of personal relevance, and to support

students to see and develop clear learning pathways that meet personal as well as external curriculum requirements. These learning approaches, by necessity, have to be based on detailed and ongoing knowledge of the strengths and weaknesses of individual students. Assessment for learning and the use of data to identify students' learning requirements on a daily basis, therefore becomes an important teaching capability.

Technologies in schools also provide principals with the challenge of how to organise a school and classrooms, based around rich data about student progress. Technologies can be used to inform teaching practices, but an emerging challenge for school principals is how to develop teachers' abilities to analyse and meaningfully act on the data they have at hand. Workforce development then is a key factor, if technologies are to be used in innovative ways to differentiate classrooms and personalise students' learning. It may be that the technologies simply provide a lens or a focus through which the teacher can filter his or her approaches to differentiated learning. If, however, the outcome is that teachers and school principals reflect upon what they teach, how they teach it, and how students' performances are assessed and reported, then useful outcomes will have been achieved.

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