

INCREASING SCHOOL ENGAGEMENT THROUGH THEME-BASED CURRICULUM

Dr Kemran Mestan. Dr Andrew Harvey
La Trobe University, Melbourne

Abstract

This paper reports on an evaluation of a distinctive university-school partnership program, Curriculum Bridges. Curriculum Bridges aims to develop the enthusiasm and capacity of students from disadvantaged schools in the fields of science, technology, engineering and mathematics (STEM). These objectives are sought by developing a theme in the curriculum across subjects in years 10, 11 and 12. In the pilot phase, the curricula of English, Maths and Biology were linked together through the theme of 'understanding and curing disease'. These curricula were developed by the school teachers, who received training in the 'backward design' approach. The model also integrates into the curriculum university on-campus activities and excursions. UniBridges was originally implemented in three schools in 2011 and is ongoing. Our evaluation found that UniBridges has increased student engagement and participation in STEM fields. However, the aims of the program could be advanced by adjusting various elements, such as expanding teacher professional development, especially in regard to curriculum design. The findings from this evaluation can be used to assist in replicating the program in other schools.

Introduction

Students from disadvantaged schools often lack access to, and under-perform in, subjects related to science, technology, engineering, and mathematics (STEM) (Teese & Polesel, 2003). Consequently, students from these schools are impeded from embarking on a wide range of higher education courses. A hierarchy of curriculum maps onto the hierarchy of schools, where higher status schools are able to offer and encourage enrolment in certain clusters of subjects that lead to prestigious university courses (Teese, 2007). Curriculum Bridges has been developed in response to this problem.

Curriculum Bridges is a pilot program led by La Trobe University in conjunction with the Victorian Department of Education and Early Childhood Development (DEECD), the Victorian Curriculum and Assessment Authority (VCAA) and three secondary schools. The program aims to increase student interest and achievement in STEM, primarily through the development and delivery of theme-based curriculum across senior secondary years. This paper outlines findings from an evaluation of the program, and examines the extent to which the program is succeeding in engaging students. Specifically, the authors consider the design and implementation of thematic curriculum; the effectiveness of teacher professional development; the impacts of the program on students; and the potential of the program to be replicated. The program was found to have a positive impact on many students and to have achieved most of its stated objectives. However, some challenges of implementation affected the celerity of curriculum development. Numerous lessons about the impediments to curriculum development were identified in the evaluation, which will assist with replicating Curriculum Bridges and implementing similar programs in future.

Context

There are multiple motivations for reforming secondary school curriculum, particularly within the STEM disciplines. First, insufficient numbers of students are completing their final year of schooling to meet national school and higher education targets. Nationally, a target was established in 2009 by the Council of Australian Governments (COAG) to reach 90% year 12 (or equivalent) attainment by

2015 (COAG, 2009). In 2012, only 76.3% of people between the ages of 20 and 24 had year 12 or equivalent attainment (ABS, 2012). School completion is important for higher education participation. Following the Bradley review, the Australian Government established a target of 40% of 25-34 year olds to have a bachelor's degree or above by 2025 (Bradley, Noonan, Nugent, & Scales, 2008). Recent analysis by Gale and Parker (cited in Hare, 2013) has cast doubt on the likelihood of this target being reached, increased school completion rates will be required if growth in higher education is to continue. Curriculum reform is important for raising school completion rates given two major reasons for student withdrawal are: disengagement; and schools lacking desired subjects or courses (Curtis & McMillan, 2008).

School completion rates are uneven across Australia. Within the OECD Programme for International School Assessment (PISA), Australian education performance has been characterised as 'high quality, low equity' (McGaw, 2013). Schools record substantial differences in achievement across geographic areas and among students of different socio-economic backgrounds (Gonski, 2011). The 'long tail' of Australian education performance particularly applies to the STEM disciplines (Marginson, Tytler, Freeman, & Roberts, 2013). In 2013 the Australian Government announced the Gonski funding reforms to address inequity, as well as developing a national curriculum to improve consistency across jurisdictions, establishing the Australian Curriculum Assessment and Reporting Authority (ACARA). Inequity continues within the higher education sector, where participation from students from low socio-economic, regional, and Indigenous backgrounds remains proportionately low (Bradley et al., 2008). A reason for this disparity is the Australian Tertiary Admissions Rank (ATAR), by which most school leavers are admitted into universities. Upon completing secondary schooling, students' final grades are converted into an ATAR, and this rank has been shown to be mediated by socio-economic status and school type (Dobson & Skuja, 2005; Harvey, Burnheim, Joschko, & Luckman, 2012). The flawed nature of the ATAR is partly a reflection of the hierarchy of curriculum. More advantaged schools offer and encourage participation in high status subjects such as STEM (Teese & Polesel, 2003). It is these subjects which commonly lead to higher education pathways, in part because students are able to follow a thematic line of study throughout their senior secondary years (Curtis & McMillan, 2008).

Theme based curriculum has been implemented in other jurisdictions, for example a large scale program was established in Ontario, Canada (Ontario Government, 2010). Synergistic with organising curriculum around a theme, student engagement in STEM is facilitated through curricula focussed on problem-solving and inquiry (Marginson et al., 2013). Similarly, Victoria is proposing the development of specialised programs at senior secondary level, alongside existing theme-based approaches such as Curriculum Bridges. As a discussion paper by the Victorian Curriculum and Assessment Authority (VCAA) notes:

As universities increasingly look beyond a single entrance score in their admissions procedures, evidence of an intentional decision to pursue ... a specialist program of study can offer students a key advantage as they make the transition to tertiary education. Given this trend, it is important that the Victorian Certificate of Education offer students new opportunities to be recognised for achievement in their learning program beyond the single measure of the ATAR. (VCAA, 2013, p.4)

Finally, there is a need to focus on STEM given a recent trend away from the study of science and mathematics. In Australia, the proportion of students studying science in Year 12 has dramatically decreased over the past two decades, from approximately 90 per cent in 1991 to 80 per cent in 2000 and 50 per cent in 2010 (Goodrum & Abbs, 2011). The decline in Year 12 science participation effects university science participation (Lyons et al., 2012). Dobson & Calderon reveal that the likelihood of enrolling in a science course at university increases with the number of science subjects studied as part of Year 12 (cited in Tytler et al., 2008). International comparisons suggest that targeting demographic groups who are under-represented in STEM would effectively increase national participation in STEM fields (Marginson et al., 2013). There are thus multiple policy reasons to develop STEM based

thematic curriculum within disadvantaged schools.

The program

In the wake of uncapping Commonwealth supported places for enrolments in higher education, as recommended in the Bradley Review (2008), combined with the Commonwealth's Participation and Partnerships Program (HEPPP), there has been a proliferation of university outreach programs. University outreach programs have usually been focussed on recruitment (Ferrier, 2009). They are most commonly visits to schools, which are often sporadic and even one-off events, commonly spread across many schools (Gale et al., 2010). Conversely, Curriculum Bridges is concentrated, deep and well-resourced. DEECD provided nearly one million dollars for development of the pilot project in the three schools over three years. This recognises the experimental nature of the project with schools (and La Trobe University) asked to develop a program from scratch under only very broad guidance.

In recognition of the curriculum focus of the project, in late 2012 responsibility for managing the pilot project was handed over from DEECD to VCAA.

In consultation with La Trobe University staff and Prof. Richard Teese, whose work on educational inequality informed the project, three schools were selected to participate in the program. The three secondary schools selected for the program were Reservoir High School, Bendigo Senior Secondary College, and Mill Park Secondary College, which will subsequently be referred to as 'Reservoir', 'Bendigo', and 'Mill Park'. The schools were invited to participate largely due to their low socio-economic or regional status, the under-representation at university of recent former students, their close proximity to a La Trobe campus and their willingness to participate.

Within the program, the curricula of English, Maths and Science subjects have been modified to accommodate a common theme. All schools adopted the same theme of 'understanding and curing disease'. Adopting a common theme was encouraged to facilitate cooperation and knowledge sharing between the schools. Within the common theme and structure, each school adapted the program to its own circumstances. Both Bendigo and Mill Park allowed students to opt into the program. The program was not explicitly targeted to traditional high achievers but to students who were perceived as less likely to attend university. Students were then grouped together in the classes with the modified curricula, with about 25 students in each school. Reservoir, which is a much smaller school, chose to apply the program across its entire year 10 cohort, which numbers almost 100 students. Mill Park also commenced the program with year 10 students, whereas Bendigo commenced it with year 11 students, as that school exclusively teaches the final two years of schooling. Although the pilot was initially funded only until the end of 2013, all schools agreed that students would participate in the program until the completion of their schooling. Thus, students who commenced the program in 2012 are currently in the second year of the program, and a new cohort of students commenced the program in 2013.

The core of the program – to modify the curricula of a cluster of subjects according to a common theme – was supplemented by other elements. La Trobe agreed to make early offers to participants for certain courses, prior to them receiving their ATAR, based on successful completion of the Curriculum Bridges program. Participating students regularly visit the university to engage in various activities that have been integrated into the curriculum, including workshops and lectures. There have also been excursions to other sites, such as hospital laboratories. Additionally, a digital learning platform has been developed, enabling communication between all the involved academics, teachers and students.

To advance the objective of teachers designing curriculum, the program incorporates professional development. A number of short workshops were held for teachers on aspects of curriculum design. Two examples of topics covered were digital learning and the specific design framework adopted for

the program. Additionally, a small number of more extensive professional development events were conducted, including a two day retreat.

Methodology

Qualitative research methods were used to conduct the evaluation on which this paper is based. Thirty-seven semi-structured interviews were conducted face to face in late 2012 and early 2013. All of the key personnel involved with the program were interviewed. Eight interviews were conducted with La Trobe staff in administrative, coordination, management, advisor or consultancy roles. This includes staff who were especially employed for the program, as well as those whose broader role involved some contribution to the program. Nine La Trobe academics were interviewed. These academics were involved with Curriculum Bridges through conducting workshops, presenting lectures or coordinating the involvement of their department. Six interviews were conducted with senior school staff, such as principals, vice principals, and program co-ordinators. Twelve teachers at schools were interviewed. Two staff from DEECD, who have been involved with the program, were interviewed. The interviewees were broadly asked about their involvement with the program, the nature of the program operation, and the impacts of the program.

Three focus groups were conducted with students - one from each school. Between four and eight students participated in each focus group. All students in the program were asked if they would like to participate in the focus group. E-mail was used to communicate with students, and it was made clear that participation was voluntary. The focus groups elicited student opinions about the program.

All the qualitative data were thematically analysed. The various kinds of responses to each set of questions were identified, grouped and ranked. Codes were developed through an iterative process, where preliminary codes were first applied to interpret the data, with each code being refined, rejected or combined through the process of analysis, as well as new codes being added. For example, a number of objectives of the program were hypothesised, with interview responses to the question about objectives being categorised under one of the codes, but the codes altered based on people's answers. Then the codes that identified the dominant responses, in number and emphasis, were developed into themes. Finally, deductions were made from the themes. Internal validity was promoted by considering the strength of the evidence to support conclusions. It was considered whether most of the relevant people made certain claims, what were the claims of the people best placed and whether there was consistency between people's claims. All of the data and thematic analysis has been recorded and is available for corroboration.

A limitation of this research is that the program has not been operating for long enough to identify whether it has had an impact on student participation in higher education. Accordingly, in assessing the impacts on students, the focus is currently on student engagement with learning at school. A further concern relates to the objectivity of the researchers, who are evaluating a program in which their own university is a project partner. This risk is mitigated by the fact that the researchers are employed by a separate unit to the part of the University responsible for the program's operation. The research unit has no direct link to the Department, schools, or areas of the University involved in outreach and program activity, and operates financially independent from the project.

The research proposal gained ethics approval from La Trobe University and DEECD as well as permission from the three participating schools.

Findings

Curriculum development

The schools were found to have clearly modified curriculum of select subjects around a single theme. The three schools did collaborate with each other to some extent, as well as localised the curriculum for their own students. However, the evaluation identified scope for more extensive curriculum modification in any future program expansion.

Teachers explained that because the theme crosses multiple subjects, students were able to ‘draw on knowledge that they have developed in other subjects’. Accordingly, teachers did not have to spend as much time on basic ‘underlying content’, which enabled more rigorous exploration of topics. One teacher commented that ‘I’ve definitely gone into more depth’. Enabling teachers to explore topics in depth may better prepare students for higher education.

Teachers were apprehensive about ‘overexposing’ students to the theme, and were concerned about students becoming bored with it. One school leader observed that four subjects is the right number to gain the benefits of subjects being related to each other without wearying students. Students concurred, noting that they did not get tired of the theme, but would not have liked any more subjects to share the same theme.

Some subjects were easier for teachers to modify than others. For example, one teacher said about year 11 biology that ‘the theme is very relevant and easy to apply particularly to unit three. So there is potential for some really exciting stuff there.’ One teacher reported that s/he changed about 40% of year 11 English. This was achieved by replacing entire modules. However, it was explained that in year 12, modules are unable to be replaced. Consequently, this teacher will attempt to weave the theme throughout the course, which means that only about 10% of the subject will be modified.

Teachers were understandably concerned about disadvantaging their year 12 students. It was explained by personnel from DEECD that although the year 12 curriculum is not inherently inflexible, teachers feel obliged to maximise their students’ performance in exams, which has the impact of restricting the potential breadth of content covered. For this reason, it appears that Curriculum Bridges will have a more limited role in the curriculum of year 12. One teacher shared that their ‘big fear would be at the end of year 12 a student doesn’t elect into one of those courses at La Trobe. They want to do something else and they say I felt like we weren’t as well prepared for the exam.’ Some teachers openly rejected implementing the program in their year 12 subjects. It is important to note, however, that the program does not restrict participating students from undertaking the same subjects and exams as other year 12 students, and all participants are eligible to receive an ATAR and apply to universities through the standard tertiary admissions process.

It has been particularly difficult to implement the Curriculum Bridges theme in Maths Methods in year 11 and year 12. A teacher commented that it was ‘too difficult to find connections given the pace of the course’. All the Maths Methods teachers reported great difficulty modifying their subjects. The restricted extent that Maths Methods has been modified was one of the greatest limitations of the pilot program. In discussing the objectives of the program one interviewee explained that:

if you could make significant inroads in the area of mathematics you would open up a lot of courses at university that are of limited availability to kids from poor backgrounds
Mathematical Methods is a gateway subject to many courses in sciences and in engineering and in business, you really can’t afford to lose your students on this subject and so it’s important to try to crack this particular nut, to make advanced mathematics accessible.

It was acknowledged by a member of the Curriculum Bridges reference group that the program has been limited in its ability to make advanced mathematics more accessible to students.

Nonetheless, Curriculum Bridges has certainly had an impact on less advanced mathematics. A teacher of General Maths reported that s/he changed 30 per cent of the year 11 subject, and that s/he

could do likewise for year 12 Further Maths, as it has a large statistics component that can be easily adapted to the theme. Thus, Curriculum Bridges is influencing mathematical content, but for it to achieve its objective in full, Maths Methods needs to be targeted more intensively. Teachers may need greater support from the university to embed a Curriculum Bridges theme in Maths Methods, while not disadvantaging the performance of students in the exam. A meta-analysis of research suggests that effective teacher professional development in mathematics improves student outcomes (Blank & de las Alas, 2009).

Some teachers commented that they particularly would have liked help about how to connect their curriculum with the University, such as which on-campus activities could be integrated. The initial year of the program saw La Trobe navigate a developmental phase with its on-campus activities. In the following years La Trobe staff developed a detailed calendar of activities, enabling schools to choose activities in which to participate. Teachers particularly commended this forward planning. Teachers recognised that on-campus activities provide opportunities for students to learn from experts, and as one teacher said, 'it's a lot more up to date'. In focus groups, students showed that they are excited about being involved with the university and being exposed to new things, reporting that they would like more university activities. However, academics operating some of the on-campus activities also underlined the need for teachers to participate vigorously in the activities to enable students to benefit fully. One academic commented that 'it's really important to have the teachers present there and actively engaged in what the students are doing so that the exposure and experience the students have can be nurtured back at school'. It was explained that the outreach activities have greater educational impacts when integrated into class learning.

Teacher professional development

Developing the capacities of teachers is an important aim of Curriculum Bridges. One La Trobe staff member said that 'I was interested as much in the teachers as the students.' This aim is consistent with evidence showing that countries that perform well in STEM education emphasise the professional development of teachers in those fields (Marginson et al., 2013). University outreach programs often neglect teachers, despite evidence suggesting that teachers play an important role in shaping the STEM-related aspirations of students (Bray & Cridge, 2012). La Trobe staff provided guidance and support to teachers on curriculum design. This included templates, books, professional development (PD) sessions and information. A two day workshop with multiple speakers on various topics was particularly notable, which teachers said was 'fantastic' and 'really good'. A couple of teachers mentioned that it improved their planning. This particularly related to 'making connections with other subjects' and adopting a 'bigger picture view' so that the content they teach is contextualised more.

Additionally, multiple teachers spoke positively about a two day workshop on digital learning. This workshop appears to have had a positive impact on pedagogy. One teacher said that this professional development 'influenced the way I teach, ... I have been using more web 2.0 tools and I have found that students have engaged with those.' A La Trobe staff member observed that this professional development session increased the use of the on-line learning platform by about 30 per cent, albeit only from students in the classes where the teachers received the training. It became apparent that teachers need to integrate digital learning into their curriculum and encourage students to use it, for students to embrace the on-line learning platform. This is substantiated by a review of literature that found that the gains from information technology in class rooms are generally greater when it is structured, planned and integrated (Meiers, Knight, & White, 2010).

Teachers commonly reported wanting more guidance about developing curriculum. A teacher commented that they 'just wanted to make sure that ... I was meeting the expectations of what Curriculum Bridges is actually trying to achieve'. Some teachers were uncertain of what the 'end product needed to look like'. Lack of specificity around some objectives, logistical impediments, and time pressures in implementation, contributed to an imperfect curriculum design process.

It has been acknowledged by La Trobe and DEECD staff that schools did not have sufficient available expertise to develop curriculum in the manner outlined. A La Trobe staff member commented that the teachers 'probably know a lot about their subjects, but they don't necessarily have a deep understanding about principles of curriculum design'. Another staff member observed that it took a long time for teachers to comprehend the curriculum design framework adopted for the program, called 'Understanding by Design', which was informed by the University's own curriculum reform processes. This framework involves first identifying learning goals and then working backwards in designing lesson plans (McTighe & Thomas, 2003). Differences in expectations and practices around curriculum reform may have inhibited the ability of teachers to adapt to a university-informed approach. Understandably, most participating teachers initially had limited familiarity with the design framework to be implemented.

At the extreme end, one participant argued that 'expecting people to engage in a level of professional activity, namely curriculum development, without sufficient training and sufficient time was ... a bit naïve.' One teacher conceded a lack of expertise in some areas, admitting that sometimes teachers 'might not ... know very much about a particular topic' within the thematic framework. Nonetheless, this teacher thought that collaborating with La Trobe academics would be a 'fantastic' way to help the development of curriculum.

Overall, based on teacher feedback, the support La Trobe initially offered was perceived as important but limited considering the level of experience and expertise of the teachers. Indeed, a La Trobe staff member also acknowledged that 'everybody lacked sufficient training in the Understanding by Design format'. In developing the project, the need to strengthen curriculum expertise and professional development has been highlighted.

A review of research about effective professional development suggests that it should focus on specific curriculum content rather than abstract principles of pedagogy alone (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009). For example, improving the teaching of mathematics should directly relate to mathematics content. Further research also highlights that professional development that combines specific curriculum content with pedagogical knowledge is more effective than concentrating on curriculum content alone (Timperley, Wilson, Barrar, & Fung, 2007). In all cases, it is important not only that specific content be included in professional development activities, but that such activities involve teacher consultation in what and how their professional development can be advanced (Hawley & Valli, 1999).

A major reason for the limitations of professional development under the program was that many teachers were unable to attend all of the scheduled sessions. This is one reason that professional development is often better provided through short workshops in schools, rather than lengthy sessions at external locations (Hawley & Valli, 1999). Teachers found the time commitment required by the program its most challenging aspect. As one teacher said, 'the most important thing teachers need ... is more time!' Although sufficient funding was provided for casual relief teaching (CRT), teachers were reluctant to leave their classes, especially year 12 classes. Ideally, Curriculum Bridges teachers would have a reduced teaching load. A teacher commented that 'having an eighty per cent work load would be wonderful'. This would make available twenty per cent of a teacher's time, which in addition to professional development, could also be used for developing and documenting curriculum, attending meetings, and participating in excursions. However, in order to reduce teaching loads, schools would need to commence planning about twelve months in advance and substantial funding would need to be provided.

Despite having limited time to undertake professional development, teachers would have liked more of it, especially relating to curriculum design. Providing intermittent events and activities was perceived

as insufficient. Many teachers need a support structure enabling them to seek personalised advice on specific issues. The experimental nature of the pilot made it difficult to provide a highly structured professional development plan, but this can be established as the program becomes more systematised. Evaluation results highlighted the perceived importance of professional development to the success of the program. Future challenges include the need to resource schools sufficiently to enable teacher participation in all professional development activities, and the need to engage teachers and academics with deep curriculum expertise.

Impacts on students

Teachers reported that Curriculum Bridges increased student engagement, with one school leader noting that parents have conveyed ‘how much their child has enjoyed the program.’ Developing a theme appears to have been a useful pedagogical technique within the program. A mathematics teacher found that the theme boosted student interest levels, as the students could appreciate the applicability of mathematics. For some students, the ability of the program to engage them has been decisive. A school leader commented that there was one student who ‘we would not have retained in this school if she was not in Curriculum Bridges.’ Hence, the program appears to have some positive impact on most students engaged with it, along with a more substantial impact on some students.

A biology teacher observed that Curriculum Bridges helps students to ‘see why science is relevant’. An important part of students coming to see the relevance of science has been witnessing some of the ‘fabulous things’ at the university and other organisations, where students can observe science in action. These visits have ‘broadened the [students’] knowledge of what science is and what are the opportunities in science.’ Consequently, teachers perceived that some students were more inclined to pursue science related courses at university. These teacher observations are substantiated by student comments. For instance, one student said that ‘my science field has expanded ... it's really interesting and I think it's due to having that one theme that like really grabbed me and got me interested in it.’ Students particularly highlighted how visits to the university increased their enthusiasm toward science - as one student explained ‘you get to see like all the different equipment that they use’. Additionally, although other external activities were less frequent than visits to the university, they appear to have had a similar impact. Feedback from focus groups suggests that other excursions can be more effective than repeat visits to the university because they are new and exciting, whereas students become accustomed to the university. Furthermore, students are not always excited by lectures, which visits to the university sometimes involve.

Increased student interest appears to have advanced student capability. A teacher recounted that they said to a student. ‘you have progressed so well this year under Curriculum Bridges. And she said, “I just love it”.’ Teachers reported that having a theme has accelerated the ‘content knowledge’ of students; accordingly, student ‘confidence has increased’. Additionally, a couple of teachers noted that the outreach activities have helped develop the students’ skill levels, as they are afforded the opportunity to do things they otherwise would not.

Curriculum Bridges appears to have raised student aspirations to embark on higher education. For some students it has ‘opened up their eyes to possibilities’, as one teacher reported. For many students, a significant impact has been that students can envisage themselves at university now. One teacher said that the program has given students ‘belief in themselves’. This has partially resulted from students ‘familiarising themselves with the tertiary environment’ and becoming comfortable at La Trobe. Further, knowing that the program provides them with a ‘golden opportunity’ to access university encourages students to strive. Students commented that the program has helped them decide what they want to do post-schooling. Many students are now committed to studying the STEM-related courses, whereas prior to commencing the course they were undecided. A school leader even believes that this impact has reverberated through the school, remarking that ‘they were ‘gobsmacked last year when I got the subject selections in that there was a move away from the less academic subjects and a

move towards ... the academic.’ Hence, Curriculum Bridges appears to be having a substantial impact on the aspirations of students in the program, as well as some impact on other students in the school.

Replication

Curriculum Bridges was initially funded with the idea that ‘the three schools would be pilot schools, that they would develop new curriculum, which they could then hand over to further schools’, as a La Trobe staff member said. DEECD staff concurred, with one commenting that ‘hopefully out of the project we’ll have a Curriculum Bridges handbook’. DEECD staff are concerned with improving the outcomes of all Victorian underachieving students, focussing on areas with concentrated disadvantage. From their perspective, any narrowly focussed intervention should be ‘capable of being scaled up.’ It was commented that with the pilot schools having developed a model for Curriculum Bridges, it ‘could be picked up and transplanted’, with the program being ‘rolled out to other schools’.

An initial problem with producing curricula material for other schools was that teachers did not always fully document the curriculum they developed. As one La Trobe staff member came to realise, ‘it seems that curriculum in schools is pretty fluid and amorphous ... there’s not necessarily a whole lot of documentation.’ For this reason, a curriculum writer was contracted to work with the teachers to ‘scoop it together and enrich it.’ The curriculum writer’s role has been to put what the teachers have provided in the required format, creating consistency across modules. Additionally, along with other staff from La Trobe, s/he posed questions to teachers about their modules, thereby prompting teachers to develop their curriculum more extensively.

A further challenge in rolling out the program relates to replicating the relationship with a university. La Trobe has supported teacher professional development and on-campus activities have been integrated into curricula. A La Trobe staff member commented that: ‘you can’t just turn up, here’s your pack ... It’s partly about developing a relationship with schools, understanding what their needs are, developing some outreach activities that dovetail with their needs, supporting them in staff development.’ International comparisons suggest that schools partnering with external organisations is an important component of developing a strong STEM education system (Marginson et al., 2013). If other schools adopted the program, then a relationship with a university would need to be fostered. Universities need to help schools localise and integrate on-campus activities into curricula, as well as support teachers. However, universities may not always have the capacity to form a relationship with all the schools in need. Hence, although La Trobe was instrumental in developing Curriculum Bridges, broadening it to many more schools may mean that the curriculum is less integrated with the university. The capacity for systemic expansion may depend on the involvement of multiple university partners and/or technological advancements.

If other universities become engaged with the program, they will need to appreciate details about school operations. One school leader said ‘the culture at the university is totally different ... they don’t understand us, we don’t understand them’. This view is consistent with a finding from the evaluation of an initial phase of the Curriculum Bridges pilot (Rice, Klatt, Polesel, Stokes, & Turnbull, 2012). Nevertheless, our evaluation found that, with time, the university and schools have come to understand each other and cooperate with each other better. For example, La Trobe came to appreciate the strict timelines by which schools operate, and adjusted their expectations and planning levels accordingly. For the future development of curriculum to be expedited, universities will need to ensure that they understand school culture, capacities and expectations.

A further limitation in ‘transplanting’ the same curriculum is the desire of teachers to customise modules according to local context and need. One La Trobe staff member affirmed that ‘if we gave [teachers] a unit they wouldn’t be able to teach it. They have got to create it themselves’. This difficulty is also recognised by staff at DEECD. It was commented that ‘I know that when you are

handed a unit of work that someone else has created, it's not you.' Staff went on to explain that 'there will have to be professional learning around the next team of teachers that take it on.' Professional learning will need to be combined with curriculum flexibility to enable Curriculum Bridges modules to be taught by other teachers across contexts. Nonetheless, teachers do adopt other study guides, particularly in year 12. Providing teachers have leeway to customise a module to their abilities, their school's circumstances and their students' needs, Curriculum Bridges modules could certainly function as broad unit guides for teachers from various and diverse schools.

Curriculum Bridges could be considered as advancing a less ambitious goal than some individuals occasionally espoused. Rather than wholly replicating the curriculum derived within the pilot program to a broader range of schools, 'out of these pilots we would put together a broad framework and ... develop some resources which could be then made available to other schools', as a DEECD staff member stated. It was also highlighted that the pilot schools could address logistical issues, such as timetabling, from which others schools could learn. Accordingly, rather than simply duplicating the program in other schools, each school will need to adapt the curriculum to their circumstances within a set of common parameters.

Some staff at La Trobe affirmed that the aim of the program was to 'develop curriculum that would suit the students from that locality'. Staff from DEECD also recognised this aim, with one commenting that:

the best thing to get that engagement is to allow them to identify what problem they were interested in solving or investigating. ...each cohort of kids are likely to have quite different interests And that was the challenge for the Curriculum Bridges in terms of the scaling up.

Given localisation of curriculum is a program objective, curriculum that is developed by one school cannot be entirely transplanted to another school. Nonetheless, the pilot project provides insight into the methods of effectively localising curriculum within agreed parameters, developing a theme, collaborating with a university, and coordinating a program.

Conclusion

Curriculum Bridges is a distinctive and ambitious university-school partnership. The program involves deep collaboration between schools and universities to alter fundamentally the learning experience of students. This paper has examined the progress of the pilot program in: developing theme-based STEM curriculum; delivering professional development to teachers; improving the engagement of students; and creating a model that can be replicated across broader school networks. The program has successfully met many of these objectives. The findings of our evaluation are clearly transferable to other contexts. For example, the importance of developing a theme across subjects in enabling teachers to enter into more content depth is potentially applicable to other schools. To assess the value of the program fully, on-going monitoring will need to be conducted on the impacts to students. The efficacy of the program was initially constrained by inter-organisation operational difficulties, differences in expectations of project partners, and insufficient capacity in the area of curriculum expertise. However, these impediments have been largely addressed during development of the pilot program, and understanding these lessons is important in considering program expansion. Curriculum Bridges underlines the potential of thematic curriculum to heighten student engagement and university aspiration in disadvantaged schools.

References

- ABS. (2012). *Education and work Australia survey, additional data cube May*: Australian Bureau of Statistics.
- Blank, R., & de las Alas, N. (2009). *Effects of teacher professional development on gains in student achievement: How meta analysis provides scientific evidence useful to educational leaders*. Washington, DC: Council of Chief State School Officers.
- Bradley, D., Noonan, P., Nugent, H., & Scales, B. (2008). *Review of Australian Higher Education*. Canberra: DEEWR.
- Bray, B. J., & Cridge, A. G. (2012). Encouraging students to study science: a new model for universities to engage school students with science. In S. Fan, T. Le, Q. Le & Y. Yue (Eds.), *International Conference: Innovative Research in a Changing and Challenging World Conference Proceedings Part A* (pp. 95 – 109). Launceston: Australian Multicultural Interaction Institute.
- COAG. (2009). *National Education Agreement*. Canberra: Council of Australian Governments.
- Curtis, D., & McMillan, J. (2008). *School Non-completers: Profiles and Initial Destinations*: Australian Centre for Education Research, LSAY.
- Darling-Hammond, L., Wei, R., Andree, A., Richardson, N., & Orphanos, S. (2009). *Professional learning in the learning profession: A status report on teacher development in the United States and abroad. Technical Report*. Dallas, TX: National Staff Development Council.
- DEEWR. (2011). *HEPPP partnerships round one projects*. Canberra: Department of Education, Employment and Workplace Relations
- Dobson, I., & Skuja, E. (2005). Secondary schooling, tertiary entry ranks and university performance. *People and Place*, 13(1), 52-62.
- Ferrier, F., Heagney, M, Long, M. (2009). Outreach: A local response to new imperatives for Australian universities. In F. a. H. Ferrier, M. (Ed.), *Higher Education in diverse communities, Global perspectives, Local initiatives*. London: European Access Network.
- Gale, T., Sellar, S., Parker, S., Hattam, R., Comber, B., Tranter, D., & Bills, D. (2010). *Interventions early in school as a means to improve higher education outcomes for disadvantaged (particularly low SES) students: A design and evaluation matrix for university outreach in schools*: DEEWR.
- Gonski, D. (2011). *Review of Funding for Schooling*. Canberra: Australian Government.
- Goodrum, D., & Abbs, J. C. (2011). *The status and quality of year 11 and 12 science in Australian schools*. Australian Academy of Science.
- Hare, J. (2013). Long way from participation targets, *The Australian*. Retrieved from <http://www.theaustralian.com.au/higher-education/long-way-from-participation-targets/story-e6frgcjx-1226571110401>
- Harvey, A., Burnheim, C., Joschko, L., & Luckman, M. (2012). *From aspiration to destination: Understanding the decisions of university applicants in regional Victoria*. Paper presented at the AARE-APERA Conference, Sydney, Australia.
- Hawley, W., & Valli, L. (1999). The essentials of effective professional development: A new consensus. In L. D.-H. a. G. Sykes (Ed.), *Teaching as the learning profession: Handbook of policy and practice*. San Francisco: Jossey-Bass.

- Lyons, T., Quinn, F., Rizk, N., Anderson, N., Hubber, P., Kenny, J., . . . Wilson, S. (2012). *Starting out in STEM: A study of young men and women in first year science, technology, engineering and mathematics courses: Interests and Recruitment in Science*.
- Marginson, S., Tytler, R., Freeman, B., & Roberts, K. (2013). *Securing Australia's future: STEM Country comparisons*. Melbourne: Australian council of Learned Academies.
- McGaw, B. (2013). *School Transformation & Pedagogy: what does the international evidence tell us?* Paper presented at the VASSP Conference, Cairns, Queensland. http://www.aspa.asn.au/index.php?option=com_content&view=article&id=107%3A2004-vassp-conference-papers-1&catid=25%3Astate-conferences&Itemid=49&limitstart=3
- McTighe, J., & Thomas, R. (2003). Backward design for forward action. *Educational Leadership*, 60, 52-55.
- Meiers, M., Knight, p., & White, G. (2010). *The Digest: The use of ICT in schools in the digital age*: Victorian Institute of Teaching.
- Ontario Government. (2010). *Specialist High Skills Major*. Ontario.
- Rice, S., Klatt, G., Polesel, J., Stokes, H., & Turnbull, M. (2012). *Evaluation of Senior Secondary School Pilot Program*. Melbourne: Melbourne Graduate School of Education.
- Teese, R. (2007). Structural inequality in Australian education: Vertical and lateral stratification of opportunity. In R. Teese, S. Lamb & M. Duru-Bellat (Eds.), *International Studies in Educational Inequality, Theory and Policy: Volume Two. Inequality in Education Systems*: Springer.
- Teese, R., & Polesel, J. (2003). *Undemocratic schooling: equity and quality in mass secondary education in Australia*. Melbourne: Melbourne University Press.
- Timperley, H., Wilson, A., Barrar, H., & Fung, I. (2007). *Teaching, professional learning and development: Best evidence synthesis iteration*. Wellington: New Zealand: Ministry of Education.
- Tytler, R., Osborne, J., Williams, G., Tytler, K., Crips, J., Tomei, A., & Forgasz, H. (2008). *Opening up pathways: Engagement in STEM across the Primary-Secondary school transition*. DEEWR.
- VCAA. (2013). *Strengthening pathways in senior secondary qualifications*. Melbourne: Victorian Curriculum and Assessment Authority.