

ACTIVE LEARNING THROUGH INFINITY MAPS

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ABSTRACT

Infinity Learning Maps are designed to facilitate in-depth and shared understandings of students' broad learning environments and to foster new learning. The visual maps that students create give rise to the development of collaborative teams of students, their teachers and parents who seek to extend learning environments in directions that are meaningful and relevant to students' lives. This study, conducted over a three-month period, reviewed the types of changes that 319 students, their teachers and parents made to support students reach a nominated challenge and examined the participants' perceptions of the utility of the Infinity Learning Maps for understanding and extending learning environments. The results indicated that each group made qualitative changes in the way they supported new learning. Students' selected challenges moved from general to specific and the strategies they used changed from reactive, passive responses to those involving active learning. Changes in teacher and parent strategies reflected this shift with the predominance of early suggestions for support requiring passive responses and later strategies encouraging students to take an active role. Student, teacher and parent participants considered that the Infinity Learning Maps had been helpful for talking about learning, finding out what to change, and supporting achievement.

INTRODUCTION

Infinity Mapping, developed by Brian Annan and Mary Wootton (2015), is an approach to understanding and enhancing students' development by promoting the integration of the latest global trends into students' learning environments. Rapid change in the way information is exchanged across the world has altered the way in which people learn, work and live. Students who prosper in the future world will be those who are able to make multiple learning connections in real-life learning activity. They will be innovative, resilient and competent in creating new solutions (see Annan, Annan, Wootton & Burton, 2014; Dumont, Istance & Benavides, 2010; Fullan, 2013; Hannon, Gillinson, & Shanks, 2013). The purpose of Infinity Maps is to stimulate learning through lateral relationships and links with contemporary local and global trends. Students are encouraged to become active learners and make connections that support new learning for the purpose of improvement and ultimately, prosperity.

The Infinity Maps process is initiated with presentation and facilitated discussion about global

trends in learning and living and the qualities that students will require to prosper in their current and future worlds. Students then depict their current learning environments on an Infinity Map. Infinity Maps are illustrations of the people who help students learn, the places they learn, the tools and artefacts that support their learning and the relationships among these elements. The students discuss their maps with fellow students and identify change priorities to improve their current learning situations. Students then make changes to their learning environments. Each participant makes decisions about the ways that they will support students' change priorities and new challenges or next steps. These mutual understandings and shared practices serve to bind the group that forms a small community of practice (see Wenger, 2010). Through the collaborative mapping process, each community of practice based around a student's learning links with other communities to exchange knowledge. Lateral exchanges create a steady flow of diverse information into and from each community (see Jackson & Temperley, 2006).

Theoretical Foundation of Infinity Maps

Three compatible ideas underpin the Infinity Maps process. They are ecologies of learning, narratives of learning and appreciation. These three ideas are discussed below.

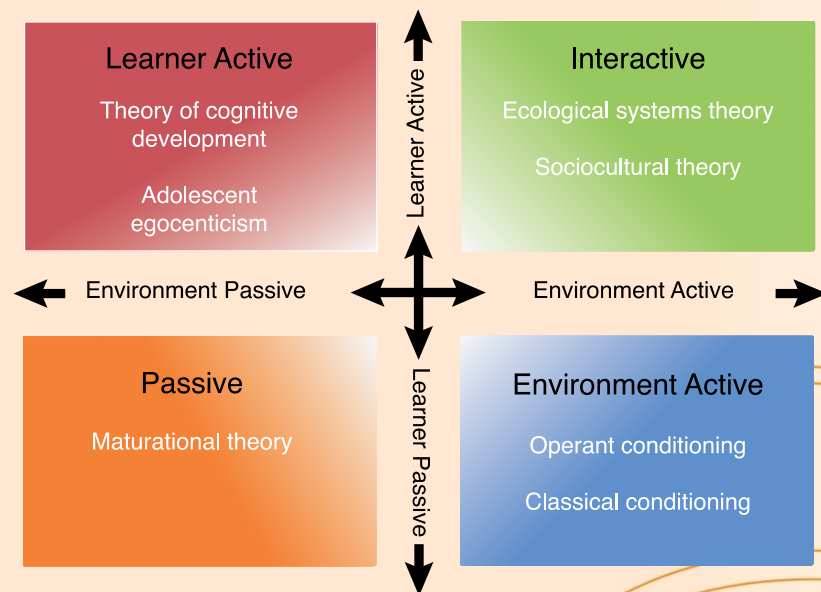


Figure 1. The Matrix of Perspectives with examples of theories falling within each quadrant (from Bowler, Annan & Mentis, 2007).

ECOLOGIES OF LEARNING The ecological perspective on human development, termed ‘interactive’ in Infinity Maps, is the first idea. This view assumes that people live in relation to one another rather than in isolation (see Bruner, 1996; Bronfenbrenner, 1979; Vygotsky, 1930-34/1978). Development is seen to occur in dynamic, interactive social systems with challenges and solutions being constantly created within the interaction among people. Interactive theory implies that every participant, be they student, parent or teacher, actively influences and is influenced by the activity within the contexts of their lives.

Within the interactive perspective both learner and environment are seen as active in determining learning. Figure 1 compares various theories of learning and human development in a two by two matrix with intersecting continua of learner and environment from passive to active (Bowler, Annan, Mentis, 2007). Interactive perspectives contrast with those theories that view children as either passive recipients of teaching or largely determinate irrespective of the environment.

To create learning environments that are relevant and engaging for young people, the mapping process includes the facilitation of dialogue among participants, including the students. Children have not always been viewed as, or encouraged to be, active in influencing decisions about their learning. However, authentic engagement of students is viewed as critical to the Infinity Maps process. Only

students themselves can contribute their unique knowledge of what it is like to be them and how the current and future worlds appear from their perspectives (see Kellett, 2010).

Participants consider the *relationships* among various aspects of children’s learning ecology, in particular, the *people* involved in their learning, the *places* where they learn and the *tools and artefacts* that support their learning. Through this shared sense-making process, networks of students, peers and adults form, creating small dynamic communities of practice that then link with one another to form a larger collective network. The communities of practice comprise the following three components:

- **Community:** Diverse groups of people involved in students’ learning environments
- **Knowledge:** Shared interest in and mutual understanding of students’ learning environments.
- **Practice:** Actions taken by all participants to change students’ learning environments

The domain of shared knowledge, with mutually held visions for extending students’ Infinity Maps, binds the participants in the communities of practice and drives them toward action (see Wenger 1998, 2010; Wenger, McDermott, & Snyder, 2002).

NARRATIVES OF LEARNING The second idea is that people live their lives in the stories they hold and act consistently with these stories. Narrative theory suggests that the unique stories held by students, teachers and parents about learning

can be largely negotiated and rescripted (see Sax, 2008; White, 2007). The Infinity Maps process aims to support the communities of practice formed around the students' challenges to design new environments that support change in a desired direction.

Language is a key tool. Through careful use of language, successes and challenges are kept in the space between people and their environments; a space external to the participants where the relationships between them can be reviewed, developed or changed. This positioning renders learning attributes, social learning structures, actions, and interactions observable and flexible rather than inherent and fixed, immovable aspects of the self.

Students, teachers and parents present multiple views of single situations and often will engage in diverse cultural practices. Therefore, active and authentic involvement of families and teachers is vital. This aspect of the Infinity Maps is included to foster the exchange of cultural knowledge and the creation of overlaps between home and school cultural practice, allowing students to perceive consistencies among their multiple identities (see Jackson 2003; Vincent, Randall, Cartledge, Tobin & Swain-Bradley, 2011).

APPRECIATIVE PERSPECTIVE The final notion in the trio is the appreciative view. This involves casting a positive lens on situations and building on the supports that already exist in learning environments and lives. The relationship between positive student experience and student achievement and/or wellbeing has been well established. Those students who experience learning and growing as positive are more likely to learn and be happy (e.g. Clore & Huntsinger, 2007; Cohen, McCabe, Mitchell & Pickeral, 2009; Daniels, Stupnisky, Pekrun, Haynes, Perry & Newall, 2009; Gilman, Huebner & Forlong, 2014; Noddings, 2003; Park, 2005; Sawka-Miller & Miller, 2007; Terjesen, Jacofsky, Froh, & DiGiuseppe, 2004; Valois, Paxton, Zullig & Huebner, 2006).

Accordingly, the Infinity Map process aims to build on the positive aspects of students' learning environments from the outset. They foreground what *is* rather than what is *not* and what is

supportive. The initial student drawing denotes the starting point or current situation. Regardless of whether supports are extensive or relatively limited, the map represents a platform on which students and those who are closest to them can grow positive relationships with learning.

This appreciative approach contrasts with deficit approaches that have focused on seeking gaps and deficiencies in development and having students make up or reach an arbitrary threshold. Positive, appreciative approaches concern the lens cast on students' learning, lens that determine to which features of situations one attends and the way sense is made of what is seen (see Annan, J. & Mentis, 2013; Linley, Joseph, Harrington, & Wood, 2006). Infinity Maps are designed to promote stories of success, hope and movement forward by focusing on aspirational learning environments.

THE RESEARCH

A study of the Infinity Maps was conducted over a three-month period. The purposes of the research were to:

- *Identify and understand the adjustments that students, teachers and parents made when collaborating to create innovative learning environments.*
- *Examine participants' perceptions of the utility of Infinity Maps to support innovation around each students' learning environment.*

Participants in the study were 319 of 387 students who participated in an Infinity Mapping project, teachers and coordinators from 21 schools and those parents who were able to attend. Three hundred and forty-seven students were from schools involved in a Ministry of Education trial of the mapping sessions, 15 were from the New Zealand Correspondence School and 48 from Akoranga o Naenae, a one-day school.

The participants met in clusters of schools in regions across New Zealand for three mapping days, one month apart. Students drew Infinity Maps and discussed them with their teachers and, where in attendance, parents. Three global trends formed the basis of participant interaction: active learning, extending learning connections, and linking learning



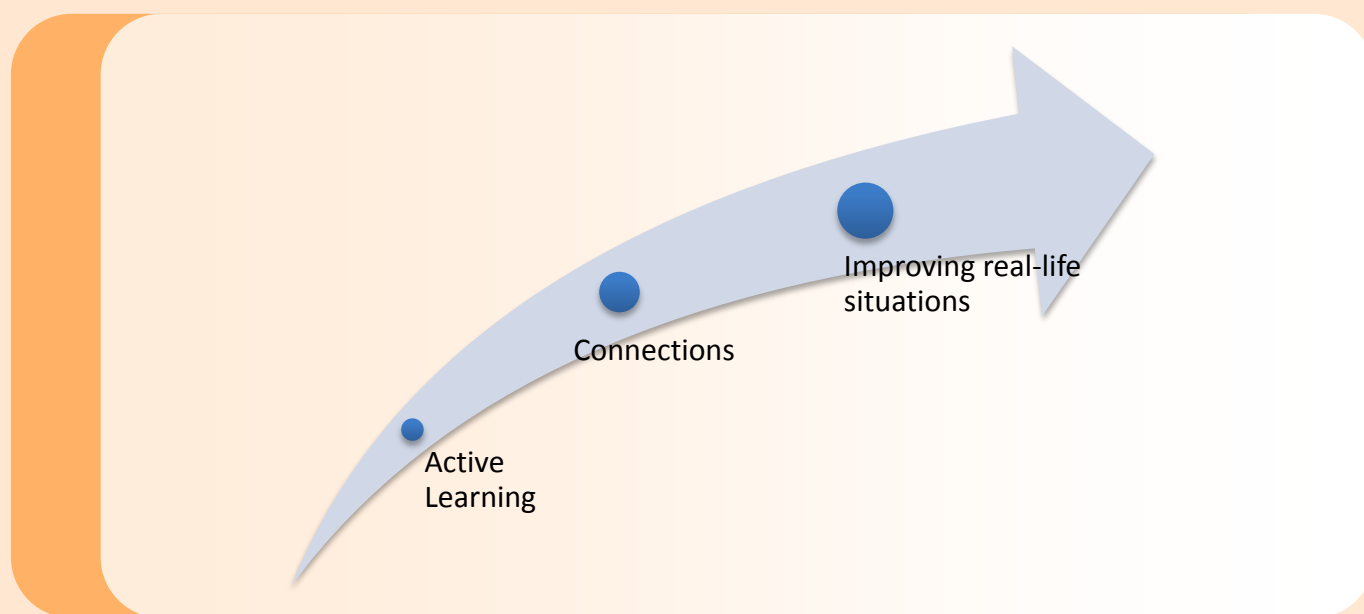


Figure 2. The Infinity Maps active learning trajectory

to the improvement of real-life situations. See Figure 2.

At the second and third mapping days, students created aspirational maps, overlaying their original maps with their plans for extending them through incorporation of aspects of the global trends. At each session the participants entered information about the maps they had drawn into an electronic form (Infinity Maps Questionnaire - IMQ). They noted the challenges they had set and the strategies they planned to use. Teachers and parents also recorded on the IMQ their plans to support students meet their challenge.

Measures

Data were collected from the IMQ to find out about the people, places and tools included in students' Infinity Maps, the nature of the challenges set and the strategies that students planned to pursue the challenges. The IMQ information collected also included the support strategies selected by the teachers and parents. Measures of challenges and strategies were taken at the first (Time 1) and the final (Time 2) mapping sessions. This data was supplemented by a. information from focus group meetings with students, teachers and parents in two schools, one of high and another of low decile (socio-economic) ranking, and b. those school staff members who had coordinated the Infinity Maps project in their schools. An on-line survey was conducted at the final mapping session to gauge

participants' perceptions of the usefulness of the process.

RESULTS

A. Infinity Maps Questionnaire

1. Student Challenges

When the challenges set by students were examined, three categories emerged: a. To work harder with no specific end-point noted (T1=14%; T2=5%), b. specification of an aim that was directly tied to an academic or applied task (T1=64%; T2=35%) and c. intentions to develop strategies that were more widely applied (e.g. problem-solving, learning strategies, making learning connections) (T1=21%; T2=61%). This finding is illustrated in Figure 3 below. Figure 4 represents the same data with the specified targets being divided into direct academic and applied targets and the strategy development divided into problem-solving and creating learning connections.

Examples of student challenges for each category are provided below:

Strategy development - connections

- *Connect with people who can help*
- *Help other people with their learning*
- *Talk to more people about my learning*



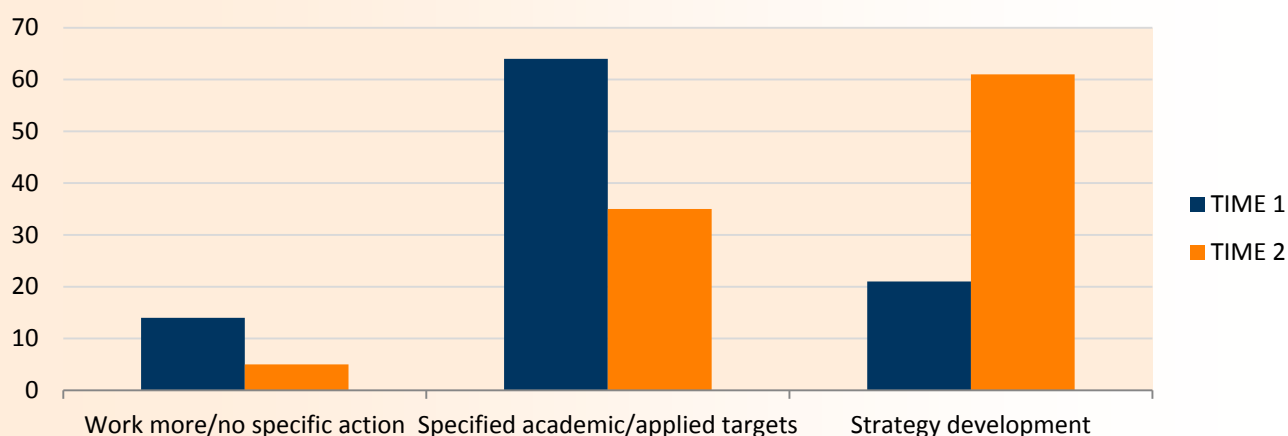


Figure 3. Graph showing the percentages of broad categories of challenges pursued by students.

Strategy development - problem-solving

- Use the learning process to find a solution
- I need to think about the types of questions [I ask]
- Think and listen before I do things
- Ask more questions and be confident about it

Specified targets - applied

- Improve the school by making it rubbish free
- Learn to play the guitar
- Improve safety in the water
- Encourage people to adopt animals from shelters

Specified target - academic

- To get better at my basic facts
- Improve my reading
- Use different sentence types and a range of punctuation
- Get my spelling words right in writing

No specific target or strategy

- I'm going to achieve
- I want to achieve and work to the best of my ability
- Try and understand
- Making the most out of my learning time

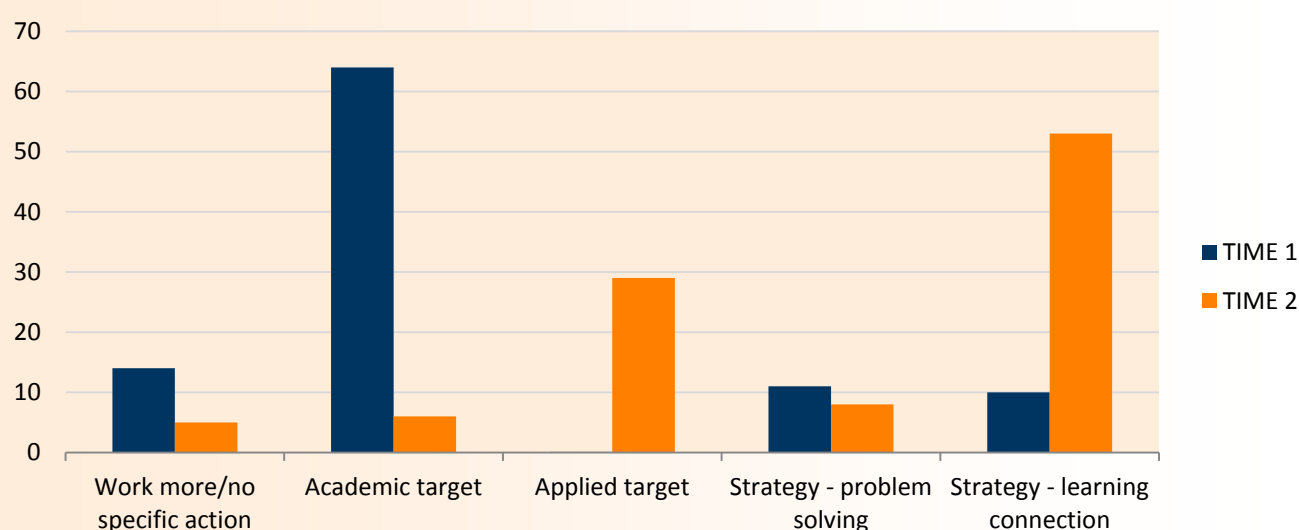


Figure 4. Graph showing percentages of types of challenges selected by the students at Times 1 and 2.



2. Students' Learning Connections

Analysis of the Infinity Maps at the beginning, midway and end of the project indicated that the extension of the learning environments did not necessarily mean increasing the numbers of

people, tools and places associated with learning. As the students' challenges and strategies became more refined, there was a slight decrease in the mean numbers of elements drawn on the maps (see Figure 5).

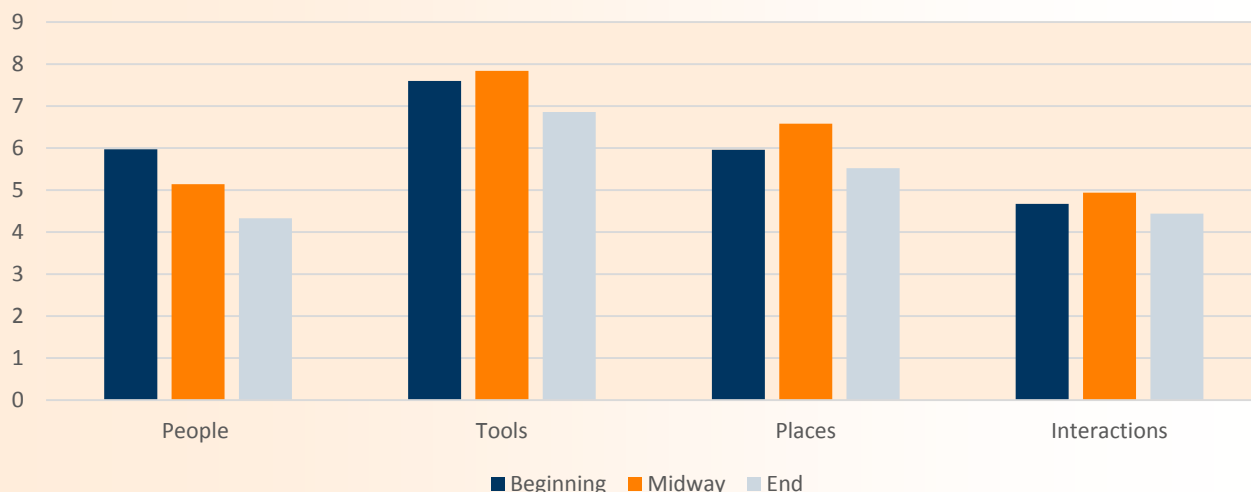


Figure 5. Graph showing the mean number for each Infinity Map element shown on students' Infinity Maps at the beginning, midway and end of the project.

3. Student strategies

Student, teacher and parent data were analysed to identify emerging categories of strategy at Time 1 and Time 2. Eight categories of strategy were observed for students. As becoming active in learning was a key focus of the Infinity Maps project, these categories were ranked on a continuum from those that involved reactive, passive action to those that required most active effort. The eight categories and frequencies of selection were: Experiencing and celebrating successful completion of tasks (T1= 9,

T2=11), completion of tasks (T1=13, T2=1), increased practicing of content (T1=102, T2=8), application of subject specific strategies (T1=94, T2=2), the introduction of general academic strategies such as questioning, listening (T1=105, T2=19), concentrating on strengthening learning relationships (T1=118, T2=30), extending local and global learning connections and (T1=75, T2=154), and the use of active learning strategies such as research, problem solving and creating plans(T1=31, T2=70). See Figure 6.

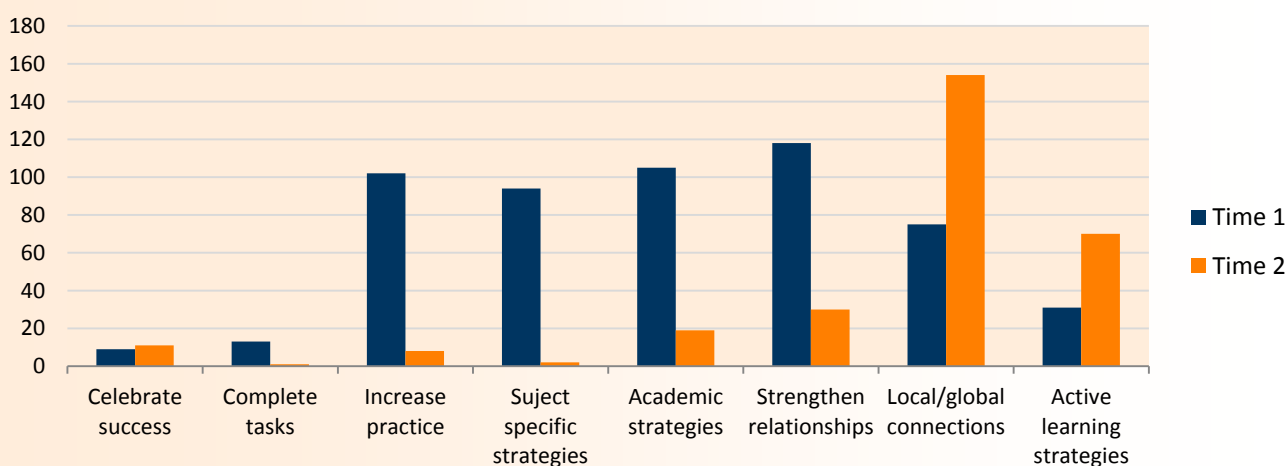


Figure 6: Frequencies of activity categories selected by students as strategies to pursue their challenges at Times 1 and 2.

4. Teacher support for children's learning

Emerging categories of teacher strategy were ranked on a continuum from those that allowed students to be passive to those that required students to be more active learners. Categories were monitoring of student engagement and

progress, additional exposure to information, modification of the physical environment, provision of reward or praise, teaching and encouraging strategy development, facilitation of social learning connections and personalized learning (see Figure 7).

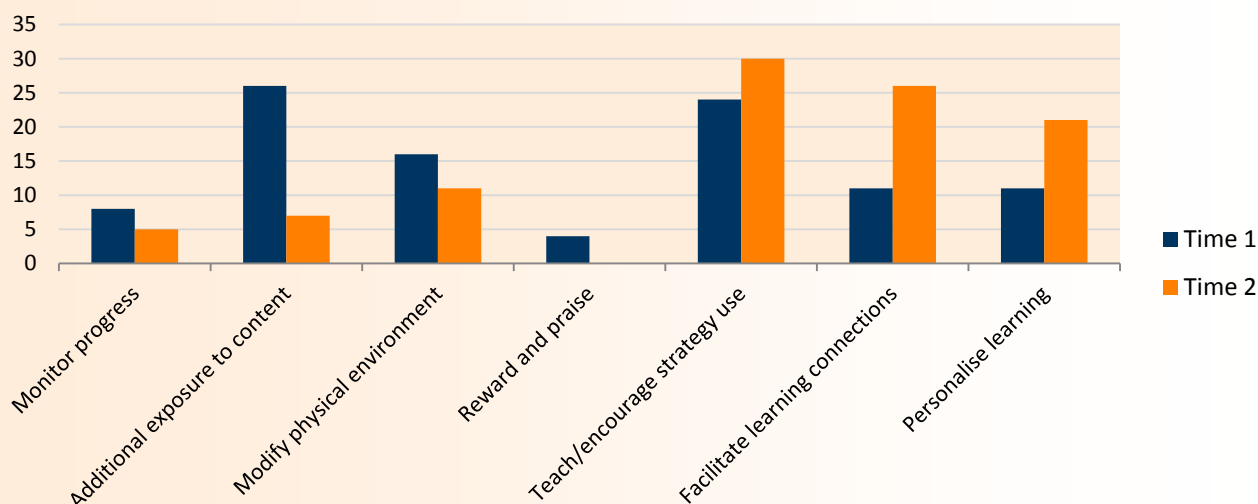


Figure 7. Mean percentages for each category of learning support offered by teachers at Times 1 and Times 2.

1. Monitoring of student engagement and progress (T1=8, T2=5). This category included the monitoring of student participation in activities, completion of tasks, progress or attendance in class.

2. Additional exposure to content (T1=26, T2=7). The second category included the provision of more time for tasks and additional practice activities, additional lessons for difficult tasks, provision of additional content (not strategy) and the prioritisation in the school programme of tasks and topics that were proving to be difficult.

3. Modification of the physical environment (T1=16, T2=11). Modifications to the physical environment included the provision and arrangement of, or access to, objects, learning spaces and tools.

4. Provision of reward or praise (T1 =4, T2=0). The fourth category comprised offers of tangible and non-tangible reward, praise for effort or performance, positive comments and feedback.

5. Teaching and encouraging strategy development (T1=24, T2=30). The promotion of strategy development was a broad category that included all offers of support intended to specifically encourage strategy development and use. This category comprised demonstrating or

providing examples of strategies in use, encouraging the development of students' own solutions and strategies, encouraging the application of strategies, supporting student reflection on learning and providing formative feedback about strategy development.

6. Facilitation of opportunities for linking with others/communication (T1=11), T2=26). The creation of opportunities for linking with one another was also broad and included relationships among all participants. The category comprised opportunities for students to share work and ideas with one another, working with buddies and groups, the use of digital technology to connect locally and globally, establishing new relationships and opportunities to share with wider audiences such as school and community.

7. Personalisation of learning (T1=11, T2=21). The personalisation of learning was reflected in several activities. These included building new learning upon the current interests of the students, considering prior learning of individuals to ensure activities were pitched appropriately for students, promoting activities that students considered to be fun and relevant, working alongside individual students in their chosen endeavours and increasing the quality or frequency of personal interactions.



5. Parent support for children's learning

The types of support offered by parents for their children's learning formed eight categories. These were ranked from activities that implied passive child involvement to those promoting active child engagement (see Figure 8). Parent strategies fell into eight categories of support, again ranked in order according to their requirement for active learning. They were monitoring and reminding, helping with homework (more time/practice), finding out about children's learning, modifying the physical environment, praising and encouraging, providing feedback, supporting problem-solving/strategy development and personalizing learning/encouraging active learning. Percentages for each category at Time 1 and Time 2 are listed as follows:

1. *Monitoring progress and task engagement/reminding* (T1=8, T2=8)
2. *Helping with homework tasks/more time/more practice* (T1=38, T2=6.8)
3. *Finding out about children's learning connections/approaches to learning/questioning and listening* (T1=12.3, T2=2.5)
4. *Modifying the physical environment* (T1=14.1, T2=13.5)
5. *Praising, encouraging* (T1=10, T2=16.7)
6. *Providing feedback* (T1=0.9, T2=19)
7. *Supporting problem-solving and strategy development* (T1=10, T2=9.26)
8. *Personalising learning, incorporating interests and actively supporting the development of children's learning connections with people and expertise* (T1=6.1, T2=19.76)

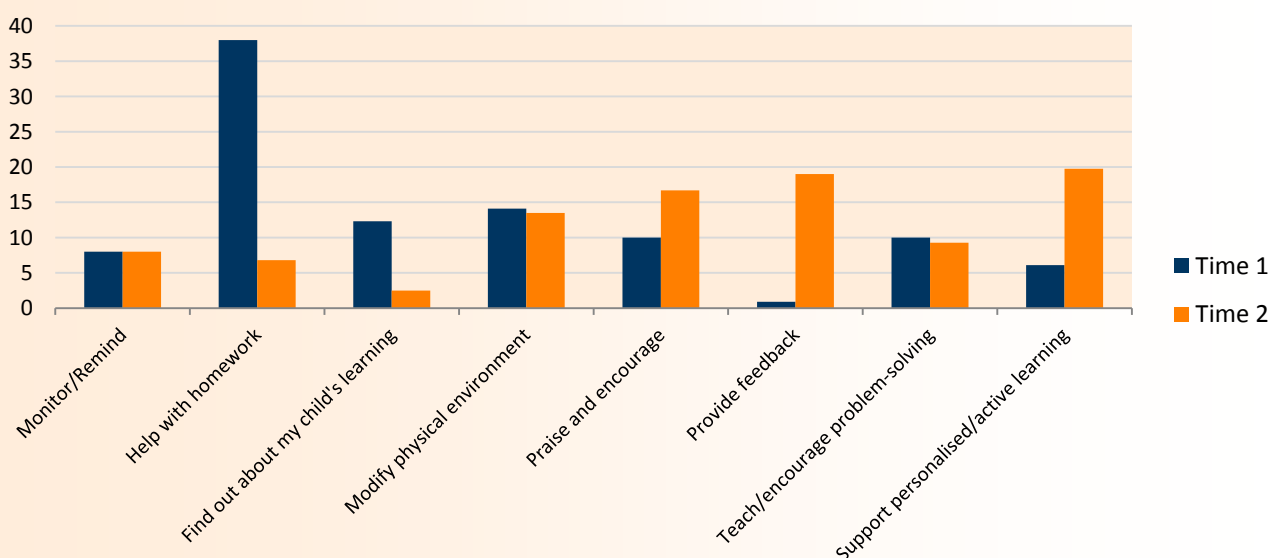


Figure 8. Figure showing the percentages of each category of learning support offered by students' parents.

6. Progress toward the challenge

The mean rating for student reported progress toward their challenge was 3.9 on a 1-5 scale, positioned between 'nearly there' and reaching the challenge. One hundred students considered they had met the challenge, 131 were nearly there, 56 had made 'a bit' of progress and 20

were yet to progress. A limitation to this result is created by the nature of challenges which, generated by the students, naturally varied between those readily attainable to those requiring long-term attention (See Figure 9).



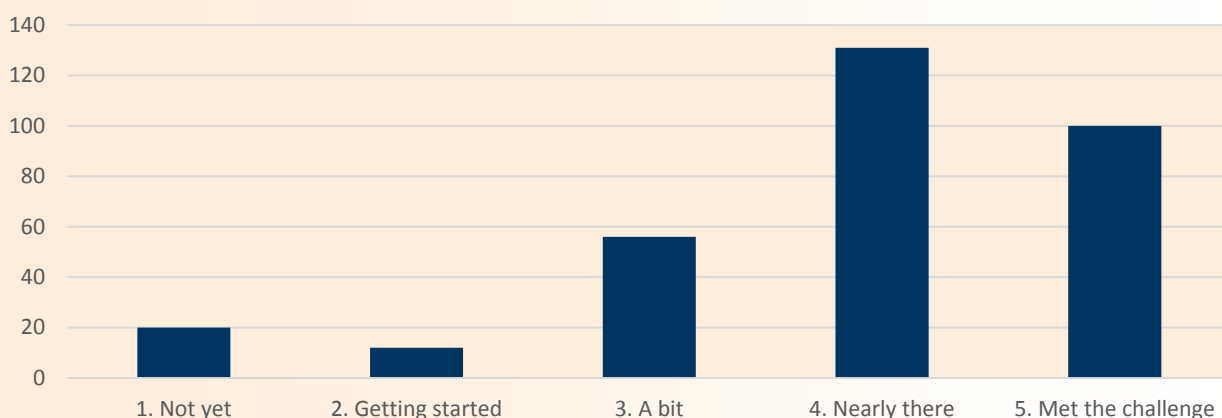


Figure 9. Graph showing the numbers of students reporting progress at each point in the learning journey.

B. Surveys

Survey data indicated that students and parents rated the maps on the four-point scale (1 = not helpful, 4 = very helpful) to be helpful to very helpful (student $m = 3.2$, parent $m = 3.2$) and teachers rated them as a bit helpful to helpful (teachers $m = 2.9$). A one-way ANOVA conducted to compare scores between participant groups showed no differences among the groups for identifying who helps students

to learn, becoming an active learner or achieving better. Differences among groups were observed for all other items. In particular, 'finding out what to change' [$F(2,4) = 7.17, p = 0.047$]. Ad hoc analysis indicated that students found the maps more useful than both parents and teachers for this purpose (See Figure 10).

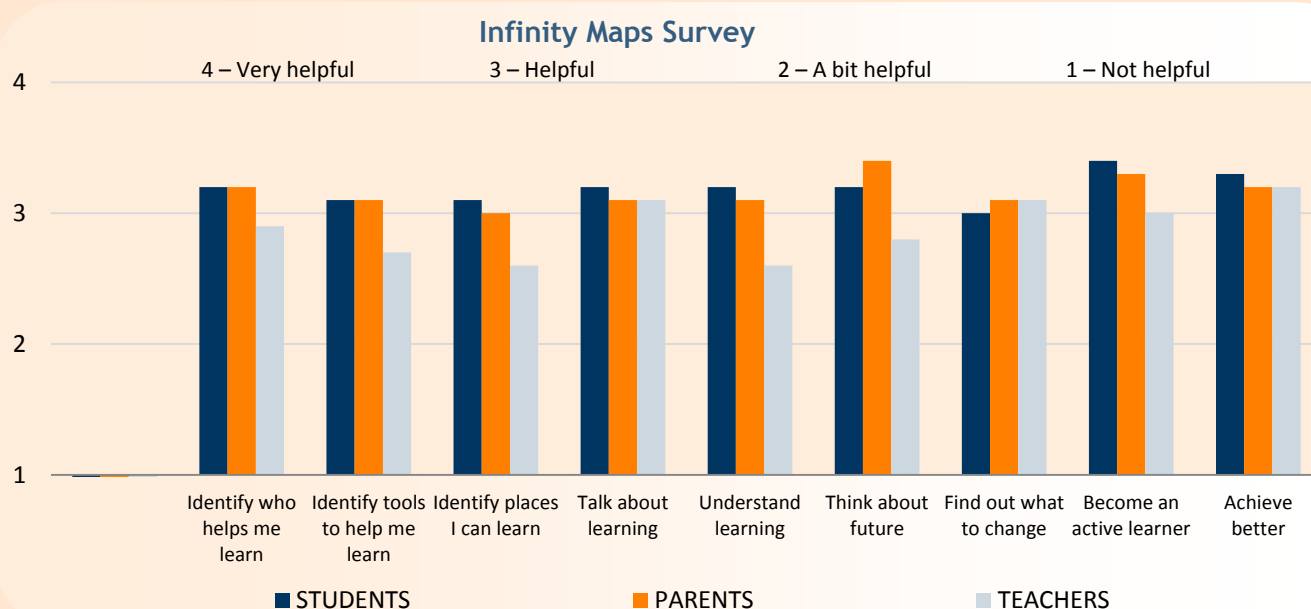


Figure 10. Graph showing mean scores assigned to each survey question by students, teachers and parents.

C. Reference groups

The dominant themes across the student, teacher, coordinator and parent groups are summarised below. While comments were diverse, each group shared strong messages. Parents commented on the need for schooling to align with contemporary and future worlds, key aspects being digital technology and collaboration. Students talked about the active way they had approached learning through the Infinity Maps process and the change they experienced in the nature of support offered to them by adults. Teachers had noticed that the Infinity Maps had 'switched the students on to learning' and observed greater engagement. Two teachers suggested refinement of the facilitation of the initial mapping sessions but were supportive of the Infinity Maps process per se. Coordinators viewed the maps as valuable for student learning and commented on their increased readiness at the end of the three sessions to carry out their support of teacher-facilitator role.

Focus on learning for a future world

The Infinity Maps helped students think about their current learning environments and the direction of learning for the future. Parents were keen for schools to align their teaching with the contemporary world in order to prepare their children for the future. One parent commented that, "Work environments have also changed so why wouldn't it be different in schools".

Appreciation of the wider learning environment

Students, parents and teachers became aware of the value of learning connections in the broad learning environment. The roles of active participation, digital technology and transfer of learning across settings were recognised. A parent commented that she was now *"more aware that interactions and sharing information are key to learning, learning outside of school and being explicit in highlighting it is an area for learning"*. A teacher commented that new learning environments were "about changing perceptions" and said that the maps had helped by *"getting to know families and how they are connected to each other"*.

New learning connections

Students and teachers reported that students had made new learning connections outside of their

initial circles and improved learning interaction in existing relationships. Parents observed their children to engage in new forms of interaction and to talk more with other children about learning. The project had provided a context for deepening relationships between teachers and students. *"One-on-one time was powerful ... showing an interest, building that relationship with them"*.

Active learning

Students noted that they used more focused learning strategies and helped one another to learn. Teachers reported that the mapping exercise had engaged students and that *"confidence in some has increased"* and they were more engaged with their learning. The students were more active, focused and able to articulate their learning. Coordinators viewed that the Infinity Maps had provided a framework and a language to discuss and create learning. Similarly, teachers noticed that some *"Kids are more articulate with each other about what they are learning outside of school"*. A teacher commented that she had *"noticed that the kids are more engaged - active with learning. There has been a change in attitude and more enthusiasm"*. This teacher also commented that the students who had taken part had been relatively low-achieving in her classroom, which made this finding noticeable. Similarly, parents appreciated the active role and responsibility that the students were taking and the new confidence they demonstrated. They had observed a range of new strategies being used by the children, one parent commenting that the approach made them *"responsible for their own actions"*.

Parent support for learning

Parents reported that the nature of support they provided had changed over the period of the Infinity Maps process. One said that *"My child doesn't want answers, but how to find out the answers - especially with peer relations, support rather than solutions"*. They discovered ways they could support the students' learning through design and inquiry and provided tailored, scaffolded assistance, for example, by *"making connections between community situations and learning"*. They noted that their children were expecting a more facilitative form of support. Parents commented on the general

public's traditional notions of education and suggested that information about contemporary teaching and learning be disseminated through greater parts of the community.

Teacher support for learning

Teachers commented that the process of mapping had been more important in learning than the specific challenges. They reported that they had developed strong relationships with the students through their one-to-one conversations and had promoted active learning in classes. They worked to extend students' understanding of what it meant to be an active learner. Some commented that they wished to offer the Infinity Maps process to a wider group in the school. Coordinators considered that the students had increased power in their learning activity and, for some parents and teachers, becoming accustomed to this took some time. Students had embraced active learning and parents and teachers had moved "on the hip of the kids".

They observed that in schools some teachers had initially viewed the mapping process as additional to regular tasks but that over time they could see how the process and its principles could be integrated with classroom activity.

Facilitation

The facilitation of the Infinity Maps process was viewed as a crucial element, especially in the early stages. Coordinators had attended a prior training session but commented that they were only ready to fully carry out their coordination role near the end of the project. There was much to learn about the process. It required deep understanding of the process and the rationale for activities as well as clarity around the coordinator role. At the point of review, after attending sessions, working with teachers and students in their schools and experiencing the approach, the coordinators said they were excited about spreading the approach to learning and teaching through their schools.

DISCUSSION

Systemic adjustments in dynamic communities of practice.

The findings of the study showed that as the mapping process progressed, students' focused more on developing general strategies that would apply to a wide range of learning activity and less on the acquisition of specific skills for particular situations. Analysis of student, teacher and parent strategy selection showed that as students' selected more active strategies to meet their challenges, the strategies that teachers and parents selected to support the students adjusted accordingly. This process was similar to that observed by Bruner (1996) who described the process by which adults, maybe without realising, adjusted their support in relation to changes in the development of children.

Value for participants

The Infinity Maps approach was considered useful by each group. The most valued aspect of the process for students was the support it offered them to become active in learning. The Infinity Maps had provided a forum for students to consider their stories about their learning environments and their role in the learning process. There were several indicators that, for some students, personal changes had occurred. Some reported that they were more

confident and parents and teachers had noticed this change. Some teachers and parents also observed that students had developed a language to talk about their learning, including learning that occurred outside of the school and were more 'switched on' to their work. The majority of students considered they had made good progress toward their selected challenges. Future research might consider the reasons that some but not all students considered they had made progress in the direction of their goal.

Participants' views of the learning environment had shifted over the Infinity Maps period to include a more specifically targeted set of learning activities. The maps had allowed students to view learning as a whole with connecting parts rather than a series of isolated events and circumstances. Linking learning to the current and future worlds became a priority, particularly for parents. Parents and students both viewed the Infinity Maps process as 'very helpful' in prompting them to consider learning in the future, the majority of teachers also viewing the maps as helpful for this purpose. Students' reset their challenges accordingly. Several parents reported their readiness to help their children extend their environments and enhance their learning in the

outside-of-school environment. Reference group parents stressed their awareness that the world was rapidly changing and appreciated the opportunity to think about what this change meant for their children's education.

Facilitation

During the Infinity Maps trial, the critical role of quality facilitation was apparent. The process constituted a major change for those participants whose views of education were more closely aligned with traditional transmission modes. It required active students and active adults who facilitated students' learning. Two teachers indicated they were not confident that they knew enough about the process to support the students and expressed some anxiety about their role. School coordinators, when coming together at the end of the project, commented that it was only at the end of the project that they viewed themselves as ready to lead the process in their schools.

Although the coordinators were skilled in working with teachers, they had required time to understand the theory and practice associated with the process and in situ experience to learn about the ways Infinity Maps could be facilitated with confidence and integrity. During the one-day initial training session, coordinators, who were to be charged with leading the Infinity Maps projects in their schools, were themselves learners. They required time to consider effective ways of working with the teachers on the project in their schools, to help teachers build content knowledge and support them to apply this in practice. The value of sound preparation for those who, as in this case, were facilitators of facilitators was observed in a study by Wootton (2013) who noted that school leaders' effectiveness in supporting teachers to prepare as facilitators relied on a thorough understanding of the work and their role. Once familiar and prepared, the school coordinators reported that they fully supported the process and were enthusiastic about working from the students' stories as illustrated on their maps.

Every coordinator and teacher necessarily interprets situations through their own set of cognitive 'filters' formed upon prior experience. These filters influence the features of the course to which the participants attend and the sense they make of the content at the time (see Schön, 1983). Participation

in the Infinity Maps process may have challenged some prior views, a process encouraging the identification and reprioritisation of various contextual features. It is possible that, while an extended preparation programme may be helpful, deep understanding may continue to require that coordinators and teachers have first-hand experience in the Infinity Maps process. Hence, irrespective of the inclusion of practical activities and expanded content, it is likely that in situ participation in the Infinity Maps process would remain a vital aspect of school coordinators' and facilitating teachers' professional preparation.

Limitations of the study and future research

The results have shown that changes associated with the Infinity Maps can occur over a relatively short period of time. Over the three-month period students were observed to identify more generalised learning challenges and more widely applicable strategies to meet these challenges. The Infinity Maps project was purposefully brief, intended to seek changes in a minimally intrusive, maximally effective way. However, the research has also provided a strong rationale for conducting an Infinity Maps study over a longer period of time. Additional time would provide the opportunity to collect data at a number of points and search for trends in strategy change. It would also allow researchers to examine the sustainability of gains and the integration of the principles of the Infinity Maps into teaching practice. Extended research might also involve analysis using a pre-empted continuum of challenges and strategies based on the findings of the present study. While a less open continuum may restrict the extent to which new categories emerge, it may allow for assignment of values to each category, supporting measurement of shifts in larger studies.

Responses used in the research analysis represented 82% of the total number of students who took part in the Infinity Maps process. These were students who added information to the IMQ at both data collection points. It is possible that the responses of those other students who filled the IMQ at only one of the data points used in this research may have differed from those who recorded the full process. Among those who filled both maps, there remained various sub-fields omitted by a number of students meaning that to compare data sets, frequencies were converted to percentages.

Conclusion

The research considered two questions. The first inquired about the nature of strategies selected by students, teachers and parents to support movement toward the challenges chosen by students. For students, a general movement was observed from specified academic actions to strategies that could be applied generally across learning activities. In addition, more students planned to establish local and global learning connections and fewer focused on subject-specific content or skill. Simultaneous shifts were observed in the strategies that parents and teachers suggested they would use to support the students pursue their selected challenge, with a general

movement from actions that supported relatively passive student learning to those that encouraged students to take an active role. The second question concerned the perceived usefulness of the Infinity Maps process for participants. Students, teachers and parents all rated the process as helpful. Each participant group assigned greatest value to different aspects of the process. The Infinity Maps were perceived by students to help them take greater agency, by teachers to encourage students to talk about learning and by parents as an opportunity to consider the education of their children for the future.

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