

Survey findings – Science and mathematics specialist pathways

In 2016, a standardised online survey was employed to explore the PSTs' experience with the Science/Mathematics Specialisation in MTeach program. The survey consisted of five sections (18 questions in total): overall experience, knowledge change, attitude change, capacity change, and students' engagement. The survey was administrated to 40 PSTs who participated in the activity, with 10 returned useable responses. The responding rate was 25.00 per cent. In order to explore the long-term impact of the activity on participants, this survey was also administrated to 39 graduate teachers who participated in the activity in 2014 and now in service. Three useable responses were collected from the graduate teacher, which indicates the responding rate is 7.69 per cent. Given the low responding rate, it may not be appropriate to generalise the survey results.

Overall experience with the activity

From the PSTs' perspective, all respondents agreed that this activity had been a valuable part of their teacher education experience. An absolute majority (90 per cent) of responding PSTs felt the activity worked well and enjoyed the process. Particularly, they agreed that the process has been effective in supporting their learning development. Improvement could be made to provide better opportunities for PSTs to interact with science/mathematics professionals since three out of ten respondents reported neutrally in this aspect.

The graduate teachers shared similar opinions with PSTs in most aspects of their overall experiences with the activity. All of the respondents agreed that the activity worked well and they enjoyed the process. Two thirds responding graduate teachers agreed with the effectiveness and value of the activity in supporting their professional development. One exception could be observed in interacting with science/mathematics professionals. Only one third of graduate teacher respondents, in contrast to 70 per cent of PST respondents, reported positively in this aspect. Table 1 shows the responses to the five questions in relation to participants' overall experiences.

Table 1. Responses from PSTs to their overall experiences with the activity

Question	2	1	0	-1	-2	
14. I felt the ReMSTEP activity worked well	30.00%	60.00%	10.00%	0.00%	0.00%	PST
	0.00%	100.00%	0.00%	0.00%	0.00%	Grad
15. I enjoyed the process of participating in this project	30.00%	60.00%	10.00%	0.00%	0.00%	PST
	0.00%	66.67%	33.33%	0.00%	0.00%	Grad
16. The process was effective in supporting my learning/professional development	50.00%	40.00%	10.00%	0.00%	0.00%	PST
	0.00%	66.67%	33.33%	0.00%	0.00%	Grad
17. I gained a lot by interacting with science/mathematics professional(s) in the project	50.00%	20.00%	30.00%	0.00%	0.00%	PST
	33.33%	0.00%	66.67%	0.00%	0.00%	Grad
18. This has been a valuable part of my	70.00%	30.00%	0.00%	0.00%	0.00%	PST

teacher education/professional development experience	0.00%	66.67%	33.33%	0.00%	0.00%	Grad
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2=Strongly Agree, 1=Somewhat Agree, 0=Neither Agree nor Disagree, -1=Somewhat Disagree, -2=Strongly Disagree

Knowledge change

Nine out of ten PST respondents and two thirds graduate teacher respondents stated that they had learnt some useful and interesting science concepts, as one of the PST commented that she/he definitely gained valuable insight into primary science teaching, and valuable practice teaching in the classroom.

This activity performed particularly well in terms of showing the PSTs how science/mathematics practices might be represented in the curriculum. All the respondents agreed with this benefit, and one of them highlighted that prior to the activity he/she did not realise how easy science learning could be integrated across the curriculum especially with mathematics and inquiry. Being involved in this activity also helped him/her considered the relevance and importance of STEM to the economy and the importance of encouraging scientific curiosity and interest in the younger students. In contrast, only two thirds responding graduate teachers reported positively in this aspect, and another one third even gave negative feedback. Table 2 presents the details of responses to the two questions in relation to participants' knowledge change.

Table 2. Responses from PSTs to their knowledge change as a result of the activity

Question	2	1	0	-1	-2	
1. I learnt some useful and interesting science concepts	40.00%	50.00%	10.00%	0.00%	0.00%	PST
	33.33%	33.33%	33.33%	0.00%	0.00%	Grad
4. I have been surprised by what I learnt about science/mathematics practices, and how these might be represented in the curriculum	60.00%	40.00%	0.00%	0.00%	0.00%	PST
	0.00%	66.67%	0.00%	33.33%	0.00%	Grad

Attitude/Identity change

This activity successfully brought changes in participants' understanding of the role of science teacher with 100 per cent of two groups of respondents reporting positively. Differences could be noticed between the two respondent groups in their answers to the question exploring changes of their attitude towards science and science teaching. Nine out of ten PST respondents claimed that there had been a positive change in their attitude towards science and science teaching. The only one who reported neutrally gave the explanation that his/her attitude had already been positively prior to undertaking the program. However, one third graduate teachers reported negatively in this aspect without giving the reason.

Table 3. Responses from PSTs to their attitude/identity change as a result of the activity

Question	2	1	0	-1	-2	
2. There has been a positive change in	60.00%	30.00%	10.00%	0.00%	0.00%	PST

my attitude towards science and/or teaching science	0.00%	66.67%	0.00%	33.33%	0.00%	Grad
3. There has been a change in my understanding of the role of science teacher	60.00%	40.00%	0.00%	0.00%	0.00%	PST
	33.33%	66.67%	0.00%	0.00%	0.00%	Grad

Capacity/Practice change

This activity has achieved spectacular results in improving participants' capabilities to provide quality science/mathematics teaching in a number of ways. All respondents claimed that they had been engaged in new and interesting approaches to teaching science, such as new models, new questioning techniques, and new resources. The two group respondents also highlighted the benefits of learning things about engaging with contemporary science that will influence their teaching in the future, and gaining experience in understanding and communicating science/mathematics ideas to students.

The two group respondents' showed slightly different opinions of their benefits in gaining ideas for how to bring contemporary science practices into the school curriculum. All responding PSTs reported positively in this aspect in comparison with two thirds graduate teachers reported in the same way. In addition, 90 per cent of PST respondents and 66.67 per cent graduate teacher respondents reported that they gained valuable ideas about how to support students to learn about what science/mathematics professionals do, and their thinking. For example, as one PST respondent pointed out, he/she learnt things such as IDPE design process, and ways to incorporating problem solving, creativity, curiosity and critical thinker.

As a result of the activity, all responding participants grew their confidence in teaching relevant subject in school. The details of the responses are presented in Table 4.

Table 4. Responses from PSTs to their capacity/practice change as a result of the activity

Question	2	1	0	-1	-2	
5. I was engaged in new and interesting approaches to teaching science	60.00%	40.00%	0.00%	0.00%	0.00%	PST
	0.00%	100.00%	0.00%	0.00%	0.00%	Grad
6. I have learnt things about engaging with contemporary science that will influence my teaching in the future	60.00%	40.00%	0.00%	0.00%	0.00%	PST
	33.33%	66.67%	0.00%	0.00%	0.00%	Grad
7. I gained ideas for how to bring contemporary science practices into the school curriculum	50.00%	50.00%	0.00%	0.00%	0.00%	PST
	33.33%	33.33%	33.33%	0.00%	0.00%	Grad
8. I have gained experience in understanding and communicating science/mathematics ideas to students	50.00%	50.00%	0.00%	0.00%	0.00%	PST
	0.00%	100.00%	0.00%	0.00%	0.00%	Grad
9. I gained valuable ideas about how to support students to learn about what science/mathematics professionals do, and their thinking	40.00%	50.00%	10.00%	0.00%	0.00%	PST
	33.33%	33.33%	33.33%	0.00%	0.00%	Grad

10. I feel more confident in teaching science/mathematics-related subjects at school	40.00%	60.00%	0.00%	0.00%	0.00%	PST
	33.33%	66.67%	0.00%	0.00%	0.00%	Grad

Students' engagement

According to the respondents' feedback, their students benefited through the activity in different ways, including development of new understanding of the nature of scientific practices, and productive engagement with learning science. Table 5 shows the responses to the three questions in relation to students' engagement. According to the two group responses, as a result of the activity, students were more likely to be engaging with science learning, particularly those learning activities infused with contemporary scientific practices. However, a considerable number of respondents held neutral opinion of the new understanding of the nature of scientific practices that students could develop.

Table 5 Responses from PSTs to the impact on students' engagement as a result of the activity

Question	2	1	0	-1	-2	
11. Students developed new understanding of the nature of scientific practices	20.00%	60.00%	20.00%	0.00%	0.00%	PST
	0.00%	33.33%	66.67%	0.00%	0.00%	Grad
12. Students were productively engaged with learning science	50.00%	40.00%	10.00%	0.00%	0.00%	PST
	0.00%	100.00%	0.00%	0.00%	0.00%	Grad
13. These activities featuring contemporary scientific practices positively impact on students' engagement with science	40.00%	40.00%	20.00%	0.00%	0.00%	PST
	0.00%	66.67%	33.33%	0.00%	0.00%	Grad