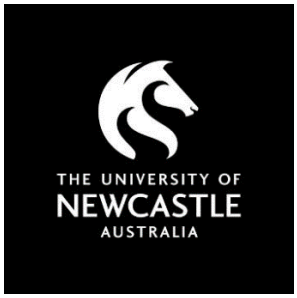

Building capacity for quality teaching in Australian schools: QTR Digital RCT final report

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Context

Australia is a uniquely sparse country, with 46% of schools, 30% of the teaching population and 28% of the student population located in rural, regional, and remote areas (ACARA, 2021). Unfortunately, teachers and school leaders in these areas face significant challenges in accessing high quality professional development (PD) (Mohan, Lingam & Chand, 2017), with 75% of teachers in rural locations reporting that it is difficult for them to select relevant and/appropriate professional learning (AITSL, 2019).

High quality, collaborative PD is more often delivered in metropolitan centres, limiting access for teachers in regional and remote settings due to their geographical isolation, the time and cost associated with travel, and difficulties in obtaining relief or casual teachers in small communities (Erickson, Noonan, & McCall, 2012; Maher & Prescott, 2017). For small schools (those with fewer than eight teachers), which represented 68% of schools in this study, participation in collaborative forms of PD, such as Quality Teaching Rounds (QTR) can present additional difficulties. In these schools, releasing four teachers to engage in Rounds can be difficult or even impossible (Patfield, Gore & Harris, 2021).

Increasingly, digital technologies have been used to overcome many of the challenges that teachers in small schools and those in regional and remote settings face in accessing professional development. A number of the participants in our research, however, expressed concern about a lack of engagement and interactivity in traditional forms of online PD, which they indicated were frequently a 'box ticking' exercise. They reported that they had benefitted from the increased availability of high-quality online professional development that has occurred as a response to COVID-19.

Developed and piloted in 2019, QTR Digital offers teachers the opportunity to engage in a rigorously tested, collaborative approach to PD, using video-recordings of teachers' lessons and videoconferencing, regardless of the size or setting of their school.

QTR Digital

QTR involves four sequential sessions (Figure 1), which have been adapted slightly for the digital environment. All teachers participating in the QTR Digital Randomised Controlled Trial attended a two-day online workshop. Within the workshop, participating teachers were allocated to a Professional Learning Community (PLC) of four teachers from different schools. The pre-allocation of PLC members enabled all teachers to build rapport and engage in learning about the QTR process with a smaller group of colleagues during the workshop.

Teachers remained with their allocated PLC to conduct a full set of Rounds, using Microsoft Teams as a secure and confidential platform for communication, file sharing, and videoconferencing.

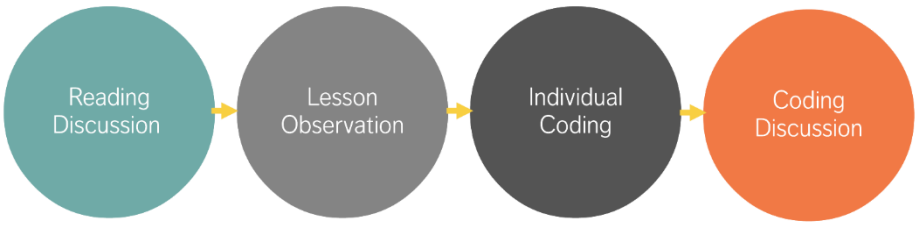
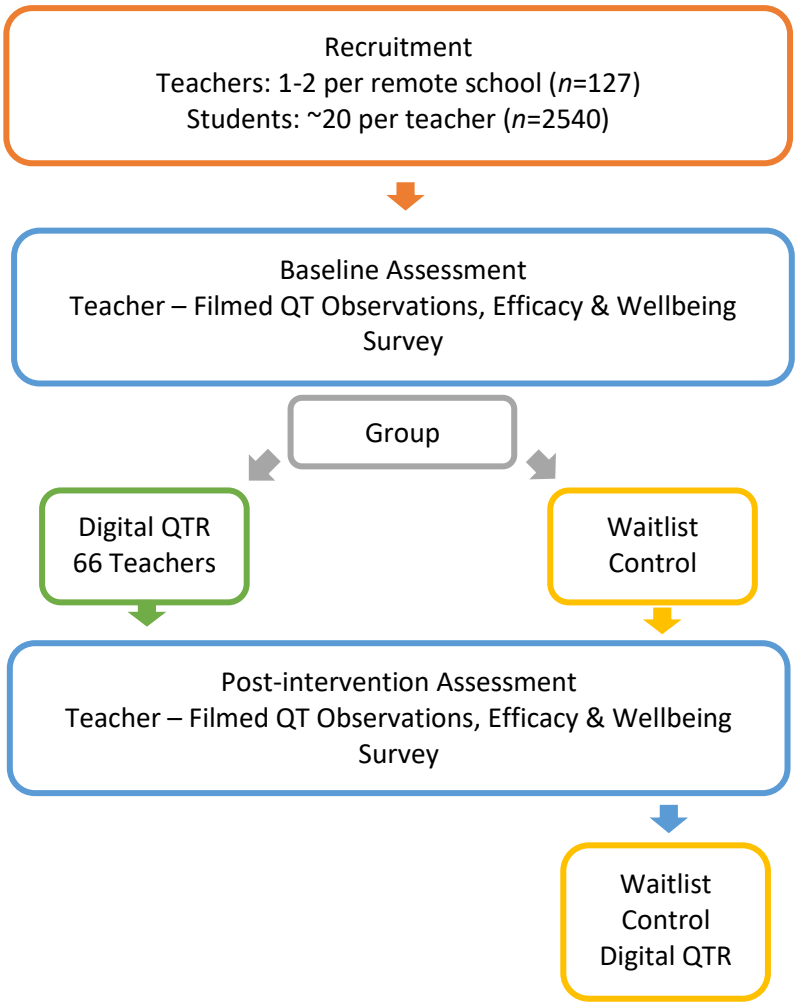


Figure 1 – The Quality Teaching Rounds process

Study design

This study was designed as a two-arm randomised controlled trial to examine the effects of participation in QTR Digital on student learning outcomes. Despite the disruption of the Term 3, learning from home period, which saw students lose up to 85 days of face-to-face teaching, the 2021 study proceeded as per the design.



October 2019
- Recruitment begins for start in 2020
- Project team navigates changing non-operational status due to bushfires

March 2020
- First week of data collection proceeds
- Project postponed as NSW DoE schools pivot to learning from home due to COVID-19 pandemic

October 2020
- Over 70% of recruited schools opt to continue in 2021.
- 127 participants from 76 schools are recruited for 2021 trial

February 2021
- Recruitment is finalised
- Project team collects 1325 student consent forms, sets up 76 PAT sites and assigns over 3000 PATs

March 2021
- Data Collection proceeds:
    - 1468 PAT Maths
    - 1452 PAT Reading
    - 119 lesson video recordings
    - 96 teacher survey responses
- Data collection period extended due to flooding in NSW

Term 2 2021
- Workshops held with 66 teachers assigned to 18 PLCs
- Rounds completed by end of term with the first Round recorded for fidelity

Term 3 2021
- 2 PLCs finalise rounds, which were disrupted by learning from home due to COVID-19 pandemic
- Schools lost up to 14 weeks of face-to-face learning

November 2021
- Data Collection proceeds:
    - 893 PAT Maths
    - 933 PAT Reading
    - 111 lesson video recordings
- Whilst the focus was on PATs, many classes faced COVID-19 positive cases meaning there were reduced attendance numbers
- 39 teachers did not complete follow-up observation videos, due to disruptions related to COVID-19

Recruitment

Participation in the project was open to any regional (Outer Regional and Inner Regional), remote (Remote and Very Remote) and/or small school (a school with 8 FTE teachers or fewer). One or two teachers were recruited from each school, however, all teachers participated in cross-school PLCs. The inclusion criteria for teachers required that they had not previously participated in QTR and were currently teaching within Stages 2-5. Teachers on Stage 4 and Stage 5 needed to specialise in English or Mathematics , however, a small number of teachers from other subject areas were involved, as requested by schools.

Recruitment commenced in Term 1 2019, with the project slated to begin in 2020. Due to the COVID-19 pandemic and NSW schools moving to learning from home in March 2020 the project was postponed until 2021. After retaining over 70% of schools that were recruited for the 2020 trial, the project team recruited a total of 127 teachers from 76 small, regional, and remote schools. Electronic Direct Mail (EDM) was used to send information to more than 1,000 schools in NSW that met inclusion criteria for this project. Phone calls were made to every school to follow up on the EDM and discuss the opportunity with the principal. Social media was also harnessed during recruitment to share information on the project with specialised rural and remote teachers and through various educator networks. The most effective means of recruitment was through Directors, Educational Leadership (DEL) contacting their schools and other internal support from the Department of Education.

In addition to the recruitment of schools and teachers, the students of participating teachers were asked to consent to their involvement in the research. The number of consenting students in Stages 2 – 5 in participating schools varied widely, from 1 to 30 students. Due to their small size, one participating school had only 2 students who were eligible to participate in the research.

Participating Schools

127 teachers were recruited from 76 small, regional, and remote schools, with substantial spread across NSW (Figure 2).

Figure 2 Map of participating schools

Following baseline data collection, the study proceeded with 112 teachers from 65 schools after the withdrawal of 15 teachers from 11 schools. Teacher withdrawal occurred throughout the project for a variety of reasons, including staff changes, lack of time and capacity, shortage of classroom teachers and casual relief teachers, and the effects of flooding across the mid-north coast in early 2021.

While the project team reached out to all schools who felt overwhelmed and offered extra support, some principals indicated that their staff were under significant stress, particularly considering the disruptions to schooling resulting from COVID.

School details at a glance

Number of Participants (Total)	127
Number of Schools (Total)	76
Highest ICSEA	1083
Lowest ICSEA	660
Highest student enrolment	1161
Lowest student enrolment	3
Number of Schools in Major Cities	6
Number of Schools in Inner Regional settings	33
Number of Schools in Outer Regional settings	21
Number of Schools in Remote settings	4
Number of Schools in Very Remote settings	1

Data

The project collected multiple forms of data to examine the impact of participation in QTR Digital on student learning outcomes, teaching quality, and the experiences, self-efficacy and morale of participating teachers. Data collection processes are outlined below.

Primary outcome - Student achievement

The primary outcomes for this randomised controlled trial were student achievement in mathematics and reading comprehension, assessed using ACER's Progressive Achievement Tests. These tests are highly reliable, norm-referenced student assessments that have a high level of predictive validity for student achievement (Fogarty, 2007). All participating teachers ran online PATs with students, who had consented to being part of this research, in accordance with research protocols.

Secondary outcomes -Teaching quality

The research team also collected, observed, and coded videos of individual teachers' lessons at two time points, pre-intervention (Term 1, 2022) and post-intervention (Term 4, 2022). Lessons were videorecorded by teachers and uploaded to a secure Microsoft Teams platform for observation and coding. 10% of the 192 lessons uploaded by teachers in these two time-periods were double-coded by the research team to check Interrater reliability.

Survey data

Data pertaining to teacher self-efficacy, morale and wellbeing were collected using an online survey, powered by Qualtrics, at five time points across the course of the research. The data were collected in Terms 1, 2, 3, and 4 in 2022 and again in Term 1, 2023 to investigate the impact of participation in QTR Digital over time and to observe any seasonal variation in responses.

Interviews

In addition, we conducted interviews with 18 teachers and school leaders pre- and post-intervention (Terms 1 and 4, 2022) to gather more nuanced data regarding teachers' experiences of participating in PD. These phone interviews used a semi-structured format, providing participants with the opportunity to discuss their own school context and experiences of engaging in various forms of PD, including QTR Digital. All interviews were recorded and transcribed by a third party. Interviews were then thematically analysed and coded by researchers from the Teachers and Teaching Research Centre, with 25% of all interviews being independently coded by two researchers to ensure consistency and reliability.

Results

Engagement in the research was difficult for many of the participants, due to widespread flooding in early 2021 and the impacts of COVID-19, causing some schools to move to a learning-from home model for up to 14 weeks across Terms 2, 3 and 4. Despite these disruptions, the project was able to proceed with a focus on the primary outcome of student achievement. Furthermore, a total of 78 teachers provided lesson videos in post-intervention data collection (Term 4, 2022), enabling analyses of both the impact of QTR Digital on both student learning outcomes and teaching quality.

Engagement with the workshops and QTR Digital

Teachers in the QTR Digital research described a variety of barriers to participating in collaborative professional development for those in small schools and regional or remote settings. In particular, the need to spend time away from the classroom to collaborate with their colleagues:

> You have those 'conversations of collegiality', but in a small school setting it's almost… impossible to facilitate that. It's not like I can go, "I'll just get in an extra teacher on this day to do things to support and to facilitate it", because that doesn't even exist. - Jeremy, Small Regional School Principal

Despite receiving funding support to participate in QTR Digital, many of our schools indicated that accessing casual relief teachers to facilitate staff professional development was the most significant barrier to engaging with PD:

> Look, the difficulty was casuals; getting casuals was very difficult all the way through. As it is now, you know, we have a position for next year and no takers. We have to hunt around for people rather than people coming to us. When not that many months or years ago, casuals were knocking on our door asking for work; now you're looking around for casuals. – Gregory, Small Regional School Teacher

> So, I guess just the logistical side of a small school was quite difficult to staff that because you were off for a whole day each time you did a round. That was probably the most challenging part. – Sarah, Small Regional School Teacher

All teachers assigned to the QTR Digital group participated in the online workshop. The workshops, run by QTR Advisers, provided teachers with a foundational understanding of the Quality Teaching Model and essential features of the Rounds. The workshops were well received by teachers, who reported that it provided them with the knowledge required to run QTR with members of their PLC, who they met during the workshops:

> Once we had the days, I felt really confident. So, the actual PL you guys did to introduce us to what we were going to be doing was phenomenal. It was one of the best PLs I've done, just to really explain what it was about. – Mia, Small Remote School Teacher

Participating teachers indicated that the online delivery of both the workshop and Rounds provided them with valuable PL, without the need for expensive and time-consuming travel. Lara indicated that while she found the workshop days 'overwhelming', QTR Digital allowed for more diversity among the group of participating teachers and less disruption to her classroom:

> Just a bit more diversity in the group … I loved every aspect of the Quality Teaching Rounds. The training day was overwhelming, I had a nap straight after. But it was fantastic and I really liked the digital process. I know that some people might prefer teachers to come into the room and sit in the room, but I also liked it for my students, because although I had a colleague in here with a phone, they knew her and it's not odd for another teacher to come into my room and observe… But I do think that if someone external came in and watched them, they would either be on their best behaviour or they wouldn't be concentrating. I really did like that digital space, and I really liked that we got to watch our video, that we got to pause it, we could fast forward. You can't do that in real time, and it made the coding more specific I found. I rave about it. – Lara, Regional School Teacher

Sampling

Due to the small number of secondary schools in the sample, and the low proportion of follow-up data available among secondary school students, all student outcomes were analysed according to the school level (primary or secondary school). Teacher data were analysed as a single cohort.
For the primary school cohort, randomisation at the school level produced a balanced sample among schools by the Index of Community Socio-Educational Advantage (ICSEA), with a slightly lower proportion of schools in 'major cities' and slightly higher proportion of remote schools in the QTR group (Table 1). At the student level, the sample was well balanced with the exclusion of a higher proportion of indigenous students (+7%) in the QTR group. The only demographic variable with greater than a five percent difference between groups was Indigenous students. The proportion of students in each grade level was well balanced for grades 2 to 4, with Years 5 and 6 within 10% difference between the groups.

The smaller secondary school cohort (Table 2), whilst balanced for ICSEA, was less balanced for several demographic variables. There were no schools from the remote category in the control group and large (> 20%) imbalances for students in Years 8 to 10. Given the size and structure of the secondary school sample, the student data were analysed only for exploratory purposes.

Table 1. Sample characteristics - Primary school cohort

	QTR		Control		Overall	
Primary schools, *n*	33		31		64	
ICSEA (mean, SD)	944.4	87.5	951.1	85.2	947.5	85.7
Location* – Major Cities (*n,* %)	2	6.1%	4	12.9%	6	9.4%
Location – Regional (*n,* %)	27	81.8%	25	80.6%	52	81.3%
Location – Remote (*n,* %)	4	12.1%	2	6.5%	6	9.4%
Teachers, *n*	48		48		96	
Experience – years (mean, SD)[a]	12.6	9.0	11.1	7.9	11.9	8.5
Qualifications – Bachelor (*n,* %) [a]	35	72.9%	33	78.6%	68	75.6%
Qualifications – Masters (*n,* %) [a]	6	12.5%	4	9.5%	10	11.1%
Students, *n*	657		811		1468	
Age (years, SD)	10.5	1.3	10.6	1.4	10.5	1.4
Female (*n,* %)	319	48.6%	386	47.6%	705	48.0%
Indigenous (*n,* %)	69	10.5%	26	3.2%	95	6.5%
LBOTE[#] (*n,* %)	14	2.1%	3	0.4%	17	1.2%
Grade						
2	79	12.0%	119	14.7%	198	13.5%
3	197	30.0%	204	25.2%	401	27.3%
4	135	20.5%	170	21.0%	305	20.8%
5	149	22.7%	123	15.2%	272	18.5%
6	97	14.8%	195	24.0%	292	19.9%
Secondary schools, n	5		4		9	
ICSEA (mean, SD)	927.2	89.9	927.0	47.2	927.1	69.8
Location – Regional (*n,* %)	4	80.0%	4	100.0%	8	88.9%
Location – Remote (*n,* %)	1	20.0%	0	0.0%	1	11.1%
Teachers, *n*	5		4		9	
Experience – years (mean, SD)	9.0	7.9	6.8	6.6	8.1	7.1
Qualifications – Bachelor (*n,* %)	5	100.0%	3	75.0%	8	88.9%
Qualifications – Masters (*n,* %)	0	0.0%	1	25.0%	1	11.1%
Students, *n*	98		83		181	
Age (years, SD)	14.8	1.1	14.4	0.9	14.6	1.0
Female (*n,* %)	51	52.0%	44	53.0%	95	52.5%
Indigenous (*n,* %)	8	8.2%	1	1.2%	9	5.0%
LBOTE* (*n,* %)	3	3.1%	1	1.2%	4	2.2%
Grade						
7	21	21.4%	30	36.1%	51	28.2%
8	55	56.1%	27	32.5%	82	45.3%
9	0	0.0%	26	31.3%	26	14.4%
10	22	22.4%	0	0.0%	22	12.2%

*Location: Regional = Inner and outer regional; Remote = Remote and very remote
a Based on valid survey responses: QTR, n = 52; Control, n = 44
#LBOTE = Language background other than English
ICSEA = Index of Community Socio-Educational Advantage

Time in school

Given the impact of COVID-19, we also examine on the days spent in school, which varied widely across the sample due to the mix of urban and rural schools. The QTR group had significantly more days in school than the control group in both primary and secondary school cohorts. This measure was calculated using the inverse of the days each school reported being in lockdown and is not a

measure of actual student attendance during the time available for schooling. Days in school are incorporated as a covariate in the modelling of student outcomes.

Table 2. Days in school per group

Group	QTR		Control		P
Primary Days in school (mean, 95% CI)	117.15	115.83 – 118.46	100.67	99.54 – 101.89	<0.001*
Secondary Days in school (mean, 95% CI)	128.61	123.98 – 133.24	107.35	103.59 – 111.106	<0.001*

* Significance at $p < 0.05$.

Intervention characteristics

Intervention fidelity

Fidelity of implementation by the QTR intervention group was assessed in two ways:

1- Observed – Research assistants observed the first Round for each PLC. These Rounds, which took place using Microsoft Teams, were videorecorded and analysed according to the fidelity checklist (below).

2- Self-reported – PLCs were asked to record their activities against the fidelity checklist during each of the four in-school days of the intervention (using SurveyMonkey).

The nine fidelity criteria for the QTR are outlined in Table 3.

Table 3. Fidelity criteria - Quality Teaching Rounds

QTR
1. Was a professional reading session conducted?
2. Was a full lesson observed?
3. Were all PLC members in attendance throughout the lesson?
4. Did all PLC members individually code prior to discussion for this Round?
5. Did all PLC members provide their codes and justification (using lesson evidence) for each QT element?
6. Did PLC members take turns leading the discussion of elements during this Round?
7. Was the QT Classroom Practice Guide a consistent point of reference throughout the discussion?
8. Were PLC members (including the observed teacher) present throughout the discussion?
9. How long was the post lesson discussion? (> 60 minutes required for fidelity)

The means for observed and self-reported fidelity, and the proportion of QTR sessions that coded 100% fidelity (9/9), are detailed in Table 4. Observed fidelity was marginally lower than self-reported fidelity. This is not unusual as participants are more likely to follow protocols when they are being observed. These fidelity scores are comparable to the average fidelity within the traditional model of QTR, with the exception of the percentage of participants achieving all criteria in an observed session. Due to the nature of QTR Digital, where the components of Rounds might not be completed in a single school day, further investigation is warranted to determine the validity of the observation processes.

Table 4. Fidelity outcomes

Outcome	QTR
Fidelity score	
Observed, mean (SD)	7.84 (1.42)
Self-reported, mean (SD)	8.65 (0.76)
Fidelity 9/9	
Observed, %	42.1%
Self-reported, %	77.5%

Analytical Models

Linear mixed effect models were used to assess treatment effects. Linear mixed effect models can allow for school level random effects, which is appropriate when implementation or response to treatment may be heterogeneous across classes recruited in the sample. Such models also allow for flexible specification of the covariance structure, such that within-subject correlated errors across time can be controlled for. The mixed effects models include fixed effects for time (baseline or 8-month follow-up), group (treatment arm) and the group-by-time interaction. Exposure to treatment was included as a fixed effect for days spent in school during the treatment period. Class level random intercepts were included, and a repeated statement was used to model within-subject correlated errors across time. Statistical significance was considered $p < 0.05$.

As a robustness check, ANCOVA was performed. ANCOVA models include the same co-variates and fixed effects specified in the linear mixed models. ANCOVA, as a more conservative analytical approach, restricts analysis to those students for whom both pre- and post-treatment test results are available for the dependent variables (Maths and Reading comprehension PAT results). For this reason, it is a useful sensitivity analysis due the baseline adjustment of the model (under the assumption that randomised groups should be equal at their baseline values).

Additionally, due to the issues with retention across this study period, evaluation of the differences within each group at baseline for those with complete data and those lost-to-follow-up is detailed. Mean and effect size difference is provided with T-test results to examine the potential effects of missing follow-up data on the results observed. Due to the size of the sample and the uncertainty around the outcome in the secondary cohort, the effects of retention are only evaluated among the primary school cohort.

Primary outcomes

Mathematics achievement

A Progressive Achievement Test (Australian Council of Education Research – ACER) – Mathematics was used to measure students' mathematical competence. The percentile score was used for analysis due to the mix of year levels in the sample.

For the primary school cohort (Table 5), the groups displayed equivalence at baseline (effect size d = -0.04; 95%CI -0.17 – 0.25; p = 0.681). The group-by-time effect comparing the rate of mathematics achievement from baseline to 8-month follow-up was not statistically significant between groups. The percentile gain was marginally lower (d = -0.07) for the QTR group across the intervention period. Baseline adjusted analysis of the students who had complete data confirms the mixed model results, displaying no significant difference and a marginally smaller negative effect size than the linear mixed model (d = -0.06) for the QTR group in comparison to the control.

Regarding the effects of retention, the difference in mathematics achievement at baseline between those who had complete data verse students that were lost to follow-up (Table 6) was greater

among the QTR group, with those with missing data starting significantly lower on average than those with complete data. This may have biased the QTR result downward on this outcome.

Table 5. Group comparison for mathematics achievement (Baseline- 8 months) - Primary

Group	QTR		Control		Effect size *d*	95% CI	P
Primary, *n*	652		788				
Ceiling, n (%)	1 (0.2)		5 (0.6)				
Retest %	80%		75%				
Baseline (mean, SD)	38.71	26.77	38.92	26.10	0.04	-0.17 – 0.25	0.681
Follow-up (mean, SD)	51.85	27.24	53.40	25.35			
Model difference (mean, 95% CI)	11.61	10.02 – 13.20	13.58	12.09 – 15.07	-0.07	-0.15 – 0.01	0.076
Baseline adjusted model (ANCOVA)							
Completers, *n*	520		591				
Follow-up (mean#, 95% CI)	51.60	49.23 – 53.98	53.36	51.08 – 55.63	-0.06	-0.19 – 0.07	0.303

ANCOVA results display comparison of follow-up results with baseline scaled score group means fixed at 40.15 for both groups.

Table 6. Group comparison of baseline mathematics achievement (Complete vs lost-to-follow-up) - Primary

Group	Status	N	Mean	SD	Difference	d	P
QTR	Complete	520	40.37	26.92			
	Lost	132	32.20	25.27	-8.17 (-13.26 - 3.08)	-0.31	0.002*
Control	Complete	591	39.96	26.31			
	Lost	197	35.82	25.27	-4.41 (- 8.35 – 0.07)	-0.16	0.054

* Significance at $p < 0.05$.

For the secondary school cohort (Table 7), the effect size difference of half a standard deviation between groups (effect size *d* = -0.18; 95%CI -1.16 – 0.79; *p* = 0.667) suggests they were not equivalent at baseline. Baseline adjusted models (like ANCOVA) are considered more appropriate if effect size differences at baseline are above 0.05 (Institute of Education Sciences, 2021). The group-by-time effect comparing the rate of mathematics achievement from baseline to 8-month follow-up was not statistically significant between groups. The percentile gain was greater for QTR compared to the control group (*d* = 0.22 in addition to control group growth) across the intervention period, however, the size of the sample, the non-equivalence at baseline and the significance value gives little confidence in this effect. The baseline adjusted analysis confirms the mixed model results, displaying no significant difference and a positive effect size difference for the QTR group relative to the control.

Table 7. Group comparison for mathematics achievement (Baseline – 8 months) - Secondary

Group	QTR		Control		Effect size *d*	95% CI	P
Secondary, n	60		79				
Ceiling, n (%)	0 (0.0)		0 (0.0)				
Retest %	48%		30%				
Baseline (mean, SD)	30.92	23.92	47.37	25.56	-0.18	-1.16 – 0.79	0.667
Follow-up (mean, SD)	31.09	27.52	39.17	26.35			
Model difference (mean, 95% CI)	0.22	-5.97 – 6.40	-5.77	-12.55 – 1.01	0.22	-0.12 – 0.57	0.196
Baseline adjusted model (ANCOVA)							
Completers, n	29		24				
Follow-up (mean#, 95% CI)	39.18	33.12 – 45.26	34.78	28.08 – 41.47	0.16	-0.18 – 0.51	0.338

ANCOVA results display comparison of follow-up results with baseline scaled score group means fixed at 39.66 for both groups, * Significance at $p < 0.05$.

Reading comprehension achievement

A Progressive Achievement Test (PAT) (Australian Council of Education Research – ACER) in Reading comprehension was used to measure students' reading comprehension competence. The percentile score was used for analysis.

For the primary school cohort (Table 8), the groups displayed a marginal difference at baseline (effect size d = -0.05; 95%CI -0.24 – 0.13; p = 0.578), which is right on the cusp of d = 0.05 recommended for baseline equivalence. The group-by-time effect comparing the rate of reading comprehension achievement from baseline to 8-month follow-up was statistically significant between groups (p = 0.040). The percentile gain was greater for the QTR group across the intervention period (d = 0.10), representing approximately 2-months additional growth for the QTR students (Education Endowment Foundation, 2018). Baseline adjusted analysis of the students who had complete data confirms the positive effects seen in the mixed model results, however, the effect size was reduced, and the statistical significance is not obtained (d = 0.04*; p* = 0.608) among this sample. The adjustment for non-equivalence at baseline and the amount of data lost to follow-up is likely the cause of the difference between the models and is discussed below.

Baseline difference for those with complete data in comparison to those lost-to-follow-up (Table 9) indicates that students with missing data in the QTR group were 3.99 (95%CI -9.32-1.33) lower at baseline than those that completed, and this difference was not as pronounced among the control group. Whilst not statistically significant, the effect size difference of d = -0.15 among the lost-to-follow-up students in the QTR group potentially biases the QTR result downwards in this analysis. As the ANCOVA model adjusts for the bias associated with different starting values between the groups (i.e those that started lower [QTR] are likely to display more growth, but the growth is adjusted downward when the starting values are assumed equal [mean of QTR and Control]), the effect among these two groups of students is likely to lie somewhere between the effect sizes report (i.e., 0.04 – 0.10) for the different models.

Table 8. Group comparison for reading achievement (Baseline – 8 months) - Primary

Group	QTR		Control		Effect size *d*	95% CI	P
Primary, *n*	639		773				
Ceiling, n (%)	6 (0.5)		4 (0.3)				
Retest %	80%		74%				
Baseline (mean, SD)	33.74	27.43	35.64	28.02	-0.05	-0.24 – 0.13	0.578
Follow-up (mean, SD)	48.40	29.02	47.81	28.77			
Model difference (mean, 95% CI)	14.33	12.42 – 16.25	11.57	9.76 – 13.38	0.10	0.01 – 0.19	0.040
Baseline adjusted model (ANCOVA)							
Completers, *n*	513		574				
Follow-up (mean#, 95% CI)	48.97	45.68 – 52.26	47.73	44.47 – 51.00	0.04	-0.12 – 0.21	0.608

ANCOVA results display comparison of follow-up results with baseline scaled score group means fixed at 35.29 for both groups.

Table 9. Group comparison of baseline mathematics achievement (Complete vs lost-to-follow-up) - Primary

Group	Status	N	Mean	SD	Difference	D	P
QTR	Complete	513	34.10	27.47			
	Lost	126	30.10	26.47	-3.99 (-9.32-1.33)	-0.15	0.141
Control	Complete	574	36.35	28.19			
	Lost	199	34.82	28.03	-1.53 (-6.08 - 3.01)	-0.05	0.508

The secondary school cohort (Table 10) displayed a significant imbalance at baseline for reading comprehension (effect size *d* = -0.55; 95% CI 0.13 – 0.97; *p* = 0.018). The group-by-time effect comparing the rate of reading achievement from baseline to 8-month follow-up was not statistically significant between groups. The percentile gain was greater for QTR compared to the control group (*d* = 0.21 in addition to control group growth) across the intervention period, and this result is confirmed in the ANCOVA model. Again, the size of the sample, the non-equivalence at baseline and the significance value gives little confidence in this effect.

Table 10. Group comparison for reading achievement (Baseline – 8 months) - Secondary

Group	QTR		Control		Effect size *d*	95% CI	P
Secondary, n	81		54				
Ceiling, n (%)	0 (0.0)		0 (0.0)				
Retest %	33%		76%				
Baseline (mean, SD)	41.89	26.03	25.69	32.39	0.55	0.13 – 0.97	0.018
Follow-up (mean, SD)	54.65	10.55	32.37	32.41			
Model difference (mean, 95% CI)	12.75	2.17 – 23.33	6.68	1.30 – 12.06	0.21	-0.19 – 0.61	0.304
Baseline adjusted model (ANCOVA)							
Completers, n	27		41				
Follow-up (mean#, 95% CI)	58.19	47.61 – 68.77	41.26	37.24 – 45.28	0.56	0.17 – 0.95	0.005

ANCOVA results display comparison of follow-up results with baseline scaled score group means fixed at 35.10 for both groups.

Secondary outcomes – Teacher

Quality of teaching

The quality of teaching was assessed using the Quality Teaching Model scales. Trained assessors coded videorecorded lessons at baseline and 8-month follow-up. A single lesson per teacher was coded at each time point. Teaching quality was equivalent (*d* = -0.02; 95%CI -0.41 – 0.37; *p* = 0.913) among the allocation groups at baseline (Table 11). There was a significant between group change in teaching quality across the intervention period (*p* = 0.048), with the QTR group displaying significant positive effects (Figure 2). The improvement in lesson quality in relation to the control group represents an effect size of *d* = 0.57 (0.01 – 1.13). The ANCOVA model confirms this result among those who completed assessment at both time points.

Table 11. Cohort 1 - Group comparison for quality of teaching (Baseline – 8 months); Intention-to-treat

Group	QTR		Control		Effect size d	95% CI	P
Total sample, n	66		53				
Retest %	68%		49%				
Baseline (mean, SD)	2.65	0.52	2.65	0.52	-0.02	-0.41 – 0.37	0.913
Follow-up (mean, SD)	2.83	0.54	2.60	0.47			
Difference (mean, 95% CI)	0.18	0.00 – 0.363	-0.12	-0.35 – 0.12	0.57	0.01 – 1.13	0.048*
Baseline adjusted model (ANCOVA)							
Completers, n	45		26				
Follow-up (mean#, 95% CI)	2.84	2.69 – 2.99	2.57	2.37 – 2.78	0.52	0.03 – 1.01	0.038*

ANCOVA results display comparison of follow-up results with baseline scaled score group means fixed at 2.67 for both groups, * Significance at p < 0.05.

Figure 2 Quality Teaching (Group x Time)

Teacher survey outcomes

Teachers were asked to complete 'teaching efficacy' and 'morale and appraisal' questionnaires at baseline (Term 1), during week 7 of each subsequent school term in 2021 and in Term 1, 2022. Results across the study period are presented in Table 10. Due to the significant drop in response rates for both groups, analysis is performed on the original data and using an imputed (and thus complete) data set as a sensitivity analysis to determine if any results observed in the original data are suffering from bias due to missing values at follow-up.

Data were imputed using fully conditional specification in SPSS. This procedure uses multivariate imputation by chained equations (MICE) which does not rely on the assumption of multivariate normality (Fitzmaurice, Laird, & Ware, 2011). The imputation included the outcome variables, group, and time covariates. Observed covariates of teaching experience (continuous) and school ICSEA (continuous) were included in addition to the variables included in the planned analysis to improve precision and reduce bias in line with increasing plausibility of the assumption of data being missing at random (White, Royston, & Wood, 2011). Two-way interactions were included for categorical variables (year and time). Ten imputations were obtained using 500 iterations.

Data were analysed using linear mixed models. ANCOVA was not used as there is no assumption that teacher questionnaire data should be equivalent at baseline. To account for the correlation among repeated measures within individuals, an unstructured covariance pattern for repeated measures was specified with an individual random intercept. Profile (time specified as categorical to analyse group difference between baseline and subsequent time points) and trend (time specified as continuous to analyse the difference in the summary regression slope of each group) analyses were undertaken to evaluate differences at each time point and the overall trajectory of the group outcomes.

Table 12. Cohort 1 - Group comparison for morale (Baseline – 8 months)

		QTR			Control		
	Time	Mean	SD	N	Mean	SD	N
Management	Term 1	7.37	1.06	52	7.23	1.12	44
	Term 2	7.50	1.07	31	7.40	1.08	15
	Term 3	7.58	0.81	18	7.14	0.50	7
	Term 4	7.48	1.13	12	7.53	1.32	10
Engagement	Term 1	7.10	1.19	52	6.76	1.08	44
	Term 2	6.75	1.27	31	6.68	1.33	15
	Term 3	7.22	0.97	18	6.54	0.34	7
	Term 4	6.92	1.12	12	6.80	0.90	10
Instruction	Term 1	7.03	1.06	52	6.79	0.78	44
	Term 2	7.27	0.91	31	6.98	0.99	15
	Term 3	7.54	0.86	18	6.82	0.97	7
	Term 4	7.63	0.91	12	6.95	1.05	10
Efficacy (total)	Term 1	7.17	0.96	52	6.93	0.89	44
	Term 2	7.17	0.96	31	7.02	1.02	15
	Term 3	7.45	0.81	18	6.83	0.40	7
	Term 4	7.34	0.95	12	7.09	0.96	10
Morale	Term 1	4.42	0.78	52	4.32	0.73	44
	Term 2	4.21	1.01	31	4.05	0.83	15
	Term 3	4.61	0.51	18	4.43	0.45	7
	Term 4	4.12	0.74	12	4.38	0.96	10
Appraisal	Term 1	3.93	0.89	52	3.72	0.93	44
	Term 2	3.80	1.06	31	3.88	0.85	15
	Term 3	4.21	0.88	18	4.05	0.51	7
	Term 4	3.56	1.21	12	4.12	0.69	10

For teaching efficacy outcomes, the QTR group display growth in efficacy (total of subsets) across the study period (Table 11 and Figure 3). This results in a statistically significant difference of 0.47 (95%CI 0.04 - 0.89) in perceived teaching efficacy between the Term 1 to Term 4 result between groups. This translates to an effect size difference of d = 0.52 (95%CI 0.05 – 0.99). The trend analysis (represented by the bold regression line in Figure 2) summarises the growth in efficacy across the study period among both groups. The QTR group also displayed a significantly greater slope parameter (0.16*; 95%CI 0.03 - 0.28), indicating that efficacy among the QTR increased at a rate of 0.16 scale points for each time point in comparison to the control group. This result is consistent across the original and imputed analyses. This efficacy result appears to be heavily affected by the instruction sub-scale of the efficacy questionnaire, which displays significant gain between Term 1 and Term 4 compared to the control group. However, this result is not consistently significant across the original and imputed datasets. There are no other significant changes across the study period for the management and engagement efficacy sub-scales.

With regard to the morale and appraisal outcomes, there appear to be no significant changes across the study period for either of these sub-scales.

Table 13. Cohort 1 - Group comparison for morale (Baseline – 8 months)

		Profile		Trend	
		Original data Adjusted diff (95%CI)	Imputed Adjusted diff (95%CI)	Original data Slope coefficient (95%CI)	Imputed Slope coefficient (95%CI)
Management					
	T2-T1	0.09 (-0.34 - 0.51)	-0.12 (-0.66 - 0.43)		
	T3-T1	0.17 (-0.38 - 0.71)	0.00 (-0.77 - 0.78)		
	T4-T1	0.31 (-0.25 - 0.88)	-0.07 (-0.87 - 0.73)	0.09 (-0.07 - 0.25)	-0.02 (-0.30 - 0.26)
Engagement					
	T2-T1	-0.08 (-0.57 - 0.42)	-0.09 (-0.70 - 0.53)		
	T3-T1	0.03 (-0.53 - 0.58)	0.10 (-0.61 - 0.80)		
	T4-T1	0.07 (-0.50 - 0.65)	0.00 (-0.67 - 0.66)	0.03 (-0.14 - 0.2)	0.01 (-0.21 - 0.22)
Instruction					
	T2-T1	0.14 (-0.35 - 0.62)	0.13 (-0.36 - 0.62)		
	T3-T1	0.50 (-0.22 - 1.23)	0.27 (-0.5 - 1.04)		
	T4-T1	0.82* (0.22 - 1.43)	0.28 (-0.39 - 0.95)	0.27* (0.08 - 0.45)	0.10 (-0.11 - 0.32)
Efficacy (total)					
	T2-T1	0.03 (-0.33 - 0.40)	0.03 (-0.33 - 0.40)		
	T3-T1	0.31 (-0.22 - 0.84)	0.31 (-0.22 - 0.84)		
	T4-T1	0.48* (0.05 - 0.90)	0.47* (0.04 - 0.89)	0.16* (0.03 - 0.28)	0.15* (0.03 - 0.27)
Morale					
	T2-T1	0.09 (-0.21 - 0.38)	0.03 (-0.39 - 0.46)		
	T3-T1	-0.17 (-0.44 - 0.09)	0.05 (-0.46 - 0.55)		
	T4-T1	0.13 (-0.23 - 0.49)	-0.05 (-0.62 - 0.51)	0.03 (-0.05 - 0.11)	-0.01 (-0.18 - 0.16)
Appraisal					
	T2-T1	-0.01 (-0.39 - 0.37)	-0.23 (-0.73 - 0.27)		
	T3-T1	-0.19 (-0.79 - 0.41)	-0.05 (-0.66 - 0.56)		
	T4-T1	0.08 (-0.52 - 0.69)	-0.23 (-0.81 - 0.35)	-0.01 (-0.19 - 0.16)	-0.07 (-0.26 - 0.12)

* Significant at $p < 0.05$; Adjusted diff = Adjusted mean difference (QTR [follow-up – baseline] – Control [follow-up – baseline]); T1 = Term 1; T2 = Term 2; T3 = Term 3; T4 = Term 4.

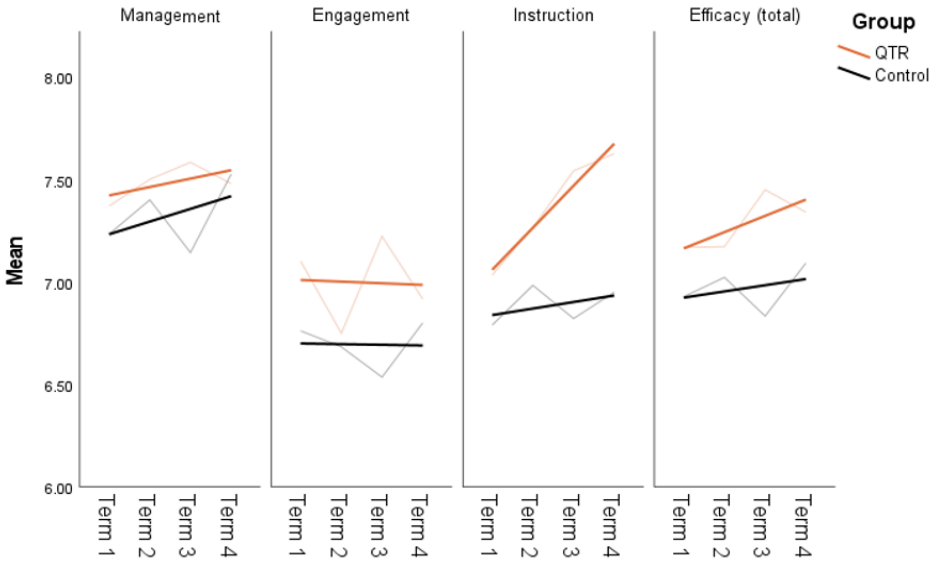


Figure 3 Efficacy by time by group – Intention-to-treat analysis (bold line = trend analysis; light line = profile analysis – mean at each time point)

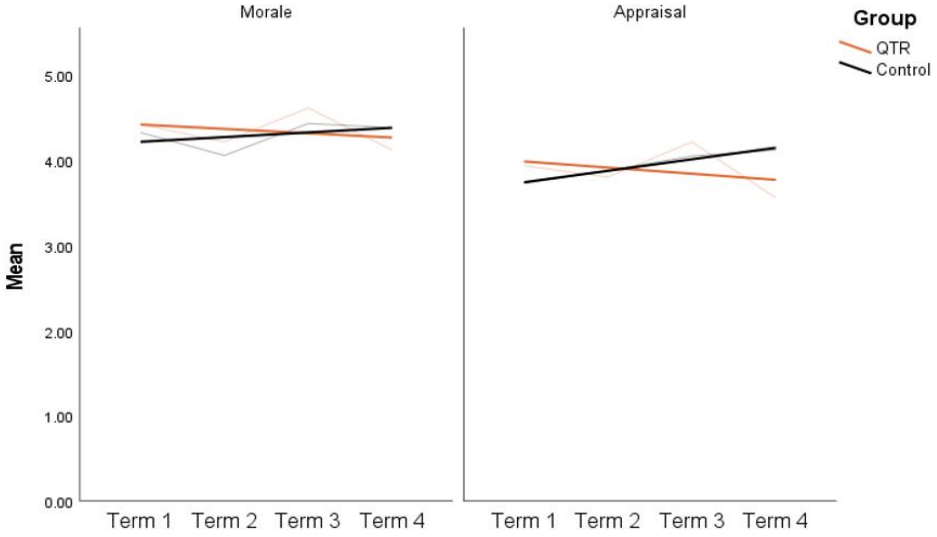


Figure 4 Morale and Appraisal by time by group – Intention-to-treat analysis (bold line = trend analysis; light line = profile analysis – mean at each time point)4

Perceptions of QTR

Overwhelmingly, participants in the QTR Digital trial reported that they found the Rounds process to be a valuable experience:

> I think it's an exceptional programme and a framework and I seriously - I don't know whether it's taught or not, but it should be something that should be incorporated into the teacher training programme. Teachers should be using that as their template for developing programmes and plans for their lessons. - Gregory, Small Regional School Teacher

A common response to participating in Rounds was that teachers felt that it gave them a sense of validation and improved their enthusiasm for, and confidence in, their teaching:

> When you watch other people teach and you watch yourself teach, as I said before, does make you a little bit more enthusiastic about what you're doing and also when you do get real quality – that was one of the biggest things, is that you get quality feedback on what you are doing and even when you do get – let's say you got a one or two code, I think you're getting feedback from colleagues and they're so lovely and they're not just like slamming you with negatives, they're like, "You're good but it just a wasn't a focus and there's nothing wrong with that." So you do kind of feel motivated to – you just feel good about yourself where you're just like, "I *am* actually doing this right" and especially from, as I said, as the only history teacher, I've just been doing what I've been doing and I've just kind of been hoping it's enough for what I need to be doing. So to have people be like, "You did this really well" is really great for morale. It does give you a bit of a boost where you do feel really like, "Oh, I *am* doing a good job." It is good to get that really positive feedback because it does boost you up a bit. – Mia, Small Remote School Teacher

> I feel like it built my confidence up to know that, you know, "I *am* on the right track with things" and there were some areas that I scored a lot higher in than others. But then it also made me consider aspects that I didn't score that highly in. So for example, in a school like mine, in my class everyone except for two students identify as Aboriginal or Torres Strait Islander. I wasn't putting that cultural perspective into the lessons as much as I could. That was one thing where I thought, "Oh, I really need to start doing that." That's something that I have been going, "Oh, this is a really good way to do this. - Lily, Small Remote School Teacher

Sarah, a teacher in a small, regional school, reported that her involvement in QTR Digital gave her the confidence to apply for a promotion. She indicated that the feelings of confidence and validation that she gained through this process led her to want to progress in her teaching career:

> Moving into doing this and feeling validated and feeling confident, I then applied for our assistant principal curriculum and instruction role next year and was successful. So it definitely didn't scare me away from the profession. It validated me more to stay and progress. – Sarah, Small Regional School Teacher

Using video for observations

A number of participants indicated that a positive element of engaging with QTR Digital was the use of video for lesson observations. Substantial academic literature promotes the use of videorecorded lessons as a prompt for individual reflection (Hollingsworth & Clarke, 2017; Pelligrino & Gerber, 2012). The process of using video to observe your teaching is described as a valuable tool "for stimulating and informing teacher reflection and action" (Hollingsworth & Clarke, 2017: 463). The overwhelmingly positive responses about the use of video from our participants resonated with this view:

> I found that really valuable. It was really interesting and once you get into it, … I think the idea of videoing your lesson and then being able to reflect on your own teaching, you can do it more often. – Rachael, Small Regional School Teacher

> I'm definitely more mindful of some of the techniques that I notice when I watch – I think watching myself teach was really eye-opening. My questioning techniques I thought were something that were really good, and they actually weren't as good as I thought when I looked back but also the feedback I got, that wasn't actually as good as I thought it was and I actually realised that I was a bit better in some areas than I thought I was as well. – Mia, Small Remote School Teacher

> So I watched my own one a couple of times actually, I watched it more than once, so I really like that and I think it's something that I might even try and aim to do a little bit more. I spoke to my old principal and he really likes the idea of making it common practice of just filming your lesson and following the model, but in general just having a look at it with another colleague and talking about the lesson. – Lara, Regional School Teacher

Perceived impact on students

Teachers reported their belief that their participation in QTR Digital had a positive impact on both their classroom practice and their students' learning outcomes. Lara, in particular, noted that she gained insight into new practices for behaviour management in cross-stage classrooms that she gained through her observations of other teachers' lessons:

> Well, it was good to see how they dealt with even the behaviours in the class and the differentiated content from teaching kids at such a low level and then a higher level. I really enjoyed watching – there was one of the teachers and he was quite experienced at teaching a maths lesson and he actually got his class to sit down and be engaged in maths for about 50 minutes, which I thought was amazing because that doesn't happen. - Lara, Regional School Teacher

Other teachers noted that, when using the quality teaching model, they were able to increase student engagement in the classroom:

> One thing that I have noticed, there was a significant improvement in the engagement, especially with the older kids....I do year one through to year five in my room. there was a significant improvement because I was teaching a bit differently. They were taking in the work, and they were much, much more driven. The other thing that improved was their comprehension work because it was really targeted using more specific criteria for myself when I was actually planning what I was doing. ... I think that was reflective of what I was doing more so than what they were doing. – Gregory, Small Regional School Teacher

Sarah, a teacher in a small, regional school, indicated that using the quality teaching model for planning made a substantial difference to the learning in her classroom. She suggested that the model prompted her to think more closely about what her students are learning and connect her lessons with their background knowledge:

> The change in planning … makes it simple and explicit for our kids. So the kids know what they're learning. They know why we're doing it. They can see how it links to them in the wider world or wider community, and they probably didn't have that explicit understanding until we started explicitly planning in that way. – Sarah, Small Regional School Teacher

Building networks with other teachers

While the effects on QTR Digital on teaching practice and student learning outcomes were described in a positive light, participating teachers frequently indicated that the most significant outcome of their engagement was that it enabled them to connect with other teachers and have a "virtual tour" (Jocelyn, Small Regional School Teaching Principal) of other small schools and classrooms experiencing similar challenges. As Gregory indicated, many of these teachers have classrooms that involve students at multiple stages - "I do year one through to year five in my room". Furthermore, teachers from small regional schools reported that it is often difficult to find the time to discuss planning, programming, and teaching practice in their schools:

> I think it would probably be pretty valuable for anyone, wherever they are in their teaching career, especially I think being across a small school of only three primary staff where you don't do a lot of planning and programming together, it's good to see how other schools operate and I'll definitely be recommending it to the other two primary teachers [in my school]. – Lily, Small Remote School Teacher

The diversity of the contexts and experiences of teachers within their PLC was recognised as a powerful tool for professional learning:

> The fact that you can stretch far and wide with people from different areas was great. – Rachael, Small Regional School Teacher

> It was really nice to network with people from other schools across different settings, high school versus primary, big versus small. So that was really great. Everyone in that group was so respectful and very professional, very encouraging. – Sam, Small Regional School Teaching Principal

> I think any professional learning that links teachers with teachers is useful. … like to hear from other people that are in the classroom doing the same thing that I'm doing day after day, and not the idealistic version of teaching or not the textbook version of teaching that we can often get told about in PLs, but actual real people that have multistage classes sitting in front of you that are doing the same thing as you. You instantly respect and pay attention to that more, because they get it. So yeah, linking teachers with teachers is very beneficial because all teachers want to do, and especially in a small school when you don't, I guess, have that broader network, is link in with other people to see, "Is what I'm doing okay? Is what I'm doing what I should be doing?" It's that check-in, with people at the same level as you. I think that's very valuable. – Sarah, Small Regional School Teacher

The establishment of cross-school PLCs broadened teachers' networks and, in many cases, provided them with an opportunity to view teachers in classrooms that looked like their own. As Lily reported, she found it valuable to engage in QTR Digital with other teachers in small schools, particularly those who teach cross-stage classes:

> I found I got a lot out of it in the early stages of learning how to code, especially being matched with other teachers who were in similar classroom scenarios to myself, so cross-stage classrooms in small schools or small central schools. It was really nice to have some other people to talk to about their classroom practice and that I'm not the only one out there teaching a cross-stage class. - Lily, Small Remote School Teacher

Continued implementation within schools and across school networks

Although the research took place in a year that was disrupted by COVID-19, participating teachers' engagement with members of their PLCs in QTR Digital extended beyond the virtual. The process of working across schools encouraged teachers and school principals to engage with both the concepts

of QTR and establish relationships between teachers and schools. A number of our participating teachers and school leaders reported their intention to continue QTR in their schools or across a network of schools with similar interests:

> So, since QTR [Digital], that's formed a relationship between our schools, because now that principal and myself know each other, and then I can introduce him to other staff members and that's linked our small schools together, which is nice. I think having multiple sessions really gave us the chance to get to know each other. – Sarah, Small Regional School Teacher

> We've timetabled it into our strategic direction within the school plan that we will do this in a collaborative manner and ...we want to get to the point where we are collaborating with partner schools to do the lesson observation process. I know that I'm automatically going to be using this as a part of our professional development process and then for giving feedback. – Jocelyn, Small Regional School Teaching Principal

> What we're looking at doing is how we can then sort of develop a model that's sustainable throughout our small schools' network and involving those that haven't been a part of that learning to sort of share the benefits of the [QTR Digital] system. But not only that, looking at how the people who've been trained can take on a bit more of a leadership role in developing a model that goes across the network. – Jeremy, Small Regional School Principal

Summary of findings

The QTR Digital trial produced a range of positive findings. Despite the disruption caused by COVID-19, leading to some schools having up to 17 weeks of learning from home, teachers demonstrated a strong commitment to the research and their professional learning. Participation in QTR Digital held a range of benefits for school leaders, teachers and students, including:

- Primary students with teachers in the QTR group displayed approximately 2 months' additional growth in reading comprehension achievement in relation to control group students;
- Secondary students with teachers in the QTR group displayed non-significant positive gains in reading comprehension in relation to the control group, however due to the size, loss to follow-up and baseline non-equivalence in this cohort, caution is advised when interpreting this result;
- Mathematics achievement was not significantly different for students with teachers from either group (across both cohorts);
- Participation in QTR produced significant positive effects on the quality of teaching. This replicates findings from the 2014-15 QTR RCT (Gore et al., 2017);
- Participation in QTR produced a significant positive effect on teaching efficacy, above that observed for the control condition;
- Teachers in the QTR group reported that using video for observations supported them in reflecting on their own classroom practice;
- Teachers indicated that participation in QTR Digital assisted them with their planning and improved the engagement of their students;
- The diversity of teachers in each PLC was celebrated by teachers in the QTR group, who were able to gain new ideas and see teaching practices in contexts that were both similar to and different from their own schools;
- Participation in Rounds across schools supported teachers to build their networks with colleagues;
- Following their participation in the QTR Digital research, a number of school leaders plan to implement the processes within their own schools and across small networks of schools.

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