Beyond Qualifications: Identity of Out-of-Field Teachers in Years 7–10 Mathematics in South Australia

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Concern regarding the prevalence of out-of-field teaching continues to grow, as does the body of literature calling for a better understanding of the nuanced complexities associated with out-of-field teaching. In this paper, we extend our previous analysis of data from a survey of the profession teaching Years 7–10 mathematics in South Australia. Analysing the data through an identity lens indicates that out-of-field teachers who self-identify as mathematics teachers and express a preference for teaching mathematics are more likely to exhibit levels of interest, enjoyment, confidence, and commitment that align with those of in-field teachers.

Out-of-field teaching, where educators are assigned subjects beyond their qualifications or training, is a phenomenon observed in many countries around the world. In Australia, data from 2013 indicates 17% of mathematics classes in Years 7–10 were taught by out-of-field teachers, intensifying in remote areas where the percentage rises to 26% (Weldon, 2016). Figures like these are often reported in the media to imply that out-of-field teaching is responsible for poor outcomes in standardised assessment such as NAPLAN, PISA, and TIMSS. However, definitions of out-of-field teaching that focus on the criteria used to qualify and/or register teachers (often describing them at the start of their careers) fail to recognise that teachers develop and grow throughout their career as they gain confidence, experience, and perhaps further qualifications. For example, a teacher might not have been initially trained in mathematics but may have subsequently engaged in self-study and attended professional development, becoming comfortable and competent in the subject. This evolution challenges the appropriateness of the 'out-of-field' label and its implications for teaching efficacy.

Hobbs et al. (2022) designed a multi-faceted definition of out-of-field teaching to help better understand and manage the out-of-field phenomenon, informed by the existing literature on in-field and out-of-field teaching. The definition has four dimensions: out-of-field by qualification (a mismatch between current teaching and discipline qualification, school level qualification, or both), out-of-field by specialisation (a misalignment at the sub-discipline level), out-of-field by workload (proportion, stability, and type of load), and out-of-field by capability (recognising that teachers may feel out-of-field depending on factors including experience and identity).

The approach by Hobbs et al. (2022) shifts the focus of 'out-of-fieldness' from the teacher to the context of teaching. For example, being out-of-field by workload recognises that it is the assignment of work to the teacher, not the teacher themselves, that is mismatched. Out-of-field by capability refers to a teacher's growing identity within a new context. The authors define a highly capable out-of-field teacher as one who is capable in the out-of-field subject, has a high degree of confidence, has personal interest in the subject, is professionally committed to developing and reflecting on their practice, self-identifies as proximal to the subject, and has accepted the role long-term, expanding their professional identity to include the role. In earlier work, Hobbs (2013) refers to this as 'boundary crossing', suggesting that teachers who are technically out-of-field can identify as in-field if they have sufficient support to enable them to feel confident and competent in their teaching. Conversely, teachers who are in-field by qualification can feel out-of-field by capability when placed in a new context. Ingersoll (2019) highlights how experienced and qualified teachers may become "highly unqualified if they are assigned to teach subjects for which they have little training or education" (p. 22).

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The identity of teachers is significant and has been shown to influence their practice. For instance, the literature review by Heyd-Metzuyanim et al. (2016) revealed that most of the studies reviewed demonstrated an interaction between teachers' identities and their practices, indicating that changes in one can affect the other. Similarly, Willis et al. (2023) found that identity as a teacher of mathematics and participation in professional learning were correlated.

A number of studies have demonstrated the significance of teacher identity for out-of-field teachers of mathematics (e.g., Hobbs, 2013; Ní Ríordáin et al., 2022). Goos et al. (2019) emphasised the importance of further research into understanding the development of teacher knowledge and its influence on the identities of out-of-field teachers of mathematics. Such research will create a better understanding of teacher learning, which in turn can better inform approaches to professional learning. For instance, while studies such as Ní Ríordáin et al. (2019) highlight the importance of professional learning aimed at out-of-field teaching to enhance teachers' content knowledge alongside their pedagogical content knowledge, other research, such as that by Bosse and Törner (2015) highlight the importance of attending to teachers' "subject-related identity" (p. 8).

Research Background

This section summarises previously reported research to contextualise the research questions asked in this paper; see O'Keeffe & Albrecht (2023), Albrecht et al. (2023), and Albrecht and O'Keeffe (2024) for more details.

An anonymous online survey was distributed in late 2022 by the SA Department for Education for one month, with all Years 7–10 teachers invited to participate. The survey design was informed by Hobbs et al.'s (2022) classifications of 'out-of-field', AITSL's (2021) report on the SA teacher workforce, and Weldon's (2016) study of out-of-field teaching in Australian secondary schools. Of the 232 survey participants, 196 had taught Years 7–10 mathematics at some stage. The survey collected information on teacher demographics, teaching qualifications, professional learning, teaching context and experience, employment status, and workload. It also probed teacher identity in multiple ways, including two questions: (1) Do you consider yourself a mathematics teacher? (In other words, are you comfortable calling yourself a mathematics teacher?); and (2) Do you consider yourself an out-of-field mathematics teacher?

Of the 165 teachers who responded to both questions, 60 were classified as in-field by qualification (QIN) while the remaining 105 were deemed out-of-field by qualification (QOOF). As might be expected, nearly all QIN teachers identified as mathematics teachers (98%, $n = 59$), whereas only 68% ($n = 71$) of QOOF teachers did. Similarly, almost all QIN teachers identified as 'not out-of-field' (which we refer to as identifying as in-field, for convenience). Surprisingly, about 50% of QOOF teachers ($n = 52$) also saw themselves as in-field, despite being out-of-field by qualification.

The survey also collected data on affective dimensions such as teachers' personal interest in mathematics, enjoyment teaching mathematics, confidence in their mathematical content knowledge (CK), confidence in their pedagogical approaches for teaching mathematics (PCK), and personal commitment to developing their CK and PCK. Teachers gave responses on a scale from 0 (low) to 5 (high). Teacher identity was shown to have an impact on interest, enjoyment, confidence, and commitment to teaching mathematics with those not identifying as mathematics teachers reporting the lowest means across all categories (Albrecht et al., 2023).

Finally, the survey explored confidence in teaching various aspects of the Australian Curriculum: Mathematics (AC:M) with respondents rating their confidence as low, medium, or high for: teaching each year level (Years 7–10), teaching each strand in each year level, integrating each of the four mathematical proficiencies, and integrating each of the four mathematical processes. Again, those not identifying as mathematics teachers reported the lowest means across all categories (O'Keeffe & Albrecht, 2023).

A third aspect of teacher identity, preference for teaching mathematics, was examined by Albrecht and O'Keeffe (2024) and gathered from the question 'What is your preferred learning area(s) to teach?' by including those that mentioned mathematics. Overlaying these indicators onto workload indicated that QOOF teachers with more than 50% of their teaching in mathematics predominantly saw themselves as mathematics teachers and with a preference for teaching mathematics. This led us to speculate that these 'out-of-field' teachers may have acquired the personas of in-field teachers of mathematics.

Research Question

The aim of the research reported in this paper is to further explore aspects of teacher identity, in particular: self-identifies as in-field, self-identifies as a mathematics teacher, and preference for teaching mathematics. The research question guiding the aspects reported in this paper is:

- Are various cohorts of QOOF teachers statistically indistinguishable from QIN teachers when considering factors such as interest, enjoyment, confidence, and commitment to teaching mathematics among Years 7–10 mathematics teachers in South Australia?

Findings

Comparing QIN and QOOF Teachers

We used two-tailed Mann-Whitney U tests (equal variance not assumed) to determine if the mean differences between QIN and QOOF teachers were statistically significant. Table 1 presents mean responses and p-values across eighteen dimensions, with $p \leq 0.05$ shaded grey to indicate statistical significance. The data indicates statistically significant differences between the means of QIN and QOOF teachers who self-identify as in-field for all dimensions except for enjoyment in teaching mathematics and confidence teaching Year 7 mathematics. QIN teachers demonstrated lower confidence in Year 7 mathematics, which is mostly likely attributed to the transition of Year 7 to secondary schools in South Australia occurring just a year prior to the survey being distributed.

Table 1 reveals an interesting pattern in the number of statistically significant differences between the means of various teacher cohorts. When comparing QIN teachers to QOOF teachers who self-identify as in-field, 16 out of the 18 dimensions show significant differences. However, this number decreases when comparing QIN teachers to QOOF teachers who self-identify as mathematics teachers (14 out of 18) and further reduces when comparing QIN teachers to QOOF teachers with a preference for teaching mathematics (10 out of 18). For those who self-identify as mathematics teachers, no statistically significant differences in means were observed for enjoyment teaching mathematics and commitment to developing CK and PCK. For those preferring to teach mathematics, no statistically significant differences in means were observed regarding their personal interest in mathematics, enjoyment teaching mathematics, commitment to developing CK and PCK, confidence teaching Years 7 and 8, or the problem solving and reasoning proficiencies.

Within the QOOF teachers, comparing those who self-identify as mathematics teachers to those who self-identify as in-field reveals that the former group has higher means for 16 of the 18 dimensions, with the only exceptions being confidence in CK (both groups have means of 4.10) and confidence in teaching Year 10 (the in-field group has a marginally higher mean of 3.10 compared to 3.08). A similar pattern emerges when comparing QOOF teachers with a preference for teaching mathematics to those who self-identify as in-field, with the group preferring to teach mathematics having higher means for 15 of the 18 dimensions. The exceptions in this case are confidence in teaching Year 7 (both groups have means of 4.21), confidence in teaching Year 9 (the in-field group has a slightly higher mean of 3.74 compared to 3.71), and confidence in teaching Year 10 (3.10 compared to 2.93).

In summary, the analysis reveals that QOOF teachers who self-identify as mathematics teachers or prefer teaching mathematics have more similarities to QIN teachers across various dimensions compared to those who self-identify as in-field. Within the QOOF cohort, those who self-identify as mathematics teachers or prefer teaching mathematics generally exhibit higher means across most dimensions compared to those who self-identify as in-field.

Table 1

QIN and QOOF Teachers' Mean Interest, Enjoyment, Confidence, and Commitment by Identity Grouping

Dimension	**Identifies as in-field**			**Identifies as a maths teacher**			**Prefers to teach mathematics**		
	QIN (59)	**QOOF (52)**	***p*-value**	**QIN (59)**	**QOOF (71)**	***p*-value**	**QIN (51)**	**QOOF (57)**	***p*-value**
Personal interest math	4.59	4.00	0.015	4.61	4.29	0.045	4.69	4.55	0.209
Enjoy teaching math	4.37	3.96	0.213	4.41	4.33	0.592	4.47	4.69	0.415
Confidence in CK	4.73	4.10	0.000	4.71	4.10	0.000	4.78	4.22	0.000
Confidence in PCK	4.27	3.69	0.019	4.25	3.94	0.036	4.33	4.09	0.073
Commit to develop CK	4.37	3.86	0.027	4.41	4.29	0.244	4.51	4.51	0.548
Commit to develop PCK	4.54	3.82	0.012	4.59	4.35	0.227	4.67	4.60	0.740
Year 7 mathematics	4.16	4.21	0.736	4.16	4.37	0.318	4.23	4.21	0.923
Year 8 mathematics	4.68	4.16	0.009	4.68	4.41	0.048	4.63	4.24	0.054
Year 9 mathematics	4.57	3.74	0.001	4.53	3.85	0.001	4.50	3.71	0.006
Year 10 mathematics	4.59	3.10	0.000	4.55	3.08	0.000	4.62	2.93	0.000
Problem solving	4.39	4.00	0.031	4.37	4.01	0.012	4.37	4.11	0.059
Understanding	4.73	4.06	0.000	4.71	4.19	0.000	4.73	4.25	0.000
Reasoning	4.37	3.86	0.009	4.37	3.97	0.007	4.37	4.07	0.069
Fluency	4.71	4.24	0.002	4.69	4.36	0.003	4.69	4.36	0.020
Math. modelling	4.20	3.63	0.009	4.17	3.64	0.004	4.22	3.71	0.011
Comp. thinking	4.08	3.48	0.013	4.05	3.59	0.010	4.10	3.71	0.035
Stat. investigations	4.36	3.57	0.001	4.34	3.71	0.000	4.35	3.69	0.001
Prob. experiments	4.25	3.55	0.002	4.24	3.72	0.004	4.22	3.76	0.016

Cohorts Within QOOF Teachers

To better understand the importance of each identity factor, we looked closer at the data for QOOF teachers only. Two-tailed Mann-Whitney U tests (equal variance not assumed) were used to determine statistically significant differences between the means. Table 2 presents mean responses and p-values across the eighteen dimensions, with $p \leq 0.05$ shaded grey to indicate statistical significance. The analysis in Table 2 confirms our hypothesis that self-identification as a mathematics teacher amongst QOOF teachers is significant, with statistically significant differences in means across all dimensions. A similar impact is observed for those with a preference for teaching mathematics. However, self-identity as in-field seems less influential, showing no significant differences in commitment to developing CK and PCK, confidence in teaching Years 7 and 8, or integrating the reasoning proficiency into their teaching.

Table 2

QOOF Teachers' Mean Interest, Enjoyment, Confidence, and Commitment by Identity Grouping

Dimension	**QOOF identifies as in-field**			**QOOF identifies as a maths teacher**			**QOOF prefers to teach mathematics**		
	Yes (52)	**No (53)**	***p*-value**	**Yes (71)**	**No (34)**	***p*-value**	**Yes (57)**	**No (48)**	***p*-value**
Personal interest in math.	4.00	3.19	0.003	4.29	2.18	0.000	4.55	2.50	0.000
Enjoyment teaching math.	3.96	3.35	0.014	4.33	2.26	0.000	4.69	2.46	0.000
Confidence in CK	4.10	2.98	0.000	4.10	2.38	0.000	4.22	2.75	0.000
Confidence in PCK	3.69	3.00	0.006	3.94	2.12	0.000	4.09	2.48	0.000
Commit. to develop CK	3.86	3.33	0.069	4.29	2.18	0.000	4.51	2.54	0.000
Commit. to develop PCK	3.82	3.27	0.097	4.35	1.91	0.000	4.60	2.33	0.000
Year 7 mathematics	4.21	3.86	0.151	4.37	3.34	0.000	4.21	3.82	0.147
Year 8 mathematics	4.16	3.77	0.079	4.41	3.04	0.000	4.24	3.65	0.011
Year 9 mathematics	3.74	2.71	0.005	3.85	1.90	0.000	3.71	2.64	0.001
Year 10 mathematics	3.10	1.97	0.006	3.08	1.37	0.000	2.93	2.05	0.025
Problem solving	4.00	3.53	0.029	4.01	3.22	0.002	4.11	3.35	0.001
Understanding	4.06	3.45	0.001	4.19	2.81	0.000	4.25	3.15	0.000
Reasoning	3.86	3.45	0.094	3.97	2.97	0.000	4.07	3.15	0.000
Fluency	4.24	3.51	0.001	4.36	2.77	0.000	4.36	3.27	0.000
Mathematical modelling	3.63	2.92	0.008	3.64	2.41	0.000	3.71	2.72	0.001
Computational thinking	3.48	2.88	0.019	3.59	2.23	0.000	3.71	2.52	0.000
Statistical investigations	3.57	3.10	0.047	3.71	2.45	0.000	3.69	2.88	0.012
Probability experiments	3.55	3.12	0.089	3.72	2.41	0.000	3.76	2.79	0.002

We then grouped respondents into one of eight 'identity' cohorts (summarised in Table 3) and conducted chi-square tests of independence to assess the strength of association between the three variables. This analysis revealed statistically significant associations as follows:

- Identifying as a mathematics teacher and a preference for teaching mathematics: $\chi^2(1, n = 105) = 39.211$, $p < 0.001$. The effect size, measured using Cramér's V, was found to be V = 0.611, indicating a strong association;
- Identifying as in-field and identifying as a mathematics teacher: $\chi^2(1, n = 105) = 6.990$, $p = .008$ with effect size of V = 0.258 indicating a weak to moderate association;
- Identifying as in-field and a preference for teaching mathematics: $\chi^2(1, n = 105) = 6.038$, $p = .014$ with effect size of V = 0.240 indicating a weak to moderate association.

Based on the analysis thus far, we exclude 'self-identifies as in-field' from the remainder of this paper for three reasons: (1) its less significant impact, as observed in Table 2, (2) the wide variety of QOOF teachers' definitions of out-of-field (see Albrecht and O'Keeffe, 2024), and (3) chi-square tests of independence revealing only weak to moderate associations with the other two variables. In contrast, self-identification as a mathematics teacher and a preference for teaching mathematics are strongly associated and significantly influence interest, enjoyment, confidence, and commitment.

Table 3

Eight Cohorts of QOOF Teachers by Self-Identity as In-Field, Self-Identity as a Mathematics Teacher, and Preference for Teaching Mathematics

Self-identifies as in-field or out-of-field	Self-identifies as a mathematics teacher	Prefers to teach mathematics	Total
In-field	Mathematics teacher	Yes	35
In-field	Mathematics teacher	No	7
In-field	Not mathematics teacher	Yes	0
In-field	Not mathematics teacher	No	10
Out-of-field	Mathematics teacher	Yes	19
Out-of-field	Mathematics teacher	No	10
Out-of-field	Not mathematics teacher	Yes	3
Out-of-field	Not mathematics teacher	No	21

Table 4

Four Cohorts of QOOF Teachers by Self-Identity as a Mathematics Teacher and Preference for Teaching Mathematics

	Self-identifies as a mathematics teacher	Prefers to teach mathematics	Total
Cohort 1	Mathematics teacher	Yes	54
Cohort 2	Mathematics teacher	No	17
Cohort 3	Not mathematics teacher	Yes	3
Cohort 4	Not mathematics teacher	No	31

Pairwise testing of the four cohorts in Table 4 with two-tailed Mann-Whitney U tests (equal variance not assumed) was used to check for statistically significant differences between means. Unsurprisingly, Cohort 1 exhibited the highest means across 16 of the 18 factors. The two exceptions are confidence in teaching Year 7 and Year 8. Cohort 2, which self-identifies as mathematics teachers but does not prefer teaching mathematics, exhibits the highest means for both Year 7 and Year 8. Cohort 3, consisting of only three teachers, is intriguing as they do not consider themselves mathematics teachers (and view themselves as out-of-field) and yet express a preference for teaching mathematics. With only three teachers in this group, it is difficult to draw conclusions. It is unsurprising that Cohort 4, which does not self-identify as mathematics teachers and does not prefer teaching mathematics, demonstrated markedly low means (ranging from 1.71 to 2.29) across personal interest in mathematics, enjoyment in teaching mathematics, and confidence in and commitment to developing CK and PCK.

A comparison of Cohorts 1 and 2, which self-identify as mathematics teachers but differ in their preference for teaching mathematics, showed statistically significant differences in 12 of the 18 dimensions. Notably, there were no statistically significant differences in confidence in teaching Years 7 to Year 10, nor in statistical investigations and probability experiments. A comparison of the two diametrically opposed cohorts, 1 and 4, revealed statistically significant differences across all 18 dimensions, as might be expected.

A comparison of Cohorts 2 and 4, which do not prefer teaching mathematics but differ in their self-identification as mathematics teachers, showed statistically significant differences in 14 of the 18 dimensions. There were no statistically significant differences in problem solving, reasoning, mathematical modelling or computational thinking. Cohort 3 was excluded from the pairwise comparisons due its small size of three teachers.

Comparing Cohort 1 With QIN Teachers

The pairwise comparisons suggest that Cohort 1 is distinct from the other cohorts, so we compared Cohort 1 with QIN teachers. Table 5 indicates that Cohort 1 have mean scores similar to, and sometimes higher than, QIN teachers. The only statistically significant differences relate to confidence in CK, Years 9 and 10 (arguably when content becomes more challenging), the understanding proficiency (arguably tied to content knowledge) and three of the four processes. (Note that QIN teacher confidence in the fourth process, computational thinking, is also low.) The data suggests that Cohort 1 shares identity characteristics with their in-field colleagues.

Table 5

QIN and QOOF Teachers Identifying as Mathematics Teachers and Preferring to Teach Mathematics

Dimension	Identifies as mathematics teacher and prefers to teach mathematics		
	QIN (51)	QOOF (54)	*p*-value
Personal interest in mathematics	4.69	4.58	0.303
Enjoyment teaching mathematics	4.47	4.69	0.406
Confidence in CK	4.78	4.27	0.000
Confidence in PCK	4.33	4.15	0.135
Commitment to developing CK	4.51	4.54	0.686
Commitment to developing PCK	4.67	4.63	0.961
Year 7 mathematics	4.23	4.23	0.754
Year 8 mathematics	4.63	4.36	0.134
Year 9 mathematics	4.50	3.87	0.018
Year 10 mathematics	4.62	3.05	0.000
Problem solving	4.37	4.15	0.108
Understanding	4.73	4.33	0.001
Reasoning	4.37	4.10	0.083
Fluency	4.69	4.48	0.059
Mathematical modelling	4.22	3.79	0.024
Computational thinking	4.10	3.81	0.076
Statistical investigations	4.35	3.75	0.002
Probability experiments	4.22	3.83	0.031

Summary and Conclusion

The importance of teacher identity in influencing and shaping teacher practice is well established. The findings in this study align with Neumayer-Depiper's (2013) assertion about the importance of understanding how identity is situated and negotiated by teachers in different contexts. While the QOOF teachers in this study may not be in a position to change their initial qualifications or access additional ones, this does not preclude them from positioning themselves as competent mathematics teachers.

As discussed, QOOF teachers who self-identify as mathematics teachers and prefer teaching mathematics have a high degree of confidence across many dimensions, are interested in the subject, and are professionally committed to developing and reflecting on their practice, sharing many identity characteristics with their in-field colleagues. This suggests they should not be considered out-of-field by capability. What remains unclear at this stage of our analysis are the factors that contribute to teachers identifying in this way. Nonetheless, the analysis to date shows the significance of identity in reauthoring oneself as a teacher of mathematics.

It would be fair to say that there are still very important questions to be asked about out-of-field teachers' competence and effectiveness, but those questions should be asked about all teachers. Professional learning and support is relevant to all teachers; it might just need to look, sound, and feel different depending on the individual teacher. Understanding teacher identities can help inform approaches to professional learning for these different cohorts of teachers.

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