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Quality Instruction through four Components of the Mathematical Knowledge for Teaching (MKT) and Teaching Experience in Fiji

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The rationale of this study is to find out what could be some contributing factors to low achievement in Mathematics for primary school students. For this study, the focus is to ascertain the current state of MKT for Primary School Mathematics Teachers in Fiji schools in terms of its four components: Knowledge of Content and Students (KCS); Knowledge of Content and Teaching (KCT); Common Content Knowledge (CCK); and Specialized Content Knowledge (SCK) Hill et al. (2008), with respect to teachers' Teaching Experience (TE). The study was conducted using descriptive survey with stratified random sampling using Krejie & Morgan's sample size Table in which of 363 primary school teachers participated. Sampling included a stratum from each of the four major education divisions: Northern, Central, Western, and Eastern. An MKT test was used as a tool to compare teachers' MKT levels with respect to teacher's TE, and one-way ANOVA was used to quantitatively analyze the data. Findings from this study revealed that all the four components of MKT have a significant difference with respect to teachers' TE.

Keywords: mathematical knowledge for teaching (MKT), quality instruction, common content knowledge, primary school teachers, specialized content knowledge

INTRODUCTION

One of the expectations of the Fiji Ministry of Education, Heritage and Arts (MEHA) as the sole employer for teachers is quality teaching, which indirectly contributes to higher

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student performances. To achieve this expectation, teachers need to be equipped with the necessary knowledge, which Kanadlı, (2019) opined that this sort of education is an interaction of mathematical knowledge with science and technology. Therefore, the author explained that today's rapid developments within that space force educational organizations not only to raise individuals equipped with knowledge but also to educate individuals who know how to access the knowledge and produce new information by using the knowledge they have obtained. The mathematics teacher's pedigree and skills associated with Mathematical Knowledge for Teaching (MKT), is the focus of this study. There is sufficient evidence (Hill et. al, 2005; Santagata & Lee, 2019) of students' improved performance linking appropriately to the teachers' in-depth grasp of MKT and quality instruction. Apart from teachers' MKT, other variables like teachers' attitude and capacity for reflective teaching of Mathematics also play substantial roles in teacher effectiveness (Raiula & Kumari 2018).

Mathematics Education in Fiji is currently driven by 'centre-periphery model' highlighted by Schon (1971), Kyriakides 1999, which is highly centralised. The Ministry of Education has authority in policies, regulations on teaching, prescribed curriculum which teachers are expected to abide as part of contract conditions. In Fiji schools, Mathematics is a compulsory subject from primary schools till Year Ten, then becomes an optional subject, from Year 11 to Year 13, and students make their own choices.

Shulman (1986) in his experimental model firstly initiated the MKT concept but was enhanced by Hill et al (2008) to a more inter-connected element of teachers' MKT. This has been considered a major development within mathematical education. The Model emphasised the two major elements in mathematics education, as Procedural Content Knowledge (PCK) and Subject Matter Knowledge (SMK), which Hill et al (2008) rebranded and refers to as MKT. MKT includes the knowledge and skills used to teach mathematics (Nolan, et al 2015), 'knowledge in practice' (Ghousseini, 2017), incorporating special mathematical knowledge which is different from other work using mathematics as well. Teachers who teach mathematics need MKT to explain the concepts and definitions that are appropriate and understandable to students, ask good questions, plan teaching activities, give examples of mathematical ideas and relate them to other mathematical ideas, assess textbooks, choose teaching materials and evaluate learning (Shahidi 2019). Moreover, some of the factors that affect the development of MKT for pre-service teachers are parents' education, material support and social relationship; and factors affecting mathematical beliefs are school education background and motivation to study (Novikakasari 2017). Subject Matter Knowledge include components as; Specialized Content Knowledge (SCK), Common Content Knowledge (CCK), and Horizon Content Knowledge (HCK). On the other hand, Pedagogical Content Knowledge covers Knowledge of Content and Teaching (KCT), Knowledge of Content and Students (KCS), and Knowledge of Content and Curriculum (KCC).

The following are sub-sets covered by SCK; knowledge of content relevant to mathematics education, with much reliance on in-depth preparations using appropriate materials for teaching, illustrations and making connections, meeting students' responses

and using the appropriate mathematical register for teaching. That was supported by Ipek, (2018) who emphasised on the SCK components. A teachers' possession of CCK automatically leads to proficiency in mathematical aptitude in meeting the plethora of challenges of the community and society in general. Whereas with competence in HCK, the efficiency of teachers' capabilities to apply mathematical concepts in curriculum outputs will be greatly enhanced and appropriate benchmarking happens seamlessly along different cadres of learning and teaching. On the other hand, the intractability with students' cognitive intractability with mathematical content, thereby assuaging their misunderstandings is at the core of the essence of KCS. KCC, serves as the connectivity between mathematical content and teaching resources. Nevertheless, KCC and HCK are symmetrically intertwined with the other components.

Recently, the surge in the demand for a more holistic model that accounts for an effective and efficient broader perspective around teachers' mathematics content knowledge in mathematics education, only points to the essence of the incorporation of MKT. This Hill and colleagues' modification of Shulman's conceptualised the ideal symbiotic correlation between student capacity to learn and teachers' PCK. By "mathematical quality of instruction" we mean a composite of several dimensions that characterize the precision and vitality of the mathematics of the lesson, including the presence or absence of mathematical errors, mathematical explanation and justification, mathematical representation, and related observables. With the low student achievement rate in Mathematics, and subject delivery by teachers identified as one of the main contributors to the drop in Year 6 and Year 8 National Examination results, it is the opportune time to look at new strategies of subject delivery. Furthermore, research and practice inform us that mathematics does not stand in isolation; one's experiences, emotions, successes, and failures intertwine with the mathematics one learns (Nabb & Murawska, 2020).

On mathematic proficiency, Copur-Gencturk & Lee (2021) explored and assured that it is a priority in mathematics teaching which requires strategic competence and related skills, in addition to other aspects of Mathematical Knowledge, such as Procedural Knowledge and Conceptual understanding. Gencturk et al. (2019) examined and tested the dimensionality of MKT and findings have revealed that it is uni-dimensional and further revisions need to be done to specifically find the defined parameters of each component of MKT, with defined indicators for PCK need to be identified. Siswono et al. (2018), on the other hand, designed a suitable task for 40 primary teachers' MKT for statistics under MKT components; CCK, SCK, KCS, KCT KCC and Knowledge of Content and Culture which revealed that PCK on statistics had 4 aspects; as recognising big idea, anticipating student answers, exploring content-specific strategies, and constructing shift to general. Bansilal et al. (2018) examined practising Grade R teachers' MKT of numeracy and finding revealed that some teachers were not able to solve problems which includes division and struggled with possible modification and more work is to be done to help improve numeracy.

The study by Ghousseini (2017) on the use of practices as a leveraging approach to fuse all components of MKT revealed that teachers' self-efficacy is invariably enhanced in

the instructional delivery of mathematics. However, the findings of the statistical analysis of research by Marcinek, Jakobsen & Partová (2022) which was an adaptation of an instrument on MKT developed at the University of Michigan to measure teacher knowledge in mathematics in different countries; revealed no significant difference in the mean scores between the Norwegian and the Slovak teachers in their samples, when a comparison was undertaken with the raw data from the adaptation and teachers' ability estimates on the same scale. The study equally provided perspectives into the concerns of cross-national adaptations of measures of teachers' knowledge and the congruent constraints of the methods frequently employed in the item adaptation research. Considering teaching approaches related to MKT, the experiment conducted by Yenmez, et al (2017) tried to craft in lesson study approach, into mathematical modelling, and how students could be assessed using competencies in mathematical modelling. The effect of continuous pre and post-lesson discussion resulted in an effective formulation of assessment criteria, which thoroughly measured both, the process and the product. On-going reflection and discussions contribute to progressively refined process, which positively contribute to both, teachers', and students' knowledge.

Another teaching approach, inquiry-based teaching, which was the core focus of study carried out by Slavit & Lesseig (2017), incorporated in Mathematics Education course for prospective teachers, revealed that inquiry-based approach helps teachers to tackle mathematics problems in diverse ways with flexibility and could also be used for scaffolding and rehearsal purposes. Language also contributes immensely to teaching, therefore the work of Purpura, et al (2017), in incorporating stories with mathematical language in teaching mathematics revealed that mastery of stories with mathematical language increased students' general mathematical abilities which could be used in teaching mathematics for infant class levels.

The survey conducted by Enikanolaye & Akanmu (2020), in examining variables that influence teaching and learning in Mathematics in Secondary Schools; with respect to teaching qualification, teachers' experience, teaching resources, school facilities, and teaching experiences of teachers, for teachers in Kwara State, Nigeria; used a multi-stage sampling technique and the data was analysed quantitatively using demographic data which focused on frequency and percentages. The findings thereof, revealed that these variables- teaching qualification, teaching resources and school facilities; influence effective teaching and learning of mathematics; whilst teachers' teaching experience was the most dominant variable, amongst them. One of the recommendations suggested that Teachers' Teaching Experience should be given adequate consideration in terms of teaching and learning mathematics. In another research by Ridwan et al. (2022) examined perception of teachers on application of appropriate thinking skills of junior, senior high students in mathematics learning. The study entailed qualitative with phenomenological approach, involving 21 mathematics teachers and data was analysed using interactive analysis. The findings from teachers' perception in the application of critical thinking in teaching and learning mathematics revealed that support is needed in the form of using models, related strategies or learning techniques which place emphasis on subject matter, knowledge, and much needed skills of thinking pointers. Other findings revealed that lack of; basic knowledge of mathematics; motivation to learn, and

lack of planning with limited time allocation for preparation, are contributing factors to teachers' hindrances in developing students' critical thinking skills.

Edelman (2017) examined related components to MKT; knowledge of content and students; knowledge of content and teaching; and knowledge of content and curriculum, when integrating mathematics lessons with children's literature through observation and written work by pre-service teachers in a methods course. The findings revealed that more emphasis need to focus on critical analysis of curricular materials with specific focus on representations in children's literature. Youchu (2016) further examined whether a history-based course could affect pre-service teachers' MKT and findings had revealed that through the simulated videos and re-designed tasks, and instructional plans do have an effect, as there was a more significant change in teachers' PCK than Subject matter knowledge. In addition, the history-based course had little influence on Common Content Knowledge and Knowledge of Content and Curriculum.

Baki (2016) also explored ways to enhance pre-service teachers' MKT through one's own recorded videos with critical analysis, and findings have revealed that through practice, there was an improvement in questioning to students; well –thought-out questions were prepared and an improvement in formulation of lesson plans. This brings about possible changes in the different components of MKT. Mitchell, et al (2014)'s work tried to examine the contributing factors to South Korean Primary School Mathematics Teachers' MKT which revealed that Teaching Experience and Teacher Qualification contribute positively to MKT, whilst female teachers' MKT is significantly higher than that of male teachers.

After a critical analysis of the related literature findings, the following questions arose in the minds of the researchers:

i. Whether MKT of primary school Mathematics teachers in Fiji differ, with respect to Teaching Experience?
ii. Whether MKT components of primary school Mathematics teachers in Fiji differ with respect to Teaching Experience?

Objectives of the study

This study has the following objectives:

i. To compare the level of MKT among primary school Mathematics teachers in Fiji, with respect to Teaching Experience (TE).
ii. To compare the level of MKT Components among primary school Mathematics teachers in Fiji, with respect to TE.

Hypothesis of the study

To study these objectives, the following hypothesis were formulated:

i. $\mathbf{H_1}$: Primary school Mathematics teachers with different years of TE differ significantly in MKT.
ii. $\mathbf{H_2}$: Primary school Mathematics teachers with different years of TE differ significantly in MKT Components.

METHOD

The population covers all primary school Mathematics teachers in Fiji, which has more than 7,000 teachers in 2021, from the data obtained from the Ministry of Education. The

Sample size was determined by using Krejcie & Morgan (1970) sample size table, which engaged 360 primary teachers. A quantitative descriptive survey was used with the Stratified Random Sampling technique, whereby a stratum from each of the four Fiji Education Districts: Northern. Western, Central and Eastern, were selected. Content validity was used to validate the research tool.

Analysis of data and results

The collected data were tabulated, analysed and interpreted using SPSS version 16. The data was collected by administering the tool 'A Test on MKT' which was analysed. There is a significant difference (Significant- S) if the P-Value is less than 0.05 level, and Not Significant (NS) if the P-Value is more than 0.05 Level. The details are given in Table 1.

Table 1
ANOVA details of level of MKT among primary school teachers of Fiji with respect to Teaching Experience
**Significance at 0.05 Level **S-Significance*

Table 1 shows the F-value is 7.529, P-value of .000, which is significant at .05 level, thus the null hypothesis is rejected, and the research hypothesis is retained. Hence, it can be concluded that there is a significant difference in MKT, among Primary School Mathematics Teachers with Under 5 Years, 5-10 Years, 11-15 Years, 16-20 years, and more than 20 Years TE. This indicates that at least one group is significantly higher than other groups, with respect to TE.

	Source of Variation	Sum of squares	df	Mean square	F-value	P-value	Result
MKT	Between Groups	3187.647	4	796.912	7.529	.000*	S
	Within Groups	37891.019	358	105.841			
	Total	41078.667	362				

To find out which group differences are significant Post hoc test was done. The detail of the post hoc test is given in Table 2 below.

Table 2
Post hoc test results of MKT with respect to Teaching Experience

Teaching experience Compared	Mean difference	Std. error	P-value	Results
U5yrs & 5 – 10yrs	5.5256*	1.6814	.031	S
U5yrs & 11- 15yrs	6.8725*	1.7397	.004	S
U5yrs & 16 – 20yrs	8.9167*	1.6919	.000	S
U5yrs & > 20yrs	5.3768*	1.7332	.049	S
5- 10yrs & 11 – 15yrs	1.3469	1.7069	.960	NS
5-10yrs & 16 – 20yrs	3.3910	1.6582	.384	NS
5-10yrs & > 20yrs	.1488	1.7003	1.000	NS
11-15yrs & 16 – 20yrs	2.0441	1.7173	.841	NS
11-15yrs & > 20yrs	1.4957	1.7580	.948	NS
16-20yrs & > 20yrs	3.5399	1.7107	.371	NS

**Significance at 0.05 Level **S-Significant NS- Not Significant*

Table 2 shows the greatest mean difference was between teachers with below 5 years TE and 16-20 years with 8.917 and P-value of .000 which is significant at .05 level using Scheffe's Post hoc test. The difference is in favour of teachers with 16-20 years of TE. Hence, it can be concluded that teachers with 16-20 years of TE are significantly higher in MKT than teachers below 5 years of TE. There is also a significant difference between teachers below 5 years TE with 11-15 years with a mean difference of 6.873 and a P-value of .004. The difference is in favour of 11-15 years. Therefore, it can be concluded that the MKT of teachers with 11-15 years of TE is significantly higher than teachers below 5 years TE. Similarly, from the Table, there is a significant difference between teachers below 5 years of teaching experience with 5-10 years with a mean difference of 5.526 and a P-value of .031 and the difference is in favour of teachers with 5-10 years of teaching experience. Therefore, it can be concluded that the MKT of teachers with 5-10 years of teaching experience is significantly higher than teachers below 5 years of teaching experience. Table 2 also shows a significant difference between teachers below 5 years of teaching experience with more than 20 years with a mean difference of 5.377 and a P-value of .049. The difference is in favour of teachers with more than 20 years of teaching experience. Hence it can be concluded that the MKT of teachers with more than 20 years of teaching experience is significantly higher than teachers below 5 years of teaching experience.

Table 3
ANOVA details of MKT components among Primary School Teachers of Fiji with respect to Teaching Experience

Source of variation		Sum of squares	df	Mean square	F	P-value	Results
CCK	Between Groups	165.811	4	41.453	5.763	.000	S
	Within Groups	2575.236	358	7.193			
	Total	2741.047	362				
KCT	Between Groups	149.990	4	37.498	3.922	.004	S
	Within Groups	3422.461	358	9.560			
	Total	3572.452	362				
KCS	Between Groups	141.432	4	35.358	2.909	.022	S
	Within Groups	4350.815	358	12.153			
	Total	4492.248	362				
SCK	Between Groups	393.624	4	98.406	6.864	.000	S
	Within Groups	5132.376	358	14.336			
	Total	5526.000	362				

*Significant at 0.05 Level **S- *Significant*

Table 3 shows that for CCK, the F-value is 5.763 and the P-value of .000, which is significant at 05 levels, thus the null hypothesis is rejected and the research hypothesis is retained. Hence, it can be concluded that there is a significant difference in CCK, among teachers with Under 5 Years, 5-10 Years, 11-15 Years, 16-20 Years, and More Than 20 Years TE. Table 3 also shows for KCT, the F-value is 3.922, and the P-value of .004, which is significant at .05 level, thus the null hypothesis is rejected and the research hypothesis is retained. Therefore, it can be concluded that there is a significant difference in KCT, among teachers with Under 5 Years, 5-10 Years, 11-15 Years, 16-20 Years, And More Than 20 Years TE. From the Table, it shows that for KCS, the F-

value is 2.909, and the P-value of .022, which is significant at .05 level, thus the null hypothesis is rejected and the research hypothesis is retained.

Therefore, it can be concluded that there is a significant difference in KCS, among teachers with Under 5 Years, 5-10 Years, 11-15 Years, 16-20 Years, And More Than 20 Years TE. Table 3 also shows for SCK, the F-value is 6.864 and the P-value of .000, which is significant at .05 level, thus the null hypothesis is rejected and the research hypothesis is retained. Therefore, it can be concluded that there is a significant difference in SCK, among teachers with Under 5 Years, 5-10 Years, 11-15 Years, 16-20 Years, And More Than 20 Years TE. Hence it can be concluded that teachers with below 5 years teaching experience, 5-10 years, 11-15years, 16-20 years and more than 20 years TE differ significantly with respect to CCK, KCT, KCS and SCK components of MKT. This indicates that at least one group is significantly higher than other groups with respect to TE.

To compare the differences, individual means are identified as given in Table 4.

Table 4
Mean and standard deviation of MKT components and Teaching Experience

		Mean	Std. deviation	Std. error
CCK	U5yrs	13.3478	3.07182	.36980
	5-10yrs	14.8500	2.40832	.26926
	11-15yrs	14.8986	2.87558	.34618
	16-20yrs	15.3816	2.39425	.27464
	>20yrs	14.5362	2.66557	.32090
	Total	14.6253	2.75172	.14443
KCT	U5yrs	11.5072	3.21130	.38660
	5-10yrs	12.4125	3.15303	.35252
	11-15yrs	12.8116	3.40534	.40995
	16-20yrs	13.4868	2.79282	.32036
	>20yrs	12.7681	2.87558	.34618
	Total	12.6088	3.14144	.16488
KCS	U5yrs	11.3188	3.34089	.40220
	5-10yrs	12.5750	3.31767	.37093
	11-15yrs	12.9855	3.64406	.43869
	16-20yrs	13.0789	3.49767	.40121
	>20yrs	12.2754	3.64161	.43840
	Total	12.4628	3.52272	.18489
SCK	U5yrs	10.0725	3.63528	.43764
	5-10yrs	12.0375	3.45475	.38625
	11-15yrs	12.3188	4.27542	.51470
	16-20yrs	13.3026	3.60747	.41381
	>20yrs	12.1304	3.97016	.47795
	Total	12.0000	3.90707	.20507

To find out the significance of the difference in MKT Components (CCK, KCT, KCS and SCK) with respect to TE groups, post hoc tests were done. The details are given in Table 5, Table 6, Table 7 and Table 8 respectively.

Table 5
Post-hoc test results of CCK with respect to TE of primary school teachers of Fiji

Teaching experience Comparison	Mean difference	Std. error	P-value	Results
U5yrs & 5-10yrs	1.50217*	.44065	.022	S
U5yrs & 11-15yrs	1.55072*	.45662	.023	S
U5yrs & 16-20yrs	2.03375*	.44598	.000	S
U5yrs & >20yrs	1.18841	.45662	.151	NS
5-10yrs &11-15yrs	.04855	.44065	1.000	NS
5-10yrs &16-20yrs	.53158	.42961	.821	NS
5-10yrs & >20yrs	.31377	.44065	.973	NS
11-15yrs &16-20yrs	.48303	.44598	.882	NS
11-15yrs & >20yrs	.36232	.45662	.960	NS
16-20yrs & >20yrs	.84535	.44598	.465	NS

**S-Significant, NS-Not Significant*

Table 5 shows for CCK, the highest mean difference is between teachers below 5 years teaching experience with 16-20 years which had the value of 2.034 and a P-value of .000 using Scheffe's Post hoc test. From the Table, it is also evident that teachers with 16-20 years TE is significantly higher than teachers below 5 years. Hence, it can be concluded that the CCK of teachers with 16-20 years of TE is significantly higher than teachers below 5 years of TE. The Table also reveals that the mean difference between teachers with teachers below 5 years of TE and 11-15 years was 1.551, and P-value of .023 that is significant at .05 level. The difference is in favour of teachers with 11-15 years of TE. Therefore, it can be concluded that the CCK of teachers with 11-15years of teaching experience is significantly higher than teachers below 5 years of teaching experience. In addition, the mean difference between teachers below 5years of teaching experience and 5-10 years was 1.502 and a P-value of .022, which is significant at .05 level. The difference is in favour of teachers with 5-10years of teaching experience. Hence, it can be concluded that the CCK of teachers with 5-10 years of teaching experience is significantly higher than teachers below 5 years of teaching experience.

Table 6
Post-hoc test results of KCT with respect to teaching experience of primary school teachers of Fiji

Teaching Experience Comparison	Mean Difference	Std. Error	P-value	Results
U5yrs & 5-10yrs	.90525	.50799	.530	NS
U5yrs & 11-15yrs	1.30435	.52640	.191	NS
U5yrs & 16-20yrs	1.97960*	.51414	.006	S
U5yrs & >20yrs	1.26087	.52640	.222	NS
5-10yrs & 11-15yrs	.39909	.50799	.961	NS
5-10yrs &16-20yrs	1.07434	.49527	.321	NS
5-10yrs & >20yrs	.35562	.50799	.974	NS
11-15yrs & 16-20yrs	.67525	.51414	.786	NS
11-15yrs & >20yrs	.04348	.52640	1.000	NS
16-20yrs & >20yrs	.71873	.51414	.744	NS

**S-Significant, NS-Not Significant*

Table 6 shows for KCT, the mean difference between teachers below 5 years of Teaching Experience and 16-20 years is 1.980 and a P-value of .006, which is significant at .05 level using LSD. From the table, it is also evident that teachers with 16-20 teaching experience are significantly higher in KCT than teachers below 5 years of teaching experience. Therefore, it can be concluded that the KCT of teachers with 16-20 years of teaching experience is significantly higher than teachers below 5 years of teaching experience.

Table 7
Post-hoc test results of KCS with respect to teaching experience of primary school teachers of Fiji

Teaching experience comparison	Mean difference	Std. error	Sig.	Results
11-15yrs & >20yrs	.71014	.59352	.232	NS
11-15yrs & 16-20yrs	.09344	.57969	.872	NS
16-20yrs & >20yrs	.80359	.57969	.167	NS
5-10yrs & >20yrs	.29964	.57275	.601	NS
5-10yrs & 11-15yrs	.41051	.57275	.474	NS
5-10yrs & 16-20yrs	.50395	.55841	.367	NS
U5yrs & >20yrs	.95652	.59352	.108	NS
U5yrs & 11-15yrs	1.66667*	.59352	.005	S
U5yrs & 16-20yrs	1.76011*	.57969	.003	S
U5yrs & 5-10yrs	1.25616*	.57275	.029	S

**S-Significant, NS-Not Significant*

Table 7 shows for KCS, the highest mean difference is between teachers below 5 years teaching experience and teachers with 16-20 years teaching experience, which is 1.76, and P-value of .003, which is significant at .05 level using LSD. From the Table, it is also evident that 16-20 years' teachers' KCS is significantly higher than teachers with below 5 years of teaching experience. Hence, it can be concluded that the KCS of teachers with 16-20 years of teaching experience is significantly higher than teachers with below 5 years of teaching experience. Table 1.8 also reveals the mean difference between teachers below 5 years teaching experience and 11-15 years is 1.667 and P-value of .005, which is significant at .05 level. The difference is in favour of 11-15 years of teaching experience. Hence it can be concluded that teachers with 11-15 years of teaching experience are significantly higher in KCS than teachers with below 5 years of teaching experience. Furthermore, the Table also shows the mean difference between teachers below 5 years teaching experience and 5-10 years was 1.256 and P-value of .029, which is significant at .05 level. This difference is in favour of teachers with 5-10 years of teaching experience. Hence, it can be concluded that teachers with 5-10 years of teaching experience are significantly higher in KCS than teachers with below 5 years of teaching experience.

Table 8
Post-hoc test results of SCK with respect to teaching experience of primary school teachers of Fiji

Teaching experience Compared	Mean difference	Std. error	P-value	Results
U5yrs & 5-10yrs	1.96504*	.62207	.043	S
U5yrs & 11-15yrs	2.24638*	.64463	.018	S
U5yrs & 16-20yrs	3.23017*	.62961	.000	S
U5yrs &>20yrs	2.05797*	.64463	.039	S
5-10yrs & 11-15yrs	.28134	.62207	.995	NS
5-10yrs & 16-20yrs	1.26513	.60650	.362	NS
5-10yrs & >20yrs	.09293	.62207	1.000	NS
11-15yrs & 16-20yrs	.98379	.62961	.655	NS
11-15yrs & >20yrs	.18841	.64463	.999	NS
16-20yrs & >20yrs	1.17220	.62961	.484	NS

**S-Significant, NS-Not Significant*

Table 8 shows the highest mean difference is between teachers below 5 years of teaching experience and teachers with 16-20 years of teaching experience with the value of 3.23 and a P-value of .000, which is significant at .05 level using LSD. From the Table, it is evident that teachers with 16-20 years of teaching experience are significantly higher than teachers with below 5 years of teaching experience. Hence, it can be concluded that the SCK of teachers with 16-20 years of teaching experience is significantly higher than teachers with below 5 years of teaching experience. The Table also reveals that the mean difference between teachers below 5 years teaching experience and 11-15 years is 2.246 and a P-value of .018, which is significant at .05 level. The difference is in favour of teachers with 11-15 years of teaching experience. Hence, it can be concluded that the SCK of teachers with 11-15 years of teaching is significantly higher than teachers with below 5 years of teaching experience.

Furthermore, the Table also shows the mean difference between teachers below 5 years teaching experience and 5-10 years is 1.965 and P-value of .043, which is significant at .05 level. The difference is in favour of teachers with 5-10 years of teaching experience. Hence, it can be concluded that the SCK of teachers with 5-10 years of teaching experience is significantly higher than teachers below 5 years of teaching experience. For SCK, the table also shows the mean difference between teachers below 5 years teaching experience and teachers with more than 20 years teaching experience is 2.058 and a P-value of .039, which is significant at .05 level. It is also evident from the Table that teachers with more than 20 years of teaching experience are significantly higher in SCK than teachers below 5 years of teaching experience. Therefore, it can be concluded that teachers with more than 20 years of teaching experience are significantly higher in SCK than teachers below 5 years of teaching experience.

DISCUSSION

The current study hinged on exploring the contributing factors necessitating low achievement in Mathematics for primary school students, with a specific focus on ascertaining the current state of MKT for Primary School Mathematics Teachers in Fiji schools. These four components were benchmarked in the study: Knowledge of Content

and Students (KCS); Knowledge of Content and Teaching (KCT); Common Content Knowledge (CCK); and Specialized Content Knowledge (SCK) Hill et al. (2008), with respect to teachers' Teaching Experience (TE). Therefore, the major findings in this research includes, that there is a significant difference in all MKT Components; CCK, KCT, KCS and SCK with respect to teachers' TE, although CCK is significantly higher than the other MKT Components. The CCK of Teachers with 16-20 years, 11-15years, and 5-10 years of TE, is significantly higher than teachers below 5 years of TE. That gives credence to Slavit & Lesseig's (2017) position authenticating the incorporation of Mathematics Education Course for prospective teachers. That, according to them, will ground them in inquiry-based approach that ultimately aid the tackling of mathematics problems in diverse ways with flexibility that is guaranteeing with experience. In addition, the KCT of Teachers with 16-20 years of TE is significantly higher than teachers below 5 years of TE. The KCS of Teachers with 16-20 years, 11-15 years, and 5-10 years of TE is significantly higher than teachers with below 5 years of TE. The above is in line with Edelman's (2017) examination of these related components of MKT; knowledge of content and students: knowledge of content and teaching; and knowledge of content and curriculum. The findings revealed that more emphasis need to focus on critical analysis of curricular materials over time. And finally, lending credence to Ipek, (2018) the SCK of teachers with 20 years and above, 16-20 years, 11-15 years and 5-10 years of TE is significantly higher than teachers below 5 years of TE.

Hence, the significance of mathematical proficiency in effective mathematics teaching, in terms of strategic competence and emphasis on related skills, has been emphasized by Gopur-Gencturk & Doleck (2021). Accordingly, strategies competence focuses on improvement in Pedagogical Content Knowledge (PCK) as highlighted by Youchu (2016) which include knowledge of content and teaching (KCT), knowledge of content and students (KCS), and knowledge of content and curriculum (KCC), however in this study, the focus is on KCT and KCS. More practice on MKT would bring about genuine change in teaching and learning of mathematics and this practice is time-bound and bequeath experience on the learners. Teaching Experience and teaching qualification also affect teachers MKT as shown by the findings of this research and corroborated by Mitchel et al. (2014). It is obvious from experience and studies that beginning teachers are normally faced with incompetence in teaching and frustrations.

This study also revealed that there is a significant difference in teachers' KCT and KCS, which both address pedagogical aspects in teaching mathematics which is connected well with literature. The present study revealed that there is a significant difference in MKT with teachers of different years of teaching experience, especially for those who have more years of teaching experience than those who have the least teaching experience, which supports Ipek's (2018) position. This same situation also applies for MKT Components, whereby teachers with more years of teaching experience are significantly higher than teachers with the least years of teaching experience with respect to CCK, KCT, KCS and SCK.

IMPLICATIONS

The findings highlighted from the study have implications for effective and efficient classroom practices in Fiji's primary schools, especially in the teaching of mathematics, with respect to MKT, and its four components.

To increase the level of MKT and its four Components (CCK, KCT, KCS and SCK) amongst primary school teachers with less than 5years of TE, firstly, the Ministry of Education needs to provide space for experienced teachers with sound knowledge of MKT to model related teaching approaches to teachers with less than 5 years TE to observe and analyse. This could be conducted during in-house Professional Development sessions, which is cost effective. This exercise will also boost knowledge and skills in teaching numeracy, which is greatly needed and a general concern in primary schools in Fiji.

The other option could be done in clusters, whereby neighbouring schools meet regularly and share ideas constructively about teaching approaches related MKT and activities. Such initiatives could further develop into working research teams focussing on various content strands at different levels. The composition of teams needs to be diverse, accommodating teachers varied years of TE. This approach would also empower teachers to be research active, and expanding knowledge and skills in research and MKT, especially for teachers with less than 5years of TE.

RECOMMENDATIONS

The way forward could be focussed on two aspects: for MOE and teacher training institutions. For MOE, the following could be carried out to help primary school teachers, such as providing space and funding on MKT projects as this would surely boost numeracy work for teachers in a more contextualised manner with hands-on dynamics.

Initiatives and awards to be provided to teacher-engagement in group research-based projects on MKT and related components. This initiative will surely bring about a change in mindset for teachers, thus improve teaching approaches, and indirectly affect students' performances. Teacher success stories in projects could be shared in symposiums, and national and international education conferences.

Moreover, for teacher training institutions, there is a need to review primary mathematics curriculum to incorporate MKT as part of curriculum development with assessment tasks clearly stipulated. The Teacher Education Institutions also need to continuously engage in open and constructive dialogue with MOE. Such industry collaborations will enable both parties to discuss issues related to the teaching of mathematics and numeracy, and come up with workable and practicable solutions to address numeracy issues that has been a concern in Fiji, and the whole Pacific by extension

CONCLUSION

The overarching goal of the study was the determination of the correlation between MKT and teachers' teaching experience and the findings in this study directs the need to provide support for Primary Teachers through professional development programme for quality instructional delivery mathematics in Fiji. This could indirectly contribute to the improvement of students' performances in mathematics at primary level. Moreover, the findings of the study would enable Teacher Education Institutions to incorporate MKT components as part of the mathematics education teacher training and development curriculum in Fiji.

If the proposed actions are implemented to address the areas highlighted in the study's findings, with close monitoring from the Ministry of Education, schools will become and be regarded as the centre of learning, for both teachers and students, with a completely different mind-set for teachers about their teaching, as one teaches with critical thinking, asking correct questions, analysing teaching approaches and how students learn, and how to address students' disciplinary issues. Teachers would become more interested in developing novel techniques to maximize student learning. Teachers would spend precious time engaged in in-depth thinking to try out several approaches to difficult jobs. Once new ways are proven effective, teachers will be eager to share their experiences with colleagues, perhaps through Professional Development sessions, so boosting capacity building.

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