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Original article

Teacher subject expertise and learner achievement in a Ayivu east division primary schools, Arua city, Uganda. A cross-sectional study

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Abstract

Background

Teacher subject mastery is widely linked to learner achievement, yet learning outcomes in Uganda's primary schools remain low. This study examined the relationship between teacher subject expertise and learner achievement in primary schools in the division.

Methodology

A cross-sectional design combined quantitative and qualitative methods in three Universal Primary Education (UPE) schools: Ayafio, Onziu and Asuru. From a population of 240, a sample of 148 was selected using convenience, stratified and purposive sampling. Data were collected through questionnaires, semi-structured interviews and documentary review, and analysed using descriptive statistics, Pearson's correlation (SPSS) and thematic analysis.

Results

Of 148 targeted respondents, 130 participated (87.8%). Respondents were 51.5% female and 48.5% male; 42.3% were aged 28–37 years, and 38.5% held a degree. Teacher subject expertise was rated low (average mean = 2.59 on a five-point scale), with the weakest ratings for clear explanation of content (2.44) and for curriculum knowledge and subject mastery (2.48 each). Learner achievement was also low (average mean = 2.07), weakest in applying mathematics to real-life situations (1.8). Interviews and school records agreed that fewer than 30% of pupils reached the top two PLE grade bands. Teacher subject expertise was positively and significantly correlated with learner achievement ($r = 0.69$, $p < 0.01$).

Conclusion

Teacher subject expertise is a key determinant of learner achievement in primary schools in Ayivu East Division. Pupils taught by teachers with stronger subject mastery tend to perform better.

Recommendations

Strengthen subject-specific professional development, especially in Mathematics, English and Science; set up school-based subject panels and peer review; align teacher deployment with subject specialization

Keywords: *Teacher Subject Expertise, Learner Achievement, Primary Schools, Primary Leaving Examination, Ayivu East Division, Arua City*
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Background to the Study

Globally, teachers are regarded as the most influential school-based factor in what learners achieve. Value-added research shows substantial variation in teacher quality (Hanushek & Rivkin, 2010), studies of mathematics teaching link teachers' subject knowledge to student achievement gains (Hill et al., 2005), and state policies on teacher preparation and certification are among the strongest correlates of student achievement (Darling-Hammond, 2000). Yet many education systems are not delivering basic learning. The World Bank and partners estimated that 57% of 10-year-olds in low- and middle-income countries could not read and understand a simple text before the COVID-19 pandemic, and that this had risen to about 70% by 2022 (World Bank et al., 2022).

The problem is most severe in Sub-Saharan Africa, where learning poverty was estimated at 86% before the pandemic and about 89% afterwards (World Bank et al., 2022). A major study of primary schools in seven Sub-Saharan African countries, including Uganda, found that enrolment had expanded without matching gains in learning, that large shares of teachers did not master the curricula they were teaching, and that teachers' content knowledge had a significant and large positive effect on student achievement (Bold et al., 2017). A later analysis estimated that shortfalls in teachers' content knowledge account for about 30% of the shortfall in learning relative to the curriculum (Bold et al., 2019).

In Uganda, Universal Primary Education (UPE) greatly expanded access to schooling, but concerns about the quality of learning, especially literacy and numeracy at primary level, have persisted. The Uganda National Examinations Board (UNEB) reported that although the

national Primary Leaving Examination (PLE) pass rate rose to 91.8% in 2024, the number of candidates obtaining Division One fell to 84,301 (10.7%) from 86,582 in 2023, and that candidates struggled with questions requiring problem-solving skills (UNEB, 2025). Teacher quality, particularly mastery of the subjects taught, is therefore central to improving learning outcomes in Ugandan primary schools.

At the local level, Ayivu East Division in Arua City is served by UPE schools whose pupils sit the PLE and are assessed in literacy and numeracy. Records reviewed in this study for 2022 to 2024 show that fewer than 30% of pupils attained the first and second grade bands in the PLE, with particular weakness in English, Mathematics and Science. Head teachers and education officials interviewed in the division link this performance to limited teacher subject mastery, irregular continuous professional development, and the deployment of teachers to subjects outside their areas of specialisation. This study therefore examined the relationship between teacher subject expertise and learner achievement in primary schools in Ayivu East Division.

Methodology

Research Design

The study used a cross-sectional design with both quantitative and qualitative approaches. Quantitative data were collected using questionnaires, while qualitative data were collected through interviews and documentary review. Combining the approaches allowed triangulation, which helped to converge opinions and arrive at more reliable and comprehensive conclusions (Amin, 2005).

Study Population

The population consisted of Primary Seven pupils, primary teachers (including head teachers) and members of the School Management Committees (SMCs) of the selected UPE schools in Ayivu East Division, Arua City, together with two education officials: the City Inspector of Schools and the City Education Officer. These groups were chosen because they hold the information needed for the study. Three schools were selected: Ayafio, Onziu and Asuru Primary Schools. The target population was 240 participants.

Table1: Target population by school

School	SMC member	Teachers	Pupils	Total
Ayafio Primary School	10	17	48	75
Onziu Primary School	10	19	62	91
Asuru Primary School	10	15	47	72
City Inspector of Schools and City Education Officer				2
Total	30	51	157	240

Source: Arua City Education Department (2024).

Sample Size and Sampling Techniques

A sample of 148 respondents was determined from the population of 240 using Krejcie and Morgan's (1970) table, and allocated proportionately to each group.

Table 2: Population, sample size and sampling technique

Category	Population	Sample size	Sampling technique
School Management Committee	30	19	Convenience sampling
Teachers	51	31	Stratified sampling
Pupils	157	96	Stratified sampling
City Inspector of Schools	1	1	Purposive sampling
City Education Officer	1	1	Purposive sampling
Total	240	148	

Source: Arua City Education Department (2024).

Convenience sampling was used for SMC members. Because they were few (30), all accessible and willing members were included, giving 19 respondents.

Stratified sampling was used for teachers (51) and pupils (157). Each school formed a stratum, and respondents were selected proportionately from each stratum to give 31 teachers and 96 pupils. This reduced sampling bias and ensured that every school was represented.

Purposive sampling was used to select the City Inspector of Schools and the City Education Officer because they hold specialised knowledge of education policy, supervision and administration in the schools studied.

Data Collection Methods

Questionnaires Structured questionnaires with closed-ended and open-ended items were administered to teachers and pupils to collect data on teacher subject expertise and learner achievement. They allowed

standardised data to be collected from many respondents and quantified for analysis. Pupils were guided in completing the questionnaires to ensure clarity and accuracy.

Interviews Semi-structured interviews were held with head teachers, the City Inspector of Schools and the City Education Officer. They gave in-depth insight into teachers' subject expertise, supervision of teaching and learner achievement, and allowed the researcher to probe and clarify responses.

Documentary review. School records, continuous assessment and termly progress reports, and PLE results for 2022 to 2024 were reviewed to verify respondents' information and to triangulate the primary data on learner achievement.

Validity of Instruments

Validity is the degree to which results accurately represent the phenomenon studied (Mugenda & Mugenda, 2003). Content validity was established using the Content Validity Index (CVI):

$$CVI = n / N$$

where n is the number of items rated relevant by the expert and N is the total number of items. The research supervisor reviewed the questionnaire for relevance, clarity and appropriateness. Of the 50 items, 43 were rated highly relevant, giving $CVI = 43 / 50 = 0.86$. This exceeds the recommended threshold of 0.70, so the questionnaire was considered valid.

Reliability of Instruments

Reliability is the consistency and dependability of an instrument (Mugenda & Mugenda, 2003). The questionnaire was pre-tested on a small sample from a school outside the study area, and the same respondents completed it again after two weeks. Internal consistency was measured using Cronbach's alpha, which gave a coefficient of 0.84, above the accepted threshold of 0.70. Ambiguous items identified during the pre-test were revised before the main data collection.

Data Analysis

Quantitative data. Questionnaire data were checked for completeness, coded and entered into the Statistical Package for the Social Sciences (SPSS). Frequencies, percentages, means and standard deviations summarised teacher subject expertise and learner achievement, with means interpreted against the scale midpoint of 3.0. Pearson's correlation coefficient was used to test the relationship between teacher subject expertise and learner achievement at the 0.05 level of significance.

Qualitative data. Interview and documentary data were analysed using thematic content analysis: (i) transcribing interviews and organising documentary data; (ii) reading through the data to identify patterns and categories; (iii) coding the data into themes aligned with the objectives, namely teacher subject expertise and learner achievement; and (iv) interpreting the themes to complement and triangulate the quantitative results.

Ethical Considerations

The researcher obtained an introductory letter from the School of Research and Graduate Studies and presented it to the district officials and head teachers of the selected schools.

Informed consent was obtained from respondents, who were told the purpose and expected outcomes of the study. Respondents were assured that their information would be kept confidential and used only for academic purposes. The works of other researchers were acknowledged and properly cited.

Results

Response Rate

Response rate = (respondents who participated ÷ respondents targeted) × 100.

Table 3: Response rate

Category	Targeted	Participated	Response rate (%)

School Management Committee	19	8	42.1
Teachers	31	30	96.8
Pupils	96	90	93.8
City Inspector of Schools	1	1	100
City Education Officer	1	1	100
Total	148	130	87.8

Source: Primary data (2025).

Of the 148 targeted respondents, 130 participated, giving an overall response rate of 87.8%, which is satisfactory for social science research (Mugenda & Mugenda, 2003). Teachers (96.8%) and pupils (93.8%) responded highly, and both education officials participated fully. The SMC response was lowest (42.1%) because of members' limited availability during data collection. Overall, the response rates indicate that the data are representative and reliable for examining teacher subject expertise and learner achievement.

Demographic Characteristics of Respondents

Table 4: Demographic characteristics of respondents (N = 130)

Variable	Category	Frequency	Percentage (%)
Gender	Male	63	48.5
	Female	67	51.5
Age (years)	18–27	40	30.8
	28–37	55	42.3
	38–49+	35	26.9
Education level	Diploma	35	26.9
	Degree	50	38.5
	Postgraduate diploma	20	15.4
	Master's degree	25	19.2
Marital status	Married	70	53.8
	Single	50	38.5
	Divorced	10	7.7

Source: Primary data (2025).

The sample was balanced by gender (48.5% male, 51.5% female). Most respondents (42.3%) were aged 28–37, and the sample was generally well educated, with 38.5% holding a degree. More than half (53.8%) were married. This profile gives a sound base for examining teacher subject expertise and learner achievement

Level of Teacher Subject Expertise in Ayivu East Division Primary Schools

Table 5: Subject expertise of teachers (1 = Strongly Disagree, 5 = Strongly Agree)

Statement	1	2	3	4	5	Mean	SD
Teachers demonstrate strong mastery of the subjects they teach.	28	40	25	15	7	2.48	0.92
Teachers explain subject content clearly and accurately.	30	38	27	15	5	2.44	0.89
Teachers are knowledgeable about the curriculum requirements of their subjects.	25	42	28	17	3	2.48	0.86
Teachers answer learners' questions confidently and correctly.	22	40	30	18	5	2.55	0.91
Teachers regularly update their subject knowledge.	26	38	32	15	4	2.49	0.88
Teachers use appropriate teaching methods for the subjects they teach.	24	35	33	18	5	2.58	0.93
Teachers integrate practical examples showing deep understanding of subject content.	20	36	35	18	6	2.67	0.95
Teachers demonstrate confidence when teaching complex topics.	22	34	36	20	6	2.70	0.97
Teachers effectively assess learners' understanding of subject content.	24	32	35	20	7	2.72	0.96
Teachers adapt instructional materials to reflect current subject knowledge.	18	34	37	22	7	2.82	0.98

Source: Primary data (2025).

Quantitative findings

All item means were below the scale midpoint of 3.0 (range 2.44 to 2.82; average of the ten-item means = 2.59), and standard deviations ranged from 0.86 to 0.98, showing consistent responses. Respondents therefore tended to disagree or remain neutral that teachers have adequate subject expertise.

The weakest items were core mastery indicators: clear and accurate explanation of content (Mean = 2.44), knowledge of curriculum requirements (Mean = 2.48), and strong mastery of the subjects taught (Mean = 2.48). These point to deficiencies in content mastery, curriculum understanding and clarity of explanation. Items on answering learners' questions (Mean = 2.55) and use of appropriate methods (Mean = 2.58) were also low, which suggests gaps in subject-specific teaching skills.

The highest means were for adapting instructional materials to current subject knowledge (Mean = 2.82), assessing learners' understanding (Mean = 2.72), confidence with complex topics (Mean = 2.70) and use of practical examples (Mean = 2.67). Even these remain below 3.0, so teachers show only partial competence in applying their subject knowledge in class.

Overall, teachers in Ayivu East Division show insufficient subject expertise, and the low variation in responses shows that this view is widely shared.

Qualitative findings

Head Teacher 1 (HT1) said: "Generally, the subject expertise of our teachers is still low. Many of them struggle with content mastery, especially in Mathematics and Science. Sometimes when I observe lessons, I notice that teachers rely heavily on textbooks without adding any meaningful explanation. This affects learners' understanding and slows down lesson progress."

HT1 added: "One major issue is that many teachers have not updated their knowledge since they left training college. We rarely get opportunities for continuous professional development due to limited funding. Also, some teachers were deployed to teach subjects they are not fully trained in, which increases the knowledge gap." "You will find that learners ask questions and teachers fail to answer confidently. This discourages learners from participating."

Head Teacher 2 (HT2) said: "I would say the expertise is fairly inadequate. Most teachers are committed, but commitment alone is not enough. Some teachers have shallow understanding of the curriculum and struggle to interpret learning competencies correctly. This leads to poorly structured lessons." He added: "A few try their best, but many do not use the right methods. For example, Science should be taught with experiments and demonstrations, but you find teachers teaching it verbally like Social Studies. They lack both the confidence and skills to vary methods." He also said: "We have introduced peer lesson observation and team teaching, but the impact is still limited. We need stronger support from the district to organize regular subject-based training."

The City Inspector of Schools said: "My overall assessment is that teacher subject expertise is insufficient. During school visits, I find that a big number of teachers cannot demonstrate deep understanding of the content they teach. Many of them have theoretical knowledge, but they lack practical application of subject-specific competencies." He added: "Several factors contribute. First, teacher deployment is not aligned with specialization teachers trained in Arts are sometimes assigned to teach Mathematics. Second, continuous professional development is irregular. Third, some teachers lack access to updated curriculum materials, which limits their ability to adapt instructional content." He also said: "We need regular refresher courses and in-service training focused on key subjects like Mathematics, English, and Science. Schools should also strengthen mentorship programs where strong teachers help weaker ones."

Theme 1: Limited content mastery and curriculum interpretation. Both head teachers and the City Inspector described teachers who struggle to explain content clearly, answer learners' questions confidently and interpret curriculum competencies, especially in Mathematics and Science. Teachers were described as over-dependent on textbooks and weak in practical application. The consistency of these views suggests a widespread problem rather than an isolated one.

Theme 2: Weak professional development and deployment. Respondents attributed low subject expertise to limited and irregular continuous professional development, deployment of teachers outside their specialisation, outdated curriculum materials, and weak mentorship. Peer observation and team teaching had been introduced but had limited impact without structured, funded subject-based training.

The interviews confirm the questionnaire results that teacher subject expertise in the division is low.

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Original article

Table 5: Learner achievement

Statement	SA	A	N	D	SD	Mean	Std. dev.
Pupils get good grades in PLE	5	10	20	60	35	2.3	1.1
Pupils demonstrate strong reading fluency and comprehension	2	8	30	55	35	2.1	1.0
Pupils show proficiency in writing, including spelling, grammar and sentence construction	3	7	25	60	35	2.0	1.0
Pupils have a strong understanding of numbers and basic arithmetic operations	4	10	30	50	36	2.2	1.1
Pupils can solve simple and moderately complex mathematical problems accurately	2	8	25	55	40	2.0	1.1
Pupils apply mathematical concepts to real-life situations	1	5	20	60	44	1.8	1.0

Source: Primary data (2025).

Quantitative findings

All six indicators had means below 3.0 (range 1.8 to 2.3; average of the six item means = 2.07), showing generally low academic achievement. Most pupils did not achieve good PLE grades (Mean = 2.3). Literacy was weak, with limited reading fluency and comprehension (Mean = 2.1) and low writing proficiency (Mean = 2.0). In numeracy, pupils had a poor grasp of basic arithmetic (Mean = 2.2), struggled to solve mathematical problems accurately (Mean = 2.0) and were weakest in applying mathematics to real-life situations (Mean = 1.8).

Interview findings

The City Inspector of Schools said: "From my observations during school inspections, the academic performance of pupils in Ayivu East Division is generally low. Many pupils struggle with literacy and numeracy skills, which are fundamental for learning other subjects. For example, reading fluency is poor, and pupils often cannot apply mathematical concepts to solve real-life problems." He added: "Some teachers have limited content knowledge and struggle to teach multi-disciplinary concepts effectively."

The City Education Officer said: "Overall, the achievements are below national expectations. Pupils often perform poorly in national assessments, particularly in Mathematics, English, and Science. Even in classroom assessments, we notice gaps in basic literacy and numeracy skills." He added: "We have initiated teacher support programs, including in-service training on pedagogy and subject content. We also encourage remedial lessons for struggling pupils and promote peer learning among schools. However, the interventions are limited by funding and logistics. More focused professional development and resource provision are needed to improve pupil outcomes effectively."

HT1 said: "In our school, most pupils perform below the expected level. In Literacy, they read slowly and have difficulties understanding texts. Numeracy is also weak; many cannot solve simple addition and subtraction problems or relate mathematics to everyday situations. This affects their performance in national exams like the PLE." HT1 added: "A major factor is the limited content knowledge of some teachers, which makes it hard for them to teach concepts clearly."

Respondents agreed that learner achievement is low in literacy and numeracy and in national examinations, and three of them directly linked it to limited teacher content knowledge.

Documentary findings

School records, continuous assessment reports, termly progress reports and PLE results for 2022 to 2024 were reviewed.

PLE performance: Fewer than 30% of pupils attained the first and second grade bands. About 55–60% scored in the third to fifth grade bands, and 10-15% failed to attain the minimum pass mark in one or more subjects. Weakness was greatest in English, Mathematics and Science.

Literacy: Records showed limited reading fluency and comprehension and poor spelling, grammar and sentence construction. Fewer than 40% of pupils met the expected literacy standards for their class levels.

Numeracy: Pupils had difficulty with basic arithmetic operations, and fewer than 35% could solve moderately complex mathematical problems accurately. They also struggled to apply mathematics to real-life contexts such as calculating money, measuring objects and interpreting data.

The documentary evidence is consistent with the questionnaire and interview findings: achievement in English, Mathematics and Science is persistently low,

literacy and numeracy are weak, and classroom learning is poorly applied to real-life situations.

Relationship between Teacher Subject Expertise and Learner Achievement

Pearson's correlation coefficient was used to test the hypothesis that there is a significant positive relationship between teacher subject expertise and learner achievement.

Table 6: Correlation between teacher subject expertise and learner achievement

Variables	Teacher subject expertise	Learner achievement
Teacher subject expertise	1.00	0.69**
Learner achievement	0.69**	1.00

N = 100. **Correlation is significant at the 0.01 level (2-tailed). Source: Primary data (2025).

Teacher subject expertise is positively and significantly correlated with learner achievement ($r = 0.69$, $p < 0.01$). Pupils tend to perform better academically where teachers have stronger mastery of the subjects they teach, so the hypothesis (H_1) is supported. As this is a correlation, it shows association and not cause and effect.

Discussion

The study found a significant positive correlation between teacher subject expertise and learner achievement ($r = 0.69$, $p < 0.01$). This is consistent with Darling-Hammond (2000), who found that measures of teacher preparation and certification were the strongest correlates of student achievement in reading and mathematics across states, and who pointed to state policies on teacher education, licensing, hiring and professional development.

The finding also agrees with Hill et al. (2005), who showed that teachers' mathematical knowledge for teaching was significantly related to student achievement gains. This is relevant in Ayivu East Division, where applying mathematics to real-life situations was the weakest learner indicator (Mean = 1.8) and the City Inspector reported that teachers lack practical application of subject competencies. Hanushek and Rivkin (2010) found substantial variation in teacher quality and noted that credentials such as certification and experience are not closely related to achievement gains, which supports measuring what teachers actually know, as this study did. Goldhaber and Brewer (2000) found that standard subject certification had a significant positive effect on mathematics test scores.

The result is also in line with evidence from African primary schools. Bold et al. (2017) found that teachers' content knowledge has a significant positive effect on achievement, and Bold et al. (2019) attributed about 30% of the learning shortfall relative to the curriculum to gaps in teacher content knowledge. In this study, both low teacher subject expertise (average mean = 2.59) and low learner achievement (average mean = 2.07) were reported, and head teachers and education officials linked weak pupil performance to limited teacher content knowledge, irregular continuous professional development and deployment of teachers outside their specialisations.

The correlation does not prove that low expertise causes low achievement. Other factors, such as those listed under the limitations, may also contribute, and longitudinal research is needed to confirm the direction of the relationship.

Conclusion

There is a positive and significant relationship between teacher subject expertise and learner achievement in primary schools in Ayivu East Division ($r = 0.69$, $p < 0.01$). Pupils taught by teachers with strong mastery of their subjects tend to perform better. Teacher subject expertise is therefore a key determinant of learner performance, and improving teachers' subject mastery can improve pupils' academic outcomes in the division.

Limitations of the Study

Limited geographical scope. Only three schools in Ayivu East Division were studied, which limits generalisation to other divisions and districts.
Time constraints. Data collection was restricted by school schedules and respondents' availability, which may have limited the depth of interview responses.
Respondent bias. Respondents may have given socially desirable answers on sensitive issues such as teaching competence and learner performance, despite assurances of confidentiality.
Resource limitations. Financial and logistical constraints limited the sample size and follow-up interviews.
Document availability and accuracy. Some school records were incomplete, outdated or inconsistent.
Other influences on achievement. Learner achievement is also affected by socioeconomic status, parental support, school infrastructure and learner motivation, which the study did not measure.

Recommendations

The Ministry of Education and Sports and the Arua City Education Department should strengthen subject-specific professional development, particularly in Mathematics,

English and Science, to deepen teachers' subject mastery.

Schools should set up regular internal subject panels and peer-review sessions where teachers share expertise, demonstrate instructional strategies and receive feedback on content delivery.

Teacher deployment should be aligned with subject specialisation so that teachers teach in areas where they have adequate expertise.

Future research should track teacher competence and learner performance over several years, using a longitudinal approach to establish whether gains in teacher subject expertise lead to sustained gains in learner outcomes.

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List of abbreviations

A: Agree
CVI: Content Validity Index
D: Disagree
H_1: Alternative hypothesis
HT1, HT2: Head Teacher 1, Head Teacher 2
p: Probability value
PLE: Primary Leaving Examination
r: Pearson's correlation coefficient
SA: Strongly Agree
SD: Strongly Disagree
SMC: School Management Committee
SPSS: Statistical Package for the Social Sciences
UNEB: Uganda National Examinations Board

UPE: Universal Primary Education

Informed Consent

Written informed consent was obtained from all participants prior to their inclusion in the study. Participants were informed about the purpose of the study, procedures involved, potential risks and benefits, and their right to withdraw at any time without penalty.

Source of funding

The study was not funded

Conflict of interest

There is no conflict of interest.

Availability of data

Data used in this study is available upon request from the corresponding author

Authors contribution

KSP conceptualized the study, developed the methodology, carried out the investigation, wrote the original draft.
MS Supervision, validation, writing- review and editing
All authors approved the final version of the manuscript and agreed to be accountable for the work.

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