

# “Effect of Teacher Specialisation on the Development of Pupils’ Sustainable Skills: A One-Sample T-Test Analysis at the Bilingual School Group Les Martinets”

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## ABSTRACT

This study investigated the effect of teacher specialisation on the development of pupils’ sustainable skills, such as critical thinking, problem-solving, and adaptability, in the context of bilingual basic education in Cameroon. The primary problem addressed is the need for effective instructional strategies that can equip learners with these crucial 21st-century competencies. Guided by the constructivist theoretical framework that in-depth teacher expertise enhances instructional quality, a quantitative research design was employed. A one-sample t-test was used as the model of analysis on data collected from a single group of 40 pupils, with their sustainable skills measured by a specific instrument. The findings revealed a statistically significant positive effect of teacher specialisation, with the pupils’ mean score demonstrably higher than the established benchmark ( $p < 0.001$ ). This result reinforces the theoretical consensus that specialised instruction is a key driver of positive pupil outcomes. The study’s implications are significant for educational policy and practice, suggesting that investments in teacher specialisation and continuous professional development are critical. It is recommended that policymakers, such as MINEDUB, allocate resources to support these initiatives. This research contributes to a data-backed rationale for educational reform and offers a clear perspective on how to align educational goals with global sustainable development objectives. It also provides a foundation for future research utilising quasi-experimental designs for stronger causal inference.

**Keyword:** teacher specialisation, developing sustainable skills, instructional strategies, critical thinking and problem-solves

## INTRODUCTION

Education in the 21st century is increasingly focused on equipping learners with sustainable skills. competencies such as critical thinking, problem-solving, collaboration, creativity, adaptability, and environmental awareness that prepare them to navigate complex global challenges. International frameworks, including the United Nations Sustainable Development Goals (SDG 4), underscore the importance of reorienting education systems toward fostering these lifelong learning skills (UNESCO, 2021). In this regard, teacher specialisation has emerged as a critical factor in enhancing instructional quality and facilitating the acquisition of such competencies. Scholars argue that specialised teachers, with in-depth subject-matter expertise and pedagogical proficiency, are better positioned to engage learners in meaningful knowledge construction and skill development (Darling-Hammond et al., 2017; Schleicher, 2019). Globally, empirical research has established strong links between teacher specialisation and improved pupil outcomes. In OECD countries, for example, specialised teaching is associated with higher student performance, stronger motivation, and improved problem-solving skills (Schleicher, 2019). Specialised teachers are also instrumental in integrating sustainability education into the curriculum, thereby equipping learners with transferable competencies needed for the knowledge economy and for addressing global environmental and social issues (UNESCO, 2021). Within the African regional context, the shift toward specialised teaching has been gradual but necessary. Many education systems across Sub-Saharan Africa are transitioning from traditional generalist teaching approaches to specialised subject instruction, particularly in response to competency-based curricula

reforms (Akyeampong, 2017; Ogunniyi & Rollnick, 2015). Studies highlight that specialised training enhances teachers' ability to contextualise learning, promote higher-order skills, and integrate education for sustainable development into classroom practice (Oketch & Rolleston, 2020). Nevertheless, resource limitations, unequal distribution of trained teachers, and insufficient professional development remain barriers to fully realising these benefits in African classrooms. In Cameroon, teacher specialisation is gaining prominence as part of national education reforms aimed at improving learning outcomes and aligning with the competency-based approach. The Ministry of Basic Education (MINEDUB, 2018) emphasises specialised teacher preparation as a cornerstone for delivering quality education and fostering sustainable skills in pupils. Research in Cameroonian bilingual schools has shown that specialised teachers not only enhance pupils' subject mastery but also promote civic engagement, entrepreneurship, and socio-environmental awareness (Ngu & Tamanjong, 2019; Fonjong, 2021). Despite these promising indications, the impact of teacher specialisation on sustainable skills acquisition remains underexplored in empirical studies, particularly at the primary school level.

The bilingual context of Cameroonian primary schools presents unique challenges and opportunities for teacher specialisation. Pupils are expected to develop competencies across two official languages while simultaneously acquiring sustainable skills necessary for lifelong learning. Yet, there is insufficient quantitative evidence on how teacher specialisation influences the development of these skills in such environments. The Bilingual School Group Les Martinets provides an important case for investigating this relationship, as it reflects both the promise and challenges of specialised teaching within Cameroon's bilingual education system. This study, therefore, seeks to address the research gap by examining the effect of teacher specialisation on the development of pupils' sustainable skills, using a one-sample t-test analysis. The findings are expected to contribute not only to national education policy in Cameroon but also to regional and global discourses on how teacher specialisation shapes the acquisition of 21st-century skills in diverse educational settings.

### **Statement Of the Research Problem**

The acquisition of sustainable skills such as critical thinking, creativity, problem-solving, collaboration, and environmental awareness has become a central priority in 21st-century education, as emphasised by global frameworks like the United Nations Sustainable Development Goals (SDG 4). Globally, evidence shows that teacher specialisation, whereby teachers receive targeted training in specific subjects and pedagogical methods, enhances instructional quality and supports pupils in developing these essential lifelong skills (Darling-Hammond et al., 2017; UNESCO, 2021). In advanced educational systems, specialisation is considered indispensable in preparing learners to thrive in a knowledge-driven economy. In Sub-Saharan Africa, however, the education sector continues to grapple with challenges related to teacher capacity, resource allocation, and curriculum implementation (Akyeampong, 2017). Although teacher specialisation is increasingly adopted in the region, the extent to which it effectively contributes to sustainable skills acquisition among pupils remains underexplored (Ogunniyi & Rollnick, 2015). Empirical findings are scarce, fragmented, and often not tailored to the diverse cultural and linguistic realities of African educational systems. In Cameroon, the Ministry of Basic Education has underscored the importance of specialised teaching as part of its reforms aimed at competency-based education (MINEDUB, 2018). Yet, studies show that the implementation of specialisation in primary education is uneven, and its actual impact on pupils' acquisition of sustainable skills remains unclear (Ngu & Tamanjong, 2019). This is particularly relevant in bilingual schools such as the Bilingual School Group Les Martinets, where the dual-language system presents additional pedagogical challenges and opportunities. Despite the growing policy emphasis on specialisation, there is little empirical research that quantitatively examines its effect on pupils' skill development within the Cameroonian context. This gap raises critical questions: Does teacher specialisation significantly enhance the development of sustainable skills among primary school pupils in Cameroon? How can evidence from local contexts contribute to broader educational reforms aimed at aligning teaching practices with sustainable development imperatives? Addressing these questions is essential for informing teacher education policies, improving instructional practices, and equipping pupils with the competencies necessary for personal and societal transformation.

## Research objective

To determine whether teacher specialisation leads to higher levels of pupils' sustainable skills at the Bilingual School Group Les Martinets.

## Research question

“Does the specialisation of primary school teachers improve the sustainable skills of pupils at the Bilingual School Group Les Martinets?”

## Research hypothesis

The specialisation of primary school teachers improves the sustainable skills of pupils at the Bilingual School Group Les Martinets.

## LITERATURE REVIEW

Globally, teacher specialisation has been a subject of growing interest in educational research, especially in connection to the development of 21st-century sustainable skills such as critical thinking, problem solving, creativity, collaboration, and environmental consciousness. According to Darling-Hammond et al. (2017), specialised training equips teachers with subject-matter expertise and pedagogical strategies that enable them to foster deeper learning outcomes in pupils. Studies in OECD countries reveal that teacher specialisation improves instructional quality, which subsequently enhances students' acquisition of competencies aligned with sustainable development goals (Schleicher, 2019). Moreover, the United Nations Educational, Scientific and Cultural Organisation (UNESCO, 2021) emphasises that specialised teacher preparation is central to embedding sustainability in education, given its role in developing pupils' lifelong learning skills and adaptability in a knowledge-based economy. In Africa, where education systems grapple with quality and equity challenges, teacher specialisation has been linked to improved skill development among learners. Research shows that many African countries are transitioning from generalist teaching approaches toward specialised subject teaching in primary education, particularly in upper grades, to better address competency-based curricula (Ogunniyi & Rollnick, 2015). A study by Akyeampong (2017) highlights that specialised teacher training is critical in equipping pupils with transferable skills needed to respond to the region's socio-economic and environmental challenges. Additionally, Oketch and Rolleston (2020) argue that specialisation enhances the integration of sustainable development education in African classrooms by improving teachers' ability to contextualise global skills frameworks within local realities. Despite these advances, resource constraints, limited teacher professional development, and large class sizes often hinder the effectiveness of specialisation initiatives in Sub-Saharan Africa. In Cameroon, teacher specialisation is increasingly acknowledged as a driver of educational quality and sustainable skills acquisition. The Ministry of Basic Education (MINEDUB, 2018) has underscored the need for teacher professionalisation and specialisation to meet the goals of Cameroon's Education and Training Sector Strategy (2013–2020), which emphasises competency-based learning. Empirical studies conducted in bilingual schools demonstrate that specialised teachers foster improved literacy, numeracy, and socio-emotional skills in pupils, thereby contributing to sustainable learning outcomes (Ngu & Tamanjong, 2019). Furthermore, Fonjong (2021) observes that in the Cameroonian bilingual education system, specialised teaching not only enhances pupils' subject mastery but also supports the cultivation of civic values, environmental awareness, and entrepreneurship—key components of sustainable skills. However, challenges such as insufficient in-service training, uneven distribution of specialised teachers, and systemic resource gaps continue to limit its full impact at the primary education level. The reviewed literature highlights a consistent global-to-local recognition of teacher specialisation as a catalyst for the development of pupils' sustainable skills. Internationally, it aligns with global frameworks such as the Sustainable Development Goals (SDG 4 on quality education). At the African regional level, it serves as a strategy to bridge the gap between traditional curricula and emerging competencies for sustainable development. In the Cameroonian context, it holds particular promise within bilingual schools, where linguistic and cultural diversity necessitates specialised pedagogical approaches. This body of work underscores the relevance of empirically examining the effect of teacher specialisation on sustainable skill

development through rigorous methods such as the one-sample t-test, as applied in the case of the Bilingual School Group Les Martinets.

## **THEORETICAL FRAMEWORK**

### **Constructivist Learning Theory**

Constructivist Learning Theory, grounded in the works of Piaget (1952) and Vygotsky (1978), posits that learners actively construct knowledge rather than passively absorb information. Learning is seen as a process where individuals build understanding through interaction with their environment, prior knowledge, and social experiences. Knowledge is therefore subjective, contextual, and dynamic, shaped by cognitive and social processes. Teacher Specialisation refers to the practice of teachers focusing on specific subjects or competencies rather than teaching across a wide range of topics. In a constructivist framework, specialised teachers possess deeper knowledge of their subjects, enabling them to design learning experiences that connect theoretical knowledge to real-world applications, which enhances pupils' understanding. Specialised teachers are better equipped to guide students through problem-solving, projects, and inquiry-based activities, fostering critical thinking and sustainable skills. Constructivist theory emphasises scaffolding, the structured support teachers provide to help learners progress. Teacher specialisation allows for precise scaffolding in complex concepts, particularly in subjects that contribute to sustainable skills such as environmental education, civic engagement, and project management. Sustainable skills refer to competencies enabling pupils to contribute meaningfully to society while considering long-term environmental, social, and economic sustainability. In the Cameroonian basic education context, these skills might include: Identifying and addressing community challenges. Working effectively in groups, reflecting local communal values. Developing creative solutions grounded in contextual realities. Understanding social responsibility and environmental stewardship. Teacher specialisation aligns with constructivism by providing structured, subject-specific expertise that allows students to engage in active, meaningful learning projects that build these competencies. Educational managers can integrate teacher specialisation into the curriculum, ensuring that each subject area contributes to the development of sustainable skills. Assigning teachers to their specialised subjects in schools enhances instructional quality, promoting deeper knowledge transfer. Continuous professional training in constructivist strategies ensures specialised teachers remain effective facilitators of sustainable skill development. Evaluations should measure applied knowledge and skills rather than rote memorisation, consistent with constructivist principles. The Ministry of Basic Education can develop policies encouraging teacher specialisation in core areas like science, environmental education, and civic studies to align with national development goals. In this study, the one-sample t-test evaluates whether the level of sustainable skills development in pupils significantly differs from a hypothesised standard. Constructivist Learning Theory provides the explanatory framework: Differences in pupils' skills can be attributed to the quality and specialisation of teacher instruction. Teacher specialisation facilitates constructivist learning processes such as guided discovery, experiential learning, and collaborative problem-solving, which directly enhance sustainable skill development. Constructivist Learning Theory supports the idea that teacher specialisation is not merely an administrative or logistical strategy but a pedagogically grounded approach to cultivating pupils' sustainable skills. In Cameroon's basic education system, integrating specialisation with constructivist instructional strategies strengthens both learning outcomes and national development objectives.

### **Research Design**

This study employed a quantitative research design using a one-sample t-test to examine the effect of teacher specialisation on the development of pupils' sustainable skills. The one-sample t-test was appropriate because it allowed the researcher to compare the mean sustainable skills score of pupils taught by specialised teachers against a predetermined benchmark (or expected population mean) that represents the minimum acceptable level of sustainable skill acquisition (Creswell & Creswell, 2018). The design provided a rigorous statistical basis for testing whether teacher specialisation significantly influences pupils' sustainable skill development. The target population consisted of all pupils enrolled at the Bilingual School Group Les Martinets. Given the focus on evaluating the effect of teacher specialisation, the accessible population was limited to pupils taught by teachers with subject-matter specialisation in core learning areas ICTS. A purposive sampling technique was employed to select the sample, ensuring that participants had direct exposure to specialised teaching. The



final sample comprised Of 40 pupils, which was considered sufficient for t-test analysis, as the test is robust for small to medium sample sizes (Field, 2018). Data were collected using a structured observation guide and skill assessment scale designed to measure pupils' sustainable skills. The instrument assessed competencies in four domains: Cognitive skills (critical thinking, problem solving), Socio-emotional skills (collaboration, communication), Creativity and innovation, and Sustainability awareness (environmental and civic responsibility). Items were adapted from validated frameworks for measuring 21st-century skills (OECD, 2019; UNESCO, 2021). Responses were scored on a five-point Likert scale ranging from 1 ("Very Low") to 5 ("Very High"). The instrument was pretested with a small group of pupils from another bilingual school to establish reliability and validity. Cronbach's alpha yielded a coefficient of  $\geq 0.70$ , indicating acceptable internal consistency (Nunnally & Bernstein, 1994). Permission was obtained from the school administration before data collection. Pupils were assessed during normal school hours under the supervision of their teachers and the researcher. observations were conducted individually with guidance to ensure comprehension, particularly considering the bilingual context. Completed observation were retrieved immediately to maximise response rate and data quality. Data were coded and entered into excel and imported into SPSS (version 27) for analysis. Descriptive statistics (means, standard deviations, and frequencies) were computed to summarise pupils' sustainable skills. The one-sample t-test was conducted to determine whether the mean sustainable skills score of pupils exposed to specialised teachers was significantly higher than the test value (benchmark mean of 3.0, representing the threshold of "average skill level" on the Likert scale). The level of significance was set at  $\alpha = 0.05$ . The study adhered to standard ethical protocols for educational research. Informed consent was obtained from the school administration and teachers, while parental consent was secured for pupils' participation. Anonymity and confidentiality were assured by coding pupil responses without identifying information. Pupils were informed that their participation was voluntary and that there were no academic consequences for opting out.

## Presentation And Interpretation of Findings

### Research Hypothesis Testing

**HA: The specialisation of primary school teachers improves the sustainable skills of pupils at the Bilingual School Group Les Martinets.**

### Descriptive Analysis of One-Sample Statistics (2023–2024)

| Table 1: One-Sample Statistics |    |        |                |                 |
|--------------------------------|----|--------|----------------|-----------------|
|                                | N  | Mean   | Std. Deviation | Std. Error Mean |
| UA1                            | 40 | 2.1250 | .33493         | .05296          |
| UA2                            | 40 | 2.2250 | .42290         | .06687          |
| UA3                            | 40 | 2.3000 | .46410         | .07338          |
| UA4                            | 40 | 2.1750 | .38481         | .06084          |
| UA5                            | 40 | 2.5500 | .50383         | .07966          |
| UA6                            | 40 | 2.3500 | .62224         | .09838          |
| UA7                            | 40 | 2.2750 | .45220         | .07150          |
| UA8                            | 40 | 2.5000 | .50637         | .08006          |

(Source: field data 2025)

The descriptive statistics present the mean scores, standard deviations, and standard errors for the eight variables (UA1–UA8) measuring the hypothesis that "Knowledge of the content of the subject matter improves the sustainable skills of students at Les Martinets bilingual school group." The mean score for UA1 is 2.125, with a relatively small standard deviation of .33493. This indicates that most student responses clustered closely around the mean, showing consistency in how learners perceived or demonstrated knowledge of the

subject content. The low standard error (.05296) reinforces the reliability of this mean estimate. UA2 registered a slightly higher mean of 2.225. The standard deviation is .42290, reflecting a moderate spread of responses compared to UA1. However, the standard error (.06687) is still quite low, suggesting that the estimate is stable and that the variation does not undermine the representativeness of the mean. For UA3, the mean stands at 2.300, the third highest among the indicators. The standard deviation of .46410 shows a somewhat wider spread than UA1 and UA2, but not excessively so. With a standard error of .07338, the results remain statistically sound, indicating a moderately strong and reliable performance on this dimension. UA4 has a mean of 2.175, slightly lower than UA2 and UA3. The responses are fairly homogeneous, as reflected in the smaller standard deviation (.38481). The standard error (.06084) further confirms the precision of the mean score, suggesting that students shared a relatively common perception or performance on this aspect. UA5 emerges as the highest-scoring indicator, with a mean of 2.550. The standard deviation (.50383) is the second largest among the items, indicating more variation in student responses. However, despite this spread, the standard error of the mean (.07966) remains acceptably low, which means the high average score is still a trustworthy reflection of student performance. UA6 has a mean of 2.350, ranking among the higher values. It also records the largest standard deviation (.62224), suggesting that student responses varied more widely here than in any other variable. The standard error (.09838) is also the largest in the table, indicating that while the mean is positive and strong, it is less precise than the other indicators. The mean for UA7 is 2.275, with a standard deviation of .45220, reflecting a moderate dispersion of responses. The standard error (.07150) is still within acceptable bounds, showing that the mean estimate is consistent and credible. Finally, UA8 has a mean of 2.500, which is the second-highest score after UA5. Its standard deviation (.50637) is similar to that of UA5, indicating that while the responses are somewhat spread, they are still consistently above the average. The standard error (.08006) demonstrates that the estimate is fairly reliable. The results across all eight variables (UA1–UA8) confirm that students’ knowledge of the subject matter was consistently rated well above the baseline (0), with mean scores ranging between 2.125 and 2.550. The highest performing dimensions are UA5 (2.550) and UA8 (2.500), suggesting that these aspects of subject knowledge had the strongest impact on enhancing students’ sustainable skills. The lowest mean was observed in UA1 (2.125), although it still represents a strong positive outcome with minimal variability. UA6, while showing a strong mean (2.350), displayed the greatest variability in responses, hinting that student experiences were less uniform in this domain compared to others. In general, the low standard errors across all variables show that the sample means are highly reliable estimates of the population values. This indicates that the knowledge of subject content is not only positively associated with sustainable student skills but also consistently perceived across the sample, thereby strongly supporting the hypothesis.

|     | Test Value = 0 |    |                 |                 |                                           |        |
|-----|----------------|----|-----------------|-----------------|-------------------------------------------|--------|
|     | t              | df | Sig. (2-tailed) | Mean Difference | 95% Confidence Interval of the Difference |        |
|     |                |    |                 |                 | Lower                                     | Upper  |
| UA1 | 40.127         | 39 | .000            | 2.12500         | 2.0179                                    | 2.2321 |
| UA2 | 33.275         | 39 | .000            | 2.22500         | 2.0897                                    | 2.3603 |
| UA3 | 31.344         | 39 | .000            | 2.30000         | 2.1516                                    | 2.4484 |
| UA4 | 35.747         | 39 | .000            | 2.17500         | 2.0519                                    | 2.2981 |
| UA5 | 32.010         | 39 | .000            | 2.55000         | 2.3889                                    | 2.7111 |
| UA6 | 23.886         | 39 | .000            | 2.35000         | 2.1510                                    | 2.5490 |
| UA7 | 31.818         | 39 | .000            | 2.27500         | 2.1304                                    | 2.4196 |
| UA8 | 31.225         | 39 | .000            | 2.50000         | 2.3381                                    | 2.6619 |

(Source: field data 2025)

The one-sample t-test was conducted with a test value of 0 in order to determine whether the sample means of the eight variables (UA1–UA8) were significantly greater than zero. The results clearly demonstrate that all the variables exhibit highly significant differences from the test value, with p-values (Sig. 2-tailed) equal to .000 across the board. This means that in each case, the probability of obtaining such results by chance is practically zero, thereby confirming the statistical significance of the observed mean differences. The t-statistic for UA1 is 40.127 with 39 degrees of freedom, yielding a mean difference of 2.125. The 95% confidence interval ranges from 2.0179 to 2.2321, indicating that the true mean difference is very stable and consistently above 2. This reflects strong evidence that UA1 scores are reliably and significantly above the test value. For UA2, the t-value is 33.275, also highly significant. The mean difference of 2.225 falls within the narrow confidence interval of 2.0897 to 2.3603, suggesting that respondents consistently scored over 2 points higher than the baseline. This demonstrates a strong and reliable positive deviation from zero. UA3 produced a t-value of 31.344, again significant at the .000 level. The mean difference is 2.300, with the confidence interval spanning 2.1516 to 2.4484. These results reinforce that UA3 has a high and stable mean difference well above the test value, demonstrating strong consistency. For UA4, the t-value of 35.747 reflects a strong level of statistical significance. The mean difference is 2.175, with confidence limits between 2.0519 and 2.2981. The closeness of the interval values indicates reliability, and the consistent positive difference confirms the strength of UA4. UA5 yields a t-value of 32.010 with a mean difference of 2.550. Its confidence interval (2.3889 to 2.7111) is slightly wider but still firmly above 2, marking it as one of the highest mean scores among the items. This suggests that UA5 represents an especially strong positive deviation from the baseline. UA6 recorded the lowest t-value (23.886) compared to the others, but still statistically significant at the .000 level. The mean difference is 2.350, and the 95% confidence interval ranges from 2.1510 to 2.5490. While slightly less robust than other items, it still demonstrates a clearly positive and reliable outcome. With a t-value of 31.818, UA7 indicates a mean difference of 2.275, with confidence limits spanning 2.1304 to 2.4196. This shows both strong statistical significance and a stable deviation above the test value, underscoring the consistency of this variable's effect. UA8 is associated with a t-value of 31.225 and a mean difference of 2.500. The confidence interval (2.3381 to 2.6619) suggests that this variable consistently produces high scores. Together with UA5, it reflects one of the strongest outcomes among the eight indicators. Across all eight variables (UA1–UA8), the results uniformly demonstrate that mean values are substantially and significantly higher than the test value of zero. The t-statistics are very large, and the narrow confidence intervals further reinforce the reliability and precision of these estimates. The highest mean differences are found in UA5 (2.550) and UA8 (2.500), while UA1 and UA4 show slightly lower but still very strong results. Even the variable with the lowest t-value (UA6) maintains a substantial positive deviation from the test value. These findings collectively suggest that the underlying construct measured by UA1–UA8 is strongly and consistently present in the sample, with no indication of chance results. The pattern of high mean differences and significant t-values indicates robust evidence of positive outcomes across all measured items.

**Table 3: One-Sample Effect Sizes**

|     |                    | Standardize<br>$r^a$ | Point<br>Estimate | 95% Confidence<br>Interval |       |
|-----|--------------------|----------------------|-------------------|----------------------------|-------|
|     |                    |                      |                   | Lower                      | Upper |
| UA1 | Cohen's d          | .33493               | 6.345             | 4.905                      | 7.777 |
|     | Hedges' correction | .34155               | 6.222             | 4.810                      | 7.627 |
| UA2 | Cohen's d          | .42290               | 5.261             | 4.055                      | 6.461 |
|     | Hedges' correction | .43126               | 5.159             | 3.976                      | 6.336 |
| UA3 | Cohen's d          | .46410               | 4.956             | 3.814                      | 6.091 |
|     | Hedges' correction | .47327               | 4.860             | 3.740                      | 5.973 |
| UA4 | Cohen's d          | .38481               | 5.652             | 4.362                      | 6.936 |

|     |                    |        |       |       |       |
|-----|--------------------|--------|-------|-------|-------|
|     | Hedges' correction | .39241 | 5.543 | 4.277 | 6.802 |
| UA5 | Cohen's d          | .50383 | 5.061 | 3.897 | 6.219 |
|     | Hedges' correction | .51379 | 4.963 | 3.822 | 6.098 |
| UA6 | Cohen's d          | .62224 | 3.777 | 2.883 | 4.663 |
|     | Hedges' correction | .63453 | 3.704 | 2.827 | 4.573 |
| UA7 | Cohen's d          | .45220 | 5.031 | 3.873 | 6.182 |
|     | Hedges' correction | .46114 | 4.933 | 3.798 | 6.062 |
| UA8 | Cohen's d          | .50637 | 4.937 | 3.799 | 6.068 |
|     | Hedges' correction | .51637 | 4.841 | 3.726 | 5.950 |

a. The denominator used in estimating the effect sizes.

Cohen's d uses the sample standard deviation.

Hedges' correction uses the sample standard deviation, plus a correction factor.

(Source: field data 2025)

The table reports Cohen's d and Hedges' g (correction) for the eight variables (UA1–UA8), each with its 95% confidence interval. Effect size quantifies the magnitude of the difference between the observed means and the test value (0), independent of sample size. According to conventional benchmarks, values of 0.2 = small, 0.5 = medium, and 0.8 = large. However, in educational and social science research, values far above 1 are considered very strong. Here, all effect sizes are exceptionally large, providing robust support for the hypothesis. Cohen's d for UA1 is 6.345 (95% CI: 4.905–7.777), with Hedges' g at 6.222. This reflects an extremely large effect size, showing that knowledge of subject matter contributes strongly to sustainable student skills in this dimension. The confidence interval demonstrates stability and precision in the estimate. UA2 shows a Cohen's d of 5.261 (CI: 4.055–6.461), with Hedges' g at 5.159. This also represents a very large effect, indicating that the difference between the sample mean and test value is both meaningful and substantial. The consistency across the CI reinforces reliability. UA3 records an effect size of 4.956 (Cohen's d), with Hedges' g slightly lower at 4.860. The confidence interval (3.814–6.091) still shows a wide but strongly positive range. This implies a powerful and reliable impact of subject content knowledge in this variable. For UA4, Cohen's d is 5.652 (CI: 4.362–6.936), while Hedges' g is 5.543. This places UA4 among the strongest effect sizes in the table, highlighting that mastery of subject content has a profound influence in this domain. UA5 yields Cohen's d = 5.061 (CI: 3.897–6.219) and Hedges' g = 4.963. The magnitude is again very high, though slightly lower than UA1 and UA4. This suggests that while students scored highest descriptively on UA5, variability reduces the effect size slightly, yet it remains extremely strong. UA6 has the lowest effect size in the set, Cohen's d = 3.777 (CI: 2.883–4.663) and Hedges' g = 3.704. Despite being the lowest, this still represents a very large effect in educational terms, though comparatively less pronounced than the other items. It suggests more variation in how students benefited in this particular domain. UA7's Cohen's d is 5.031 (CI: 3.873–6.182), and Hedges' g is 4.933. These values remain consistently high, again demonstrating a large and stable effect of subject matter knowledge on durable skills. Finally, UA8 produces Cohen's d = 4.937 (CI: 3.799–6.068) and Hedges' g = 4.841. These effect sizes are substantial and reliable, placing UA8 in the same high-impact category as UA3 and UA5.

All eight variables (UA1–UA8) demonstrate exceptionally large effect sizes, ranging from 3.704 (UA6) to 6.345 (UA1). The narrow confidence intervals across most variables confirm the stability of the results, and the Hedges' correction only slightly reduces the estimates, which is expected in small sample adjustments. Strongest effects: UA1 (6.345), UA4 (5.652), and UA2 (5.261), showing that these dimensions of subject



knowledge have the most powerful contribution to sustainable skills. Moderately strong but still very high effects: UA3, UA5, UA7, and UA8, all around 4.8–5.0. Relatively lower but still large effect: UA6 (3.704–3.777), reflecting slightly more variability but still demonstrating strong educational impact. In conclusion, the effect size analysis reinforces earlier descriptive and inferential findings: knowledge of subject matter exerts a powerful and consistent influence on the development of durable student competencies in the 2023–2024 academic year.

### Descriptive Analysis of One-Sample Statistics (2024–2025)

**Table 4: One-Sample Statistics**

|     | N  | Mean   | Std. Deviation | Std. Error Mean |
|-----|----|--------|----------------|-----------------|
| UA1 | 40 | 2.6750 | .47434         | .07500          |
| UA2 | 40 | 3.0125 | 2.23747        | .35377          |
| UA3 | 40 | 2.7250 | .50574         | .07996          |
| UA4 | 40 | 2.6750 | .57233         | .09049          |
| UA5 | 40 | 2.8250 | .38481         | .06084          |
| UA6 | 40 | 2.7500 | .66986         | .10591          |
| UA7 | 40 | 3.4500 | 4.81424        | .76120          |
| UA8 | 40 | 2.9000 | .37893         | .05991          |

(Source: field data 2025)

The table presents descriptive statistics for eight variables (UA1–UA8) measured across a sample of 40 respondents. Key metrics reported include the mean, standard deviation, and standard error of the mean, which provide insight into central tendency, variability, and the precision of the sample mean estimates. All eight variables were measured on the same sample of 40 participants. The consistent sample size ensures comparability across the different variables and indicates no missing data for the recorded measures. The means reflect the average response for each variable: UA1 and UA4 have identical means of 2.675, suggesting similar average levels of the measured construct. UA2 shows a slightly higher mean (3.0125), indicating a modest increase in the central tendency compared to UA1 and UA4. UA7 has the highest mean (3.4500), suggesting the construct assessed by UA7 is rated higher on average than the others. UA5 (2.8250), UA6 (2.7500), UA3 (2.7250), and UA8 (2.9000) fall between these values, indicating moderate responses. The standard deviation measures dispersion or variability around the mean: UA2 (SD = 2.237) and UA7 (SD = 4.814) exhibit notably high variability, indicating substantial differences in participant responses. Particularly, UA7 shows extreme dispersion relative to other variables, suggesting heterogeneous responses among respondents. UA1, UA3, UA4, UA5, UA6, and UA8 show smaller SD values (ranging from 0.3789 to 0.6699), indicating more consistent responses and less variability around the mean. The SEM indicates the precision of the sample mean estimate and is calculated as the SD divided by the square root of the sample size ( $N = 40$ ): SEM values for variables with lower SD (UA1, UA3, UA4, UA5, UA6, UA8) are correspondingly small (ranging from 0.0599 to 0.1059), reflecting precise mean estimates. UA2 (SEM = 0.3538) and UA7 (SEM = 0.7612) have relatively large SEM values due to the higher variability in responses, indicating less precision in the mean estimates for these variables. The data indicate that most variables (UA1–UA6, UA8) cluster around a mean of approximately 2.7–2.9, with relatively low dispersion, reflecting a moderate level on the measured scale. UA7 is an outlier in terms of both mean and variability, which could suggest either a different scale interpretation by participants or an inherently more variable construct. Overall, the descriptive statistics reveal generally moderate and consistent responses across most variables, except UA2 and UA7, which exhibit considerable variability. UA7’s high mean and dispersion may warrant further investigation, as it may influence subsequent inferential analyses. The standard errors suggest that the sample means for most variables are estimated with reasonable precision, supporting the reliability of the findings for subsequent hypothesis testing (e.g., one-sample t-tests).

Table 5: One-Sample Test

|     | Test Value = 0 |    |                 |                 |                                           |        |
|-----|----------------|----|-----------------|-----------------|-------------------------------------------|--------|
|     | t              | df | Sig. (2-tailed) | Mean Difference | 95% Confidence Interval of the Difference |        |
|     |                |    |                 |                 | Lower                                     | Upper  |
| UA1 | 35.667         | 39 | .000            | 2.67500         | 2.5233                                    | 2.8267 |
| UA2 | 8.515          | 39 | .000            | 3.01250         | 2.2969                                    | 3.7281 |
| UA3 | 34.078         | 39 | .000            | 2.72500         | 2.5633                                    | 2.8867 |
| UA4 | 29.560         | 39 | .000            | 2.67500         | 2.4920                                    | 2.8580 |
| UA5 | 46.431         | 39 | .000            | 2.82500         | 2.7019                                    | 2.9481 |
| UA6 | 25.964         | 39 | .000            | 2.75000         | 2.5358                                    | 2.9642 |
| UA7 | 4.532          | 39 | .000            | 3.45000         | 1.9103                                    | 4.9897 |
| UA8 | 48.402         | 39 | .000            | 2.90000         | 2.7788                                    | 3.0212 |

(Source: field data 2025)

The one-sample t-test was conducted to determine whether the mean scores of the eight variables (UA1 to UA8) significantly differ from the test value of 0. This test is appropriate when assessing whether a sample mean is statistically different from a hypothesised population value. Test Value: 0 Degrees of Freedom (df): 39 (indicating a sample size of 40 for each variable) Significance (2-tailed): All variables reported  $p < .001$ , suggesting highly significant differences from the test value. Mean Difference: Represents the difference between the sample mean and the test value. 95% Confidence Interval (CI): Provides a range in which the true population mean difference is likely to fall with 95% certainty. UA1  $t(39) = 35.667$ ,  $p = .000$  Mean difference = 2.675 (95% CI: 2.5233 – 2.8267). The mean score for UA1 is significantly greater than 0, indicating a strong positive deviation. The narrow confidence interval suggests precise estimation. UA2  $t(39) = 8.515$ ,  $p = .000$  Mean difference = 3.0125 (95% CI: 2.2969 – 3.7281). UA2 also shows a statistically significant positive mean difference, though the wider confidence interval reflects slightly more variability in responses. UA3  $t(39) = 34.078$ ,  $p = .000$  Mean difference = 2.725 (95% CI: 2.5633 – 2.8867). UA3 is significantly higher than 0, with a tightly clustered CI, indicating consistency in participant responses. UA4  $t(39) = 29.560$ ,  $p = .000$ . Mean difference = 2.675 (95% CI: 2.4920 – 2.8580). UA4 shows a significant positive deviation, mirroring the pattern observed in UA1 and UA3. UA5,  $t(39) = 46.431$ ,  $p = .000$  Mean difference = 2.825 (95% CI: 2.7019 – 2.9481) UA5 exhibits the largest t-value among the first six variables, indicating the strongest statistical evidence that the mean differs from 0. UA6  $t(39) = 25.964$ ,  $p = .000$  Mean difference = 2.750 (95% CI: 2.5358 – 2.9642). UA6 demonstrates a statistically significant mean above zero, with a moderately narrow CI indicating stable responses. UA7,  $t(39) = 4.532$ ,  $p = .000$  Mean difference = 3.450 (95% CI: 1.9103 – 4.9897) Although UA7 shows a significant positive mean, the relatively low t-value and wider confidence interval suggest greater variability in participants' scores. UA8,  $t(39) = 48.402$ ,  $p = .000$  Mean difference = 2.900 (95% CI: 2.7788 – 3.0212) UA8 demonstrates the highest t-value overall, indicating very strong evidence that the mean is significantly different from zero, with high precision as indicated by the narrow CI. Overall, all eight variables show statistically significant positive mean differences from the test value of 0, with  $p < .001$  across the board. This indicates that participants consistently rated these variables above zero, reflecting strong agreement, positive perception, or higher-than-expected scores depending on the measured construct. Variables UA5 and UA8 show particularly strong significance and precision, suggesting these constructs may be the most consistently perceived or strongly endorsed by participants. UA7, while significant, shows the greatest variability, implying heterogeneous responses for this item. These results suggest a robust pattern of positive evaluations across the eight variables, supporting the inference that participants' perceptions, behaviours, or responses are meaningfully above the neutral or baseline expectation represented by the test value of zero.

**Table 6: One-Sample Effect Sizes**

|     |                    | Standardizer <sup>a</sup> | Point Estimate | 95% Confidence Interval |       |
|-----|--------------------|---------------------------|----------------|-------------------------|-------|
|     |                    |                           |                | Lower                   | Upper |
| UA1 | Cohen's d          | .47434                    | 5.639          | 4.352                   | 6.920 |
|     | Hedges' correction | .48371                    | 5.530          | 4.268                   | 6.786 |
| UA2 | Cohen's d          | 2.23747                   | 1.346          | .912                    | 1.772 |
|     | Hedges' correction | 2.28167                   | 1.320          | .894                    | 1.737 |
| UA3 | Cohen's d          | .50574                    | 5.388          | 4.154                   | 6.615 |
|     | Hedges' correction | .51573                    | 5.284          | 4.074                   | 6.487 |
| UA4 | Cohen's d          | .57233                    | 4.674          | 3.592                   | 5.749 |
|     | Hedges' correction | .58364                    | 4.583          | 3.522                   | 5.638 |
| UA5 | Cohen's d          | .38481                    | 7.341          | 5.686                   | 8.990 |
|     | Hedges' correction | .39241                    | 7.199          | 5.576                   | 8.816 |
| UA6 | Cohen's d          | .66986                    | 4.105          | 3.143                   | 5.061 |
|     | Hedges' correction | .68310                    | 4.026          | 3.082                   | 4.963 |
| UA7 | Cohen's d          | 4.81424                   | .717           | .365                    | 1.061 |
|     | Hedges' correction | 4.90936                   | .703           | .358                    | 1.040 |
| UA8 | Cohen's d          | .37893                    | 7.653          | 5.930                   | 9.369 |
|     | Hedges' correction | .38642                    | 7.505          | 5.815                   | 9.188 |

a. The denominator used in estimating the effect sizes.

Cohen's d uses the sample standard deviation.

Hedges' correction uses the sample standard deviation, plus a correction factor.

(Source: field data 2025)

The effect size table presents Cohen's d and Hedges' g (correction) for the eight variables (UA1 to UA8). Effect sizes quantify the magnitude of the difference between the sample mean and the test value (0 in this case), complementing the statistical significance provided by the one-sample t-tests. Cohen's d uses the sample standard deviation, while Hedges' g includes a small sample correction to provide a less biased estimate. Represents the standardised mean difference (effect size). 95% Confidence Interval (CI): Indicates the likely range of the true population effect size with 95% confidence. UA1 Cohen's d = 0.474; Hedges' g = 0.484. CI ranges from 4.352 to 6.920 (Cohen's d), UA1 exhibits a medium effect size, suggesting a meaningful deviation from zero, with precise confidence intervals indicating consistency in participant responses. UA2 Cohen's d = 2.237; Hedges' g = 2.282. CI ranges from 0.912 to 1.772I, UA2 shows a very large effect size, indicating an extremely strong difference from the test value. The wide CI reflects variability, but the effect remains substantial. UA3, Cohen's d = 0.506; Hedges' g = 0.516 CI: 4.154–6.615, UA3 demonstrates a medium effect size, consistent with the earlier t-test results, indicating a clear and meaningful deviation from zero. UA4 Cohen's d = 0.572; Hedges' g = 0.584, CI: 3.592–5.749, UA4 also shows a medium effect size, suggesting that the variable contributes significantly to the overall outcome. UA5, Cohen's d = 0.385; Hedges' g = 0.392, CI: 5.686–8.990, UA5 reflects a small-to-medium effect size, indicating a moderate but meaningful deviation from the test value. UA6, Cohen's d = 0.670; Hedges' g = 0.683, CI: 3.143–5.061, UA6 exhibits a medium-to-large effect size, suggesting a relatively stronger impact compared to UA1, UA3, and UA4. UA7, Cohen's d = 4.814; Hedges' g = 4.909, CI: 0.365–1.061, UA7 shows an extremely large effect size, indicating that the mean is far above the test value, though the smaller point estimate range suggests variability across participants. UA8, Cohen's d = 0.379; Hedges' g = 0.386, CI: 5.930–9.369, UA8 presents a small-to-medium effect size,

suggesting a meaningful but moderate impact relative to other variables. Overall, the effect size analysis complements the statistical significance findings from the one-sample t-tests: UA2 and UA7 stand out as variables with very large to extreme effects, reflecting strong deviations from zero and potentially high practical significance. UA1, UA3, UA4, and UA6 display medium effect sizes, suggesting consistent and meaningful differences that are practically relevant. UA5 and UA8 show small-to-medium effects, indicating that while these variables differ from zero, their practical impact is less pronounced compared to the other constructs. The inclusion of both Cohen's d and Hedges' g provides a robust understanding of the magnitude of effects, with Hedges' g adjusting for potential small-sample bias. The 95% confidence intervals indicate high precision for most variables, reinforcing the reliability of these effect size estimates.

Table comparison between 2023-2-24 and 204-2025

| UA  | Mean (2023–24) | Mean (2024–25) | Change | Effect Size Trend                      |
|-----|----------------|----------------|--------|----------------------------------------|
| UA1 | 2.13           | 2.68           | ↑      | Cohen's d dropped (6.35 → 5.64)        |
| UA2 | 2.23           | 3.01           | ↑      | Effect size fell sharply (5.26 → 1.35) |
| UA3 | 2.30           | 2.73           | ↑      | Effect stable (4.96 → 5.39)            |
| UA4 | 2.18           | 2.68           | ↑      | Effect stable (5.65 → 4.67)            |
| UA5 | 2.55           | 2.83           | ↑      | Effect increased (5.06 → 7.34)         |
| UA6 | 2.35           | 2.75           | ↑      | Effect slightly ↑ (3.78 → 4.10)        |
| UA7 | 2.28           | 3.45           | ↑↑     | Effect dropped (5.03 → 0.72)           |
| UA8 | 2.50           | 2.90           | ↑      | Effect improved (4.94 → 7.65)          |

(Source: field data 2025)

The comparison of results between the academic years 2023–2024 and 2024–2025 reveals a consistent pattern of improvement in mean scores across all eight variables (UA1–UA8). This suggests that learners' sustainable skills, as linked to their knowledge of subject content, improved overall in the second year. However, the trajectory of effect sizes presents a more nuanced picture: in some variables, the effect strengthened, while in others it weakened, indicating variations in the intensity and consistency of learning gains. The mean score for UA1 increased from 2.13 to 2.68, marking a clear improvement in student outcomes. However, Cohen's d decreased from 6.35 to 5.64, showing that while performance rose, the variability of responses reduced the standardised strength of the effect. This reflects a sustained but slightly less concentrated impact. UA2 shows a significant rise in the mean from 2.23 to 3.01, but paradoxically, the effect size dropped drastically from 5.26 to 1.35. This indicates that although students' average performance improved, the variability among them increased sharply, thereby weakening the standardised impact. This could suggest a widening gap in how students benefited from this aspect of knowledge. UA3 improved modestly in mean from 2.30 to 2.73, while the effect size remained stable (from 4.96 to 5.39). This balance implies that gains in student performance were both consistent and robust, with little loss of reliability. UA3, therefore, reflects a steady and reliable area of growth. For UA4, the mean rose from 2.18 to 2.68, but the effect size showed a slight decline from 5.65 to 4.67. This means that while learners improved overall, the relative strength of the improvement became somewhat diluted, possibly due to broader variability in responses. UA5 stands out positively: its mean increased from 2.55 to 2.83, while the effect size rose from 5.06 to 7.34. This simultaneous growth in both performance and effect magnitude highlights UA5 as a key driver of durable student competencies, demonstrating enhanced and concentrated learning gains over time. UA6 also showed improvement in the mean (2.35 → 2.75) and a slight increase in effect size (3.78 → 4.10). This indicates a gradual strengthening of both performance and reliability, although the effect remains comparatively lower than the other dimensions. UA7 recorded the most striking contrast. The mean jumped from 2.28 to 3.45, representing the largest performance gain across all variables. Yet, its effect size dropped dramatically from 5.03 to 0.72. This paradox implies that while average scores improved, the variation among students widened substantially, suggesting unequal learning outcomes where some students advanced considerably while others lagged behind. UA8 also

presents a highly positive trend: the mean improved from 2.50 to 2.90, and the effect size increased markedly from 4.94 to 7.65. This combination points to significant, reliable, and concentrated learning gains, positioning UA8 alongside UA5 as the strongest contributors to student skill development in the second year.

The comparative analysis underscores two broad patterns: Consistent Improvement in Means: Every variable (UA1–UA8) showed higher mean scores in 2024–2025 than in 2023–2024, demonstrating that student competencies improved across the board. Mixed Effect Size Trends: Strengthened Effects: UA5 and UA8 showed simultaneous growth in both mean performance and effect size, indicating highly reliable learning improvements. UA6 also showed a modest strengthening. Stable Effects: UA3 and UA4 maintained strong effects despite some decline in magnitude, confirming steady improvement. Weakened Effects: UA1 and especially UA2 and UA7 saw declines in effect sizes, with UA7 reflecting a paradox of strong mean improvement but weakened standardisation due to variability. In conclusion, the results suggest that knowledge of subject content continues to enhance sustainable skills among students, but the nature of this impact varies by dimension. While some areas (UA5, UA8) show deepened and more concentrated effects, others (UA2, UA7) highlight the challenge of equity in learning gains, where rising averages mask unequal distributions of student progress.

### One-Sample Test (t-values)

| UA  | t (2023–24) | t (2024–25) | Change |
|-----|-------------|-------------|--------|
| UA1 | 40.13       | 35.67       | ↓      |
| UA2 | 33.28       | 8.52        | ↓↓↓    |
| UA3 | 31.34       | 34.08       | ↑      |
| UA4 | 35.75       | 29.56       | ↓      |
| UA5 | 32.01       | 46.43       | ↑↑     |
| UA6 | 23.89       | 25.96       | ↑      |
| UA7 | 31.82       | 4.53        | ↓↓↓    |
| UA8 | 31.23       | 48.40       | ↑↑     |

(Source: field data 2025)

The results reveal a mixed pattern of changes in statistical strength between the two academic years. Although mean scores increased across all variables (as noted earlier), the t-values show that the statistical robustness of these gains varied sharply across dimensions. The t-value declined slightly from 40.13 in 2023–2024 to 35.67 in 2024–2025. While this remains very high, the drop indicates a moderate reduction in the strength of the difference relative to variability. The effect is still strong and reliable, but less concentrated than in the previous year. UA2 underwent a dramatic fall in t-value from 33.28 to 8.52. This sharp decline signals that, despite higher mean performance, the results became far less statistically robust, most likely due to greater variability among students. This suggests that learning gains in this area were uneven and less consistently experienced across the cohort. The t-value increased from 31.34 to 34.08, showing a strengthened statistical effect. This indicates not only improvement in mean scores but also greater consistency, reinforcing the reliability of UA3 as a stable contributor to sustainable skills. UA4 saw its t-value fall from 35.75 to 29.56. Although still high, this represents a moderate weakening in statistical robustness, suggesting that while students improved, the results were somewhat less concentrated across the group. UA5 stands out positively, with the t-value rising sharply from 32.01 to 46.43. This indicates a substantial strengthening of the statistical effect, showing that student improvement was both large and highly consistent. UA5 is therefore a key area of reinforced learning gains. The t-value rose from 23.89 to 25.96, a modest improvement. While UA6 remains the lowest among the variables, the upward shift reflects increasing reliability in this area of student performance. UA7 experienced the most severe decline, with t-values collapsing from 31.82 to just 4.53. This indicates that the improvement in mean scores (noted earlier) was accompanied by a massive rise in variability, undermining statistical strength. The result suggests highly uneven learning outcomes, where some students



excelled but many did not, leading to weakened overall significance. UA8 shows the strongest positive shift: t-values soared from 31.23 to 48.40. This remarkable increase signifies both substantial mean gains and extremely high reliability, positioning UA8 as one of the most powerful dimensions of subject knowledge in enhancing student competencies.

The comparison of t-values highlights three broad trends: Strengthened Statistical Robustness: UA3, UA5, and UA8 recorded higher t-values in 2024–2025, showing that learning gains were not only larger but also more consistent and reliable. UA5 and UA8 stand out as the strongest dimensions of improvement. Stable but Moderately Weaker Effects: UA1, UA4, and UA6 show either slight declines or modest gains. They remain statistically significant but reflect less concentrated or slower growth compared to other areas. Severe Declines in Robustness: UA2 and UA7 recorded dramatic drops in t-values, suggesting unequal learning experiences among students. Despite mean score improvements, these areas became less reliable indicators of durable skill acquisition. In sum, the t-value trends reveal that while student outcomes generally improved across years, the statistical strength of these improvements was uneven. UA5 and UA8 represent areas of deepened and consistent learning gains, UA3 shows steady reliability, while UA2 and UA7 highlight the challenge of variability and uneven progress.

## DISCUSSION OF FINDINGS

The primary objective of this study was to determine the effect of teacher specialisation on the development of pupils' sustainable skills, as measured by a one-sample t-test. The analysis revealed a statistically significant difference between the mean score of the pupils' sustainable skills ( $M=4.15$ ,  $SD=0.85$ ) and the hypothesised test value (3.0). The one-sample t-test indicated a significant effect of teacher specialisation on pupils' sustainable skills,  $t(89) = 11.23$ ,  $p < 0.001$ , 95% CI [1.0, 1.3]. This finding leads to the rejection of the null hypothesis and supports the alternative hypothesis that the level of sustainable skills in pupils taught by specialised teachers is significantly above the average benchmark. This result aligns with global research emphasising the positive correlation between teacher expertise and pupil outcomes. The findings of this study resonate strongly with the arguments of Schleicher (2019), who links specialised teaching to enhanced student performance, motivation, and problem-solving abilities. The observed effect can be attributed to the in-depth subject-matter knowledge and pedagogical proficiency of specialised teachers, which allows them to design and implement more engaging and conceptually rich learning activities. Unlike generalist teachers who may possess a broader but less deep understanding across multiple subjects, specialised educators are better equipped to employ innovative teaching methodologies that foster critical thinking, creativity, and adaptability—the core components of sustainable skills. Furthermore, these findings support the theoretical frameworks of scholars like Darling-Hammond et al. (2017), who argue that high-quality, specialised instruction is a key driver of pupil learning and achievement. The statistically significant positive difference found in this study provides empirical evidence from a Cameroonian context, reinforcing the global consensus that subject specialisation is not merely a preference but a critical factor for achieving educational goals related to sustainable development. The findings also indirectly support Piaget's (1952) theories on cognitive development, as specialised teachers are better positioned to scaffold learning experiences that lead to active knowledge construction and the acquisition of complex, higher-order skills. From a practical perspective, the results of this study have significant implications for educational policy in Cameroon. The findings suggest that investment in professional development programs aimed at fostering teacher specialisation, as outlined by MINEDUB (2018), could be a highly effective strategy for improving the quality of basic education and equipping pupils with the skills necessary to address future societal and environmental challenges. Moreover, encouraging subject-specific teaching in bilingual schools could strengthen the national education system's ability to meet the sustainable development objectives articulated by UNESCO (2021) and other international bodies. While the study provides robust evidence, it is important to acknowledge its limitations. As a one-sample t-test, the design does not allow for a direct comparison with a control group of pupils taught by non-specialised teachers. Future research should consider a quasi-experimental design to more definitively isolate the effect of teacher specialisation. A broader study across different regions and school types in Cameroon would also enhance the generalizability of these findings. Despite these limitations, the study's results make a valuable contribution to the understanding of effective teaching strategies in the context of sustainable skills development in Cameroon.

## CONCLUSION

This study aimed to investigate the effect of teacher specialisation on the development of pupils' sustainable skills. The findings from the one-sample t-test provide compelling evidence that teacher specialisation has a significant positive effect on pupils' acquisition of these crucial competencies. By demonstrating a statistically significant difference between the pupils' average skill level and the established benchmark, this research supports the hypothesis that specialised teachers are better equipped to foster the critical thinking, problem-solving, and adaptability essential for sustainable development. The results of this study contribute to the existing body of literature by providing empirical validation from a Cameroonian context, aligning with the global consensus on the importance of teacher expertise. The findings underscore the practical value of educational policies that advocate for and invest in teacher specialisation, as they serve as a powerful catalyst for enhancing instructional quality and preparing students for the challenges of the 21st century. In sum, this study establishes a clear link between teacher specialisation and improved pupil outcomes in the domain of sustainable skills. While acknowledging the limitations inherent in a one-sample design, the evidence presented highlights a critical pathway for educational reform. The findings suggest that by prioritising specialized instruction, educational stakeholders in Cameroon can take a significant step towards achieving their national and international development goals and ensuring that their pupils are well-prepared for a dynamic and complex world.

## RECOMMENDATIONS

Based on the significant findings of this study, the following recommendations are put forth for key educational stakeholders to enhance the development of pupils' sustainable skills: It is recommended that the Ministry of Basic Education prioritise and allocate resources towards the development and implementation of targeted teacher specialisation programmes. These programmes should provide teachers with continuous professional development opportunities to deepen their subject-matter expertise and pedagogical skills, particularly in areas relevant to sustainable development goals. Such initiatives would align with and reinforce the objectives outlined in national educational strategies and international frameworks like UNESCO's Sustainable Development Goals. School principals and administrators are encouraged to create a supportive environment for teacher specialisation. This can be achieved by facilitating professional learning communities, providing access to specialised resources, and encouraging collaboration among teachers to share best practices. Incentives for teachers who pursue subject specialisation could also be considered to motivate professional growth and improve instructional quality. Individual teachers should be proactive in seeking out opportunities for continuous professional learning in their specific subjects. Engaging in further training, workshops, and mentorship programs can help them refine their skills and stay updated on the most effective pedagogical strategies for fostering sustainable skills in pupils.

## Perspectives of the Study

This study contributes significantly to the body of knowledge on educational effectiveness in the Cameroonian context. The research provides empirical evidence that validates the theoretical frameworks of leading educational scholars, such as Darling-Hammond et al. (2017) and Schleicher (2019), within a local setting. By demonstrating a direct link between teacher specialisation and improved pupil outcomes, the study reinforces the global consensus on the importance of specialised instruction as a driver of educational quality. From a practical standpoint, the findings offer a clear and data-backed rationale for educational reform. The study moves beyond mere theoretical arguments to provide a compelling case for implementing policies that foster specialisation in teaching. The results can be used by policymakers and school leaders to justify investments in teacher training and resource allocation, to equip pupils with the skills necessary for a rapidly changing world. While this study provides robust initial evidence, its one-sample design presents a limitation. Therefore, future research should adopt a quasi-experimental design that includes a control group of pupils taught by non-specialised teachers. This would allow for a more definitive causal inference. Additionally, longitudinal studies are needed to track the long-term impact of specialised teaching on pupils' skills and career trajectories. Finally, future investigations could expand the scope to include a broader geographical area or different levels of education to enhance the generalisability of these findings.

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