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Teachers' Perceptions of the Role of ICT Training in Enhancing the Quality of Education in Government-Aided Secondary Schools in Busia District

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Abstract

This study examined teachers' perceptions of ICT training and its influence on the quality of education in government-aided secondary schools in Busia District, Uganda. It focused on formal ICT training, training frequency, and the relevance of training programs. Participants were 334 teachers with at least one year of teaching experience, selected through stratified random sampling. Data were collected via questionnaires and interviews and analysed using a mixed-methods approach, integrating quantitative analysis (descriptive statistics, Pearson correlation, and regression) with qualitative thematic content analysis. Results indicated that 58.7% of teachers had received formal ICT training, though much was general rather than subject-specific. Frequent and relevant training enhanced teachers' confidence and their integration of ICT, with 69% reporting regular use of digital tools. Correlation ($r = 0.719$, $p < 0.001$) and regression ($\beta = 0.771$, $p < 0.001$) analyses revealed a strong, statistically significant relationship between ICT training and quality of education, measured through instructional effectiveness, student engagement, and learning outcomes, explaining over 60% of variance. The study concludes that continuous, practical, and subject-focused ICT training is vital for improving teaching practices and learner outcomes. Recommendations include increasing training frequency, enhancing content relevance, and strengthening leadership support and ICT infrastructure.

Keywords: ICT training, teacher perceptions, quality of education, professional development

1. Introduction

Globally, Information and Communication Technology (ICT) has become a cornerstone of modern education, transforming teaching practices and learners' engagement. ICT integration is widely recognised as a driver of pedagogical innovation, improved learner participation, and enhanced academic outcomes (Charles, M. et al., 2021). Effective ICT support is critical for achieving Sustainable Development Goal 4 (SDG 4), which emphasises inclusive and equitable quality education for all, by enabling access to digital learning resources, enhancing instructional practices, and promoting learner engagement across diverse contexts (Li et al., 2025).

In developed countries, sustained investment in ICT infrastructure, teacher training, and digital curricula has allowed schools to adopt learner-centred, technology-driven approaches that foster creativity, collaboration, and problem-solving (Li et al., 2025). Across Africa, governments and development partners have increasingly

recognised the transformative potential of ICT in education. However, challenges such as limited infrastructure, unstable electricity, and insufficient teacher capacity persist, particularly in rural areas. Studies indicate that the effectiveness of ICT integration depends not only on resources but also on teachers' training, perceptions, and confidence in using technology (Tella & Ajani, 2022; Agyapong et al., 2025). Teachers who receive comprehensive ICT training are more likely to apply digital tools effectively, improving learner engagement and instructional quality. ICT teacher training encompasses pre-service and in-service programs that equip teachers with the knowledge, skills, and attitudes to integrate technology into pedagogy. Beyond basic computer literacy, these programs cover digital pedagogy, online content creation, and the use of learning management systems (Kozma, 2011). High-quality ICT training enhances teachers' readiness to integrate technology, thereby improving instructional effectiveness and student achievement (Buabeng-Andoh, 2025).

In Uganda, ICT teacher training has evolved over several decades, beginning with the East African School of Posts and Telecommunications in 1968, later renamed the Uganda Institute of Information and Communications Technology (UICT), which expanded to broader ICT education and teacher capacity-building initiatives (UICT, 2021). National frameworks, including the National ICT Policy (2014), the ICT in Education Policy (2019), and the Digital Agenda 2023–2027, emphasise continuous professional development to strengthen teaching effectiveness and learning outcomes (MoES, 2019; Ministry of ICT & National Guidance, 2023). Key stakeholders, such as UICT, the Ministry of Education and Sports (MoES), the National Curriculum Development Centre (NCDC), and the Uganda Communications Commission (UCC), collaborate with development partners, including UNESCO, UNICEF, and Airtel Uganda, to provide training and ICT infrastructure support (Li et al., 2025; UNICEF, 2022; UCC, 2023).

Despite these initiatives, rural government-aided secondary schools in districts like Busia continue to face ICT adoption challenges, including inadequate facilities, limited internet access, and inconsistent professional development opportunities (UCC, 2023; Kavuma, 2022). Teachers' perceptions of ICT training, particularly its relevance, practicality, and applicability, significantly influence their willingness and ability to integrate technology into classroom practice (Agyapong et al., 2025). Although national policies and training programs exist, there is limited evidence on how teachers in rural Ugandan secondary schools perceive ICT training and how these perceptions affect instructional practices and educational quality. Without understanding these perceptions, ICT initiatives risk being underutilised, reducing their impact on learning outcomes.

1.1 Purpose of the Study

The purpose of this study was to explore Teachers' Perceptions of the Role of ICT Training in enhancing the Quality of Education in Government-Aided Secondary Schools in Busia District.

1.2 Research Objectives

The study was guided by the following objectives.

1) To examine teachers' perceptions of formal ICT training and its role in enhancing the quality of education in government-aided secondary schools in Busia District.
2) To assess how the frequency of ICT training influences teachers' ability to integrate technology into teaching and learning in government-aided secondary schools in Busia District.
3) To evaluate teachers' perceptions of the relevance of ICT training programs in improving instructional practices and learning outcomes in government-aided secondary schools in Busia District.

1.3 Research Question

This study intended to respond to the following research questions.

1) What are teachers' perceptions of formal ICT training and its role in enhancing the quality of education in government-aided secondary schools in Busia District?
2) How does the frequency of ICT training influence teachers' ability to integrate technology into teaching and learning in government-aided secondary schools in Busia District?
3) To what extent do teachers perceive ICT training programs as relevant to improving instructional practices and learning outcomes in government-aided secondary schools in Busia District?

1.4 Hypotheses

This study tested the following hypotheses.

H1: There is a significant positive relationship between teachers' formal ICT training and the quality of education in government-aided secondary schools in Busia District.

H2: The frequency of ICT training significantly influences teachers' ability to integrate technology into teaching and learning in government-aided secondary schools in Busia District.

H3: Teachers' perception of the relevance of ICT training significantly affects the improvement of instructional practices and learning outcomes in government-aided secondary schools in Busia District.

2. Theory of the Study

This study adopted the Technology Acceptance Model (TAM) developed by Davis (1989) to explain teachers' adoption of ICT in classroom instruction. TAM originated from the Theory of Reasoned Action (TRA) by Ajzen and Fishbein (1980), which posits that an individual's behaviour is shaped by behavioural intentions influenced by attitudes and subjective norms. While TRA provides a broad explanation of human behaviour, TAM refines the model specifically for technology-related behaviours by introducing two core determinants: perceived usefulness (PU) and perceived ease of use (PEOU) (Davis, 1989). Perceived usefulness refers to the extent to which an individual believes that a particular technology will enhance job performance, whereas perceived ease of use denotes the degree to which using the technology is free from effort. TAM argues that when users find a technology both useful and easy to use, their intention to adopt and effectively apply it increases (Teo, 2011; Albirini, 2006).

In relation to this study, TAM provides a coherent framework for explaining how ICT training shapes teachers' perceptions and subsequent adoption of ICT tools in teaching. Training equips teachers with essential digital skills, practical knowledge, and exposure to instructional technologies (Charles, M. et al., 2021). Frequent training strengthens competence and improves confidence, while relevant and context-specific training ensures that acquired skills directly support instructional needs. These components of ICT training positively influence teachers' perceived usefulness by demonstrating how ICT can improve teaching efficiency and learning outcomes, and they enhance perceived ease of use by reducing the effort and anxiety associated with technology use. Consequently, improved PU and PEOU increase teachers' willingness and behavioural intention to integrate ICT into lesson delivery (Buabeng-Andoh, 2025; Tella & Ajani, 2022).

The implications of TAM in this study underline the centrality of teachers' attitudes and perceptions in determining successful ICT integration. Teachers who perceive ICT training as valuable, frequent, and relevant are more likely to adopt digital tools, enrich their pedagogical practices, and promote learner engagement and improved academic performance (Agyapong et al., 2025). Therefore, TAM provides a robust theoretical foundation for examining the influence of ICT training on teachers' adoption of ICT and its contribution to enhancing the quality of education in government-aided secondary schools in Busia District.

3. Literature Review

3.1 Teachers' Perceptions of Formal ICT Training

Formal ICT training plays a central role in shaping teachers' ability to integrate technology into classroom instruction. Tella and Ajani (2022), through a systematic review across African countries, found that structured ICT training enhances teachers' confidence, competence, and willingness to adopt digital tools. Their review, however, provides a broad regional perspective and does not address rural Ugandan secondary schools, particularly government-aided institutions, where infrastructural limitations and training access differ significantly. This contextual omission creates a gap that the current study addresses by examining teachers' perceptions of formal ICT training within the rural context of Busia District.

Similarly, Agyapong et al. (2025) demonstrated that relevant and continuous ICT training significantly improves teachers' digital competence and classroom technology use. Despite these contributions, the study focuses on university lecturers in urban Ghana, limiting its applicability to rural secondary schools in Uganda. The present study expands this understanding by exploring how rural secondary school teachers perceive ICT training and how these perceptions influence technology adoption.

Likewise, Buabeng-Andoh (2025) reported that well-structured ICT training enhances teachers' pedagogical competence and digital skills. Teachers emphasised the need for training aligned with subject needs and classroom realities. However, the study did not examine Ugandan schools, nor did it assess how teachers' perceptions shape the effectiveness of ICT training in rural contexts. The current study fills this gap by focusing specifically on how teachers in Busia District perceive the adequacy, quality, and applicability of ICT training programs.

In East Africa, studies such as Muoki and Mutiso (2020) and Namae (2020) have shown that formal ICT training enhances teachers' instructional effectiveness and improves student learning outcomes. However, both studies fail to consider issues of equity, particularly how training influences equitable access to ICT-based learning in resource-constrained rural schools. This study extends the literature by examining how ICT training affects not only teaching methods and learning outcomes but also equitable educational opportunities in Busia District.

Across studies, formal ICT training is widely recognised as crucial for improving teacher competence. However, existing literature underrepresents the Ugandan rural secondary school context and does not sufficiently examine

the link between teacher perceptions, training adequacy, and equitable educational outcomes.

3.2 Frequency of ICT Training

Training frequency is a major predictor of successful ICT adoption in schools. Muoki and Mutiso (2020) found that frequent ICT training strengthened teachers' digital literacy, improved their confidence, and increased their capacity to use technology in teaching. Teachers with sporadic or infrequent training struggled to integrate ICT tools effectively (Kaahwa, Y. T., Nansamba, F., & Muweesi, C., 2023). Nevertheless, their study did not examine Ugandan rural secondary schools or consider teachers' perceptions of how training frequency shapes classroom practices. The current study addresses these gaps by investigating the role of training frequency in ICT adoption within government-aided secondary schools in Busia District.

Namae (2020) similarly found that teachers who participated in frequent ICT training sessions demonstrated higher proficiency and were better able to adapt technology to various learner needs. The study, however, did not explore teachers' perceptions of training frequency or its influence on sustained technology use in classrooms. This study examines these dimensions to provide a deeper understanding of how training frequency affects ICT integration in rural school environments.

Tella and Ajani (2022) further confirmed that continuous ICT training improves teachers' readiness and confidence to deploy technology in teaching. Yet, their regional synthesis did not provide localised evidence for rural Ugandan secondary schools. The current study responds to this contextual gap by analysing how frequent ICT training affects teachers' classroom practices in Busia District.

Additionally, Edison and Kasujja (2020) showed that the frequency of ICT use and training had a significant positive effect on student performance. Although insightful, their research focused on higher education and did not investigate secondary teacher perceptions. The present study fills this gap by examining how training frequency influences classroom ICT adoption and perceptions of equitable technology-supported learning.

While evidence consistently supports the importance of frequent ICT training, the literature lacks context-specific studies exploring how training frequency shapes teacher perceptions and behaviour in rural Ugandan secondary schools.

3.3 Relevance of ICT Training Programs

Training relevance, the degree to which ICT training is aligned with teachers' subjects, classroom needs, and pedagogical tasks, is essential for effective technology integration. Barakabitze et al. (2019) concluded that a lack of context-specific ICT skills and inadequate teacher awareness hindered ICT adoption across Sub-Saharan Africa. Their work underscores the need for practical, locally relevant training, but does not address the Ugandan rural context or how teachers perceive the relevance of training programs.

Similarly, Buabeng-Andoh (2025) found that teachers valued ICT training programs that were practical, applicable, and tailored to subject-specific needs. However, the study's Ghanaian context limits its transferability to Ugandan rural settings. The current study investigates the relevance of ICT training as perceived by secondary school teachers in Busia District, thereby providing localised insight.

Agyapong et al. (2025) also emphasised that relevant ICT training predicts actual classroom implementation of digital tools, whereas generic training results in minimal adoption. However, the study was limited to higher education in urban Ghana. The present study extends the inquiry to rural secondary schools, where relevance may play an even more significant role due to limited resources and infrastructure.

Namae (2020) found that relevant ICT training improved teachers' ability to integrate technology into lesson planning and delivery, positively influencing student learning. However, the study did not investigate how relevance affects equitable access to ICT-supported learning. The current study examines this dimension to offer a more holistic understanding.

Furthermore, Edison and Kasujja (2020) highlighted that training effectiveness depends largely on relevance and practical applicability. Their work, though valuable, focused on higher education. The present study fills this gap by examining relevance in secondary school settings.

Although literature underscores the role of relevance in effective ICT training, limited empirical work examines teachers' perceptions of relevance in rural Ugandan secondary schools, a gap this study addresses.

3.4 How the Current Study Fills the Gaps

The reviewed literature reveals a notable *contextual gap*, as most existing studies on ICT training focus on urban areas, higher education institutions, or countries outside Uganda. These contexts differ significantly from the realities of rural secondary schools, where infrastructure, resources, and support systems may be more limited. To address this gap, the current study focuses specifically on rural, government-aided secondary schools in Busia District, Uganda. By examining ICT training within this setting, the study provides context-specific evidence

that reflects the unique challenges and opportunities present in rural learning environments.

A second gap identified in the literature is the *perceptual gap*. Although many studies acknowledge the role of ICT training in improving teacher competence, few explore how teachers themselves perceive the adequacy, frequency, and relevance of these training programs. Understanding these perceptions is critical because they shape teachers' willingness, motivation, and ability to integrate ICT into classroom instruction. This study addresses this gap by examining teachers' views and experiences with ICT training, offering deeper insight into how these perceptions influence ICT adoption in secondary schools.

The third gap is the *equity gap*. While several studies highlight the benefits of ICT integration, limited research examines how ICT training contributes to equitable access to quality teaching and learning, particularly in resource-constrained rural settings. Rural schools often face disparities in infrastructure, digital tools, and teacher preparedness, which can widen educational inequalities. This study fills this gap by assessing how ICT training affects equitable access to ICT-supported learning opportunities in Busia District, providing evidence on whether such training promotes fairness in learning outcomes.

4. Methodology

4.1 Design

This study adopted a cross-sectional research design to collect data at a single point in time, focusing on teachers' perceptions of ICT training and its contribution to education quality. A cross-sectional design is appropriate for examining existing conditions and relationships among variables within a defined population, as it provides an efficient snapshot of current practices and perceptions (Kothari, 2004). In this study, the design enabled the assessment of how aspects of ICT training, such as adequacy, frequency, and relevance, are associated with teachers' instructional practices in government-aided secondary schools in Busia District. While the design does not establish causation, it allows the identification of patterns and correlations that offer valuable insights into how ICT training aligns with educational outcomes in the study context.

4.2 Population and Sampling

Table 1.

Category	Gender	Population (n)	Sample size (s)	Sampling method (Quantitative)	Sampling method (Qualitative)	Data collection method (Quantitative)	Data collection method (Qualitative)
Head teachers	Male	8	2	Purposive	Purposive	N/A	Interview
	Female	4	2				
Teachers	Male	203	20	Purposive	Purposive	Questionnaire	Interview
	Female	107	20				
Students	Male	4,323	169	Simple random	Purposive	Questionnaire	FGD
	Female	3,465	154				
Total		8,110	367				

Source: Primary Data using Krejcie and Morgan Table (1970), sample size Determination, Sampling and Participants.

The study involved 367 participants from a population of 8,110, using purposive and simple random sampling. Head teachers and teachers were purposively selected for their expertise in ICT integration, while students were randomly selected for quantitative surveys to reduce bias. Purposive selection was applied for Focus Group Discussions (FGDs) to explore in-depth perspectives. This approach ensured representative quantitative data and rich qualitative insights, enabling integration of findings across methods.

4.3 Instrument Development and Validation

Data were collected through questionnaires, interviews, and FGDs, developed from literature and validated instruments on ICT training and educational quality. Instruments were pilot-tested with 10% of the sample, and reliability was confirmed with Cronbach's alpha = 0.82. Expert review ensured the content validity of the interview and FGD guides.

4.4 Data Analysis and Integration

Quantitative data were analysed using descriptive statistics, Pearson correlation, and regression in SPSS v24 (Creswell et al., 2026). Qualitative data were analysed using thematic content analysis (Braun & Clarke, 2006; Clarke & Braun, 2022). Integration occurred at the interpretation stage, where statistical trends were triangulated with qualitative themes, providing a comprehensive understanding of how teachers' perceptions of ICT training influence instructional practices and education quality (Creswell, 2021).

4.5 Ethical Considerations

Ethical clearance was obtained from the institutional review board. Participants provided informed consent, and confidentiality, anonymity, and the right to withdraw were ensured. Data were securely stored and used solely for research purposes.

5. Findings

5.1 Teachers' Perceptions of Formal ICT Training

The results show that **58.7% of teachers received formal ICT training**, while 27.3% had not, indicating moderate access (mean = 3.45). Teachers generally had **positive attitudes**, noting benefits such as improved teaching effectiveness, frequent use of ICT in lesson preparation, and motivation to enhance their ICT skills. This highlights the importance of expanding and institutionalising ICT training programs to ensure all educators are equipped to deliver high-quality, technology-enhanced instruction. Interviews supported the survey results, showing that although many teachers received ICT training, it was often general rather than subject-specific, limiting classroom application. The findings highlight the need for more practical, specialised training to enhance ICT integration in teaching. For example, one of the respondents noted;

> *"Over the years, most of our teachers have participated in various ICT training sessions, primarily organised by government education authorities or through NGO-supported initiatives. These workshops often cover basic computer skills, internet usage, and some pedagogical applications of ICT. However, the majority of these trainings tend to be quite broad and generic, lacking the depth or focus that would tailor the skills to specific subject areas such as science, mathematics, or languages. Because of this, teachers often struggle to translate the training into practical classroom use that directly enhances their teaching content."*

Teachers view ICT training as useful but too general, making it difficult to apply in classrooms. More targeted, subject-specific training is needed to effectively improve teaching and education quality in Busia District.

5.2 The Frequency of ICT Training

About **67% of teachers** feel encouraged to update their ICT skills (mean = 3.68, SD = 1.15), reflecting generally positive perceptions of ongoing support. Many Busia District schools support ongoing ICT skill development, helping teachers adapt to digital tools and enhance education quality. The interview insights complement the survey findings, illustrating how a supportive school culture fosters ongoing ICT skill development among teachers. For example, one respondent shared;

> *"In our school, there is a strong culture of growth and continuous improvement. We often notice teachers attending online courses and training sessions after school hours to learn about new ICT tools and methods. In the staffroom, it is common to hear discussions about innovative apps and software that enhance teaching and learning. This clearly shows that the school management is committed to encouraging teachers to keep developing their ICT skills."*

Findings highlight that Teachers view ICT training positively and supported by leadership, actively engage in ongoing learning, demonstrating their role in enhancing teaching quality in Busia District schools.

About **69% of teachers frequently use ICT** for lesson preparation (mean = 3.74, SD = 1.14), showing strong adoption, while a smaller portion disagreed or were neutral. Most teachers actively use digital tools to enhance lesson planning, highlighting ICT's key role in improving teaching practices in Busia District schools. Interactions in focus group discussions with students confirmed that regular ICT use helps teachers create clearer lessons and communicate more effectively, thereby improving teaching quality. They noted;

> *"From our experience as students, many of our teachers consistently use ICT tools to prepare notes and assignments. For example, it is common for us to receive printed handouts that have been carefully typed and formatted on computers, which makes the materials clearer and easier to read compared to handwritten notes. Beyond printed work, some teachers also use digital platforms like WhatsApp and email to share assignments and revision notes, especially during school breaks or before exams."*

Teachers use ICT to create and share clear, accessible learning materials, enhancing student learning and demonstrating the positive impact of ICT training in Busia District schools.

Only about half of teachers (50.9%) reported regular ICT workshops, indicating inconsistent professional development (mean = 3.25, SD = 1.25). This suggests that many teachers experience irregular and insufficient opportunities for ICT training, highlighting a need to establish more consistent and systematic workshops to support continuous skill enhancement. The interview findings reinforce the survey results, revealing that inconsistent and voluntary ICT workshops contribute to varied teacher skill levels and hinder the pace of technology integration. For example, one respondent noted;

> *"From what we observe in school, it is evident that some teachers remain hesitant and afraid to use computers and projectors during lessons. We believe this reluctance stems from inadequate training opportunities. Our head teacher tries to arrange workshops to help improve ICT skills, but attendance is often low, and not everyone takes part in these sessions. Because of this, the teachers who miss out fall behind in acquiring new digital skills. Progress in ICT adoption is therefore uneven and slow."*

Focus group discussion revealed that inadequate training and low workshop participation cause uneven ICT use, emphasising the need for more inclusive, effective training in Busia District schools.

5.3 The Relevance of ICT Training Programs

About 68% of teachers reported that ICT training improved teaching effectiveness (mean = 3.73, SD = 1.09), showing strong agreement on its positive impact. This survey finding reflects a clear and widespread perception among teachers that ICT training meaningfully contributes to improving their instructional quality. Interview findings support the results by showing how teachers' favourable views of ICT training lead to real improvements in teaching effectiveness and student involvement. For example, one respondent remarked:

> *Teachers who embraced ICTs early on have experienced a remarkable transformation in their teaching practices. Many reports improved student performance and note a reduction in absenteeism since incorporating digital tools into their lessons. The use of multimedia presentations, videos, and interactive software not only makes lessons more engaging but also motivates learners to participate actively. We have observed that students look forward to ICTs-based lessons because they find them more interesting and easier to understand compared to traditional methods."*

Qualitative data confirm that ICT-trained teachers using digital tools enhance teaching effectiveness, student engagement, and lesson accessibility, emphasising ICT training's value in Busia District schools.

The data shows that **66.7% of teachers feel confident using ICT** (mean = 3.67), indicating general digital competence, though some variation exists (SD = 1.15). This reflects a positive outlook for technology integration in teaching. Most teachers feel digitally competent, supporting ICT use in teaching, but varied confidence levels indicate a need for **targeted training** to enhance ICT integration in Busia District schools. Interview insights supported the survey results by illustrating how teachers' confidence in using ICT translates into more engaging and interactive classroom experiences. For example, one respondent noted;

> *"It is quite easy to identify teachers who are confident in using ICT during lessons. These teachers frequently use tools like PowerPoint presentations, digital simulations, and even incorporate educational videos, which make lessons much more interesting and interactive. This use of technology not only breaks the monotony of traditional chalk-and-talk methods but also helps us to understand concepts better because we can see examples and visual explanations rather than just hearing or reading about them."*

These findings highlight that Confident teachers use ICT tools like presentations and videos to make lessons engaging, improving student understanding and teaching quality in Busia District schools.

Similarly, the adequacy of ICT training programs, only 50% of the teachers felt that the training was sufficient, with 32.4% disagreeing and 17.7% remaining neutral. The mean of 3.25 and the standard deviation of 1.24 reflect mixed perceptions on the sufficiency of training. Findings show mixed feedback: some teachers find ICT training useful, while others see it as generic or misaligned. This highlights the need for subject-specific, ongoing training to improve teaching quality in Busia District schools. While interacting with head teachers through interviews, it was confirmed that ICT training is often brief and theoretical, leaving teachers underprepared and highlighting the need for continuous, practical training. One head teacher noted;

> *"While our teachers are generally eager to improve their ICT skills, the professional development opportunities currently available are often inadequate in scope and continuity. Most of the training sessions are one-off workshops that provide theoretical knowledge but*

> *lack practical, hands-on components that teachers can immediately apply in their classrooms. Additionally, there are little to no follow-up or refresher courses to reinforce learning and address emerging challenges with ICT tools. This sporadic approach means that some teachers leave these trainings feeling unprepared to fully integrate technology into their teaching routines."*

Interviews show teachers are eager to improve ICT skills, but current brief, theoretical training leaves them unprepared, highlighting the need for ongoing, practical ICT training in Busia District schools.

About 60% of teachers feel skilled in integrating ICT into classrooms (mean = 3.50, SD = 1.21), showing moderate confidence in using technology for instruction. This finding suggests that varied levels of confidence among teachers point to the need for targeted support to help all educators feel more competent and comfortable with ICT integration in teaching. Interacting with head teachers in interviews confirms that ICT-confident teachers use digital tools to make lessons more engaging and accessible, supporting the survey findings, for example, one of the head teachers noted;

> *"Among our teaching staff, those who have embraced ICT tools consistently demonstrate higher levels of student engagement. These teachers actively incorporate interactive technologies such as projectors to display multimedia presentations, educational software that offers simulations and practice exercises, and other digital resources that make lessons more dynamic and accessible. This approach not only captures students' attention but also helps accommodate different learning styles."*

The findings show that teachers trained in ICT use multimedia and interactive tools to boost student engagement and improve lesson delivery, enhancing teaching quality in Busia District schools.

5.4 Correlation Between ICT Training and Quality of Education

The relationship between ICT training and the quality of education is essential to understand how the professional development of teachers in ICT can enhance teaching effectiveness. Table 11 presents the results of this analysis.

Table 2. Correlation between ICT Training and Quality of Education

Variable	**ICT Training**	**Quality of Education**
ICT Training	1	0.719**
Quality of Education	0.719**	1
Sig. (2-tailed)	0.000	0.000
N	334	334

Pearson correlation shows a strong positive correlation ($r = 0.719$, $p < 0.01$), which shows that better Teacher ICT training is linked to improved education quality in Busia District schools. Given that $p < 0.01$, the null hypothesis is rejected. This finding supports the alternative Hypothesis, confirming that enhanced ICT teacher training positively influences the quality of education. There is a strong and statistically significant positive association between ICT training and the quality of education in government-aided secondary schools in Busia District, suggesting that enhancing ICT training for teachers is likely to improve teaching and learning outcomes.

5.5 Linear Regression Model for the Prediction of Quality of Education Using ICT Training

To determine whether ICT training has a predictive value for the quality of education, a linear regression model was applied. The results are presented in Table 3.

Table 3. Regression for ICT Training and Quality of Education

Model	**Standardised (β)**	**Significance (p)**
ICT Training	0.771	0.000
Adjusted R^2	0.623	
F	77.661	p = 0.000
a. Dependent Variable: Quality of Education		

Regression results show that ICT training strongly and positively influences education quality in Busia District schools ($\beta = 0.771$), with the relationship being statistically significant ($F = 77.661$, $p = 0.000$), indicating that improving training can substantially enhance educational outcomes. Moreover, the adjusted R^2 value of 0.623 means that over 60% of the variance in educational quality was directly attributed to the level of ICT training teachers receive. In educational research, this is a substantial explanatory power, highlighting that teacher training is not just a contributing factor but a central determinant of effective education in the digital age. The findings highlight that continuous, structured ICT training is essential for building teacher competence and maximising ICT's impact on education quality.

6. Discussion of Findings

The study found that 58.7% of teachers had received formal ICT training, reflecting moderate access to professional development within Busia District. Although teachers generally expressed positive perceptions, highlighting improved lesson preparation, enhanced teaching effectiveness, and motivation to advance their digital skills, the qualitative findings revealed that much of the training remains broad and insufficiently aligned to subject-specific needs. This gap limits the effective translation of skills into classroom practice. The mixed-method results, therefore, suggest that while training opportunities exist, their depth, relevance, and practical orientation must be strengthened to meaningfully influence technology-enhanced pedagogy. (Kagambe, E. et al., 2024)

Teachers also reported frequent use of ICT in lesson preparation (69%) and strong encouragement to update their ICT skills (67%). These quantitative results corresponded with interview data showing a supportive school culture that promotes ICT use. However, inconsistent participation in workshops and a lack of follow-up mechanisms contribute to uneven digital competence across teachers. This triangulation implies that ICT integration improves where training is continuous and supported, but stagnates where professional development is irregular or optional.

Furthermore, 68% of teachers believed ICT training improved teaching effectiveness, and 66.7% felt confident using ICT tools. These findings indicate that perceived relevance and practical applicability of training are essential drivers of teacher competence and classroom technology use. Qualitative insights confirmed that teachers with higher confidence actively applied ICT tools—such as multimedia presentations and digital simulations—thereby increasing student engagement. Thus, the study demonstrates that quality ICT training not only enhances teacher capability but also promotes inclusive and more engaging learning environments.

7. Conclusion

This study explored teachers' perceptions of ICT training and its contribution to improving educational quality in government-aided secondary schools in Busia District. The findings show that teachers generally value ICT training and recognise its potential to enhance lesson preparation and instructional delivery. However, the training provided is often broad and insufficiently tailored to subject-specific needs, reducing its direct classroom impact. The results further indicate that consistent and continuous ICT training strengthens teachers' confidence and supports regular integration of digital tools into teaching, whereas irregular or one-off workshops limit sustained adoption. The study established a strong positive association between ICT training and educational quality, with training variables explaining over 60% of the variance in instructional outcomes. This underscores the importance of structured, accessible, and contextually relevant ICT professional development for improving teaching practices and student engagement, particularly in rural school settings.

8. Recommendations

Grounded in the Technology Acceptance Model (TAM), these recommendations focus on enhancing Perceived Usefulness (PU), Perceived Ease of Use (PEOU), and Behavioural Intention (BI) to ensure effective ICT adoption in government-aided secondary schools in Busia District. **Develop Subject-Specific, Practical ICT Training Programs (Highest Priority – Improves PU);** To strengthen teachers' Perceived Usefulness, ICT training programs must be designed to directly address subject-specific pedagogical needs. Tailoring training for subjects such as science, mathematics, and languages will help teachers understand how ICT can improve lesson delivery, thereby increasing their intention to use ICT in classrooms.

Institutionalise Continuous Professional Development (Improves PU and BI); Regular, structured ICT training offered through workshops, refresher courses, mentoring, and peer learning will reinforce teachers' skill development. Continuous exposure enhances perceptions that ICT is useful and increases teachers' behavioural intention to integrate digital tools into teaching.

Enhance Training Relevance and Context-Specificity (Improves PU); Training should address the realities of rural schools, including limited resources and varying digital competencies. Using practical methods such as hands-on demonstrations, simulations, and real classroom problem-solving activities will strengthen teachers' perceptions that ICT is relevant and beneficial to their work.

Improve Ease of Use through Skills-Based, Hands-On Instruction (Strengthens PEOU); Training should emphasise simple, step-by-step competencies such as preparing digital lesson materials, using multimedia, operating projectors, and accessing online learning platforms. When teachers find ICT easy to use, their confidence and willingness to apply it in class increases.

9. Limitations

Despite its strengths, the study had several limitations. First, the cross-sectional design limits causal interpretation, as data were collected at a single point in time. Second, self-reported measures may have introduced social desirability bias, particularly in assessing ICT competence and usage. Third, although qualitative data enriched interpretation, limited time and resources constrained the number of interviews and focus group discussions. Finally, ICT infrastructure disparities across schools may have influenced teachers' experiences, yet the study did not systematically control for these contextual factors. These limitations should guide cautious interpretation and indicate areas for further research.

References

Agyapong-Opoku, N., Agyapong-Opoku, F., & Greenshaw, A. J., (2025). Effects of social media use on youth and adolescent mental health: A scoping review of reviews. *Behavioral Sciences, 15*(5), 574.

Ajzen, I., & Fishbein, M., (1980). *Understanding attitudes and predicting social behaviour*. Prentice Hall.

Albirini, A., (2006). Teachers' attitudes toward information and communication technologies: The case of Syrian EFL teachers. *Computers & Education, 47*(4), 373–398. https://doi.org/10.1016/j.compedu.2004.10.013

Barakabitze, A. A., Lazaro, A. W., Ainea, N., Mkwizu, M. H., Maziku, H., Matofali, A. X., … Sanga, C., (2019). Transforming African education systems in STEM using ICTs: Challenges and opportunities. *Education Research International, 2019*(1), 6946809.

Braun, V., & Clarke, V., (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Buabeng-Andoh, C., (2025). Investigating student–teachers' continuous intention to use mobile learning management systems: The technology acceptance model and expectation confirmatory model. *Discover Education, 4*(1), 76.

Charles, M., Shizhou, L., Justine, N., Salome, J. K., Robert, T., & Lawrence, S., (2021). Discourses in ICT Integration: Pedagogical Orientations in Selected City Primary Schools in Uganda. *Educational Research and Reviews*, *16*(5), 172–180.

Clarke, V., & Braun, V., (2022). *Thematic analysis: A practical guide*. Sage Publications.

Creswell, J. W., (2021). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). Sage Publications.

Creswell, J. W., Shope, R., Plano Clark, V. L., & Green, D. O., (2006). How interpretive qualitative research extends mixed methods research. *Research in the Schools, 13*(1), 1–11.

Davis, F. D., (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340. https://doi.org/10.2307/249008

Edison, B., & Kasujja, J. P., (2020). ICT usage in teaching and its influence on students' academic performance in Uganda Certificate of Education (UCE) in Kasese District. *International Journal of Education and Research, 8*(2), 21–40.

Government of Uganda, (2014). *National ICT policy*. Ministry of ICT.

Government of Uganda, (2019). *ICT in education policy*. Ministry of Education and Sports.

Government of Uganda, (2023). *Digital Agenda 2023–2027*. Ministry of ICT.

Kaahwa, Y. T., Nansamba, F., & Muweesi, C., (2023). The role of technology-enabled teaching and learning in enhancing student-student interaction in secondary schools in Kampala district.

Kagambe, E., Kabasiita, J., Kisembo, M., Kasiita, T., Muweesi, C., Kaweesi, M., ... & Namubiru, A., (2024). The Integration of ICT for Effective Implementation of the Competence-Based Curriculum among Secondary Schools in Kyaka II Refugee Settlement, Uganda.

Kavuma, R., (2022). Digital transformation in Ugandan schools during COVID-19: Challenges and lessons learned. *Journal of Education and e-Learning Research, 9*(3), 210–225.

Kothari, C. R., (2004). *Research methodology: Methods and techniques* (2nd ed.). New Age International Publishers.

Kozma, R. B., (2011). ICT, education transformation, and economic development: An analysis of the U.S. National Educational Technology Plan. *E-Learning and Digital Media, 8*(2), 106–120.

Krejcie, R. V., & Morgan, D. W., (1970). Determining sample size for research activities. *Educational and Psychological Measurement, 30*(3), 607–610. https://doi.org/10.1177/001316447003000308

Li, Y., Tolosa, L., Rivas-Echeverria, F., & Marquez, R., (2025). Integrating AI in education: Navigating UNESCO global guidelines, emerging trends, and its intersection with sustainable development goals.

Ministry of Education and Sports, (2019). *ICT in education policy*. Government of Uganda.

Ministry of ICT & National Guidance, (2023). *Digital Agenda 2023–2027: Transforming Uganda through digital skills and inclusion*. Government of Uganda.

Muoki, A. M., & Mutiso, S. K., (2020). Teacher training and its effects on the adoption of ICT in public secondary schools in Machakos County, Kenya. *International Journal of Information Technology, 6*(4).

Namae, S. M., (2020). Status and use of information communication technology in Uganda secondary schools: Teachers' competencies, challenges, dispositions, and perceptions (Doctoral dissertation, University of British Columbia).

National Curriculum Development Centre, (2021). *Curriculum framework: Integrating ICT competencies in education*. Government of Uganda.

Tella, A., & Ajani, Y. A., (2022). Robots and public libraries. *Library Hi Tech News, 39*(7), 15–18.

Teo, T., (2011). Factors influencing teachers' intention to use technology: Model development and test. *Computers & Education, 57*(4), 2432–2440. https://doi.org/10.1016/j.compedu.2011.06.008

Uganda Communications Commission, (2023). Universal service and access fund annual report. Government of Uganda.

Uganda Institute of Information and Communications Technology, (2021). *History and mandate of UICT*. UICT Press.

Uganda Institute of Information and Communications Technology, (2022). *Digital change agents initiative: Annual report*. UICT Press.

UNICEF, (2022). *ICT for education in Uganda: Strengthening digital skills and inclusion*. UNICEF Uganda.

World Bank, (2023). *Emerging technologies and education in Africa: Opportunities and challenges*. World Bank Group.

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How Parents Provide Support for Their Children's Learning in Mobile ECCE Contexts: Practitioners' Views

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Abstract

Researchers are increasingly interested in the role of early childhood care and education (ECCE) provided in mobile units in South Africa. By utilizing mainly transport vehicles such as trucks, the practitioners facilitate teaching and learning to the most vulnerable children aged birth to five years in remote rural areas. The study's primary aim was to explore the practitioners' views on the support parents provide for their children's learning in a mobile ECCE context to promote quality service delivery. The study was theoretically anchored by Epstein's overlapping spheres of influence theory. The researchers adopted the interpretive research paradigm combined with the phenomenological research design to make sense of practitioners' subjectivity. Qualitative data was obtained from semi-structured, in-depth interviews by selecting and engaging twenty conveniently sampled ECCE practitioners. By adhering to the interview guide, the researchers focused on the study's objectives to elicit rich data. The collected data was analyzed thematically using the Atlas. Ti software. Findings revealed that parents support practitioners through involvement in decision-making processes, regular meeting attendance, and cleaning the mobile units. It was recommended that better parental support and increased stakeholder interest in children's early learning will result in children's enhanced early cognitive development for future success.

Keywords: children's early learning, cognitive development, ECCE practitioner, overlapping spheres of influence, parental support

1. Introduction

International research confirms that parental involvement has significant long-term advantages for families, schools, and countries' economies (Meier & Lemmer, 2015). Early childhood education has become critically dependent on parental participation (Zeynep, 2016). Active parental participation is one of the most critical factors in enhancing early childhood outcomes, especially in underprivileged settings (Segoe & Bisschoff, 2019). Therefore, it is vital to have two-way communication between the home and the school to establish sound school-parent engagement. Bower and Griffin's (2011) studies on the correlation between parental participation and children's academic achievement demonstrates that parental involvement entails many forms, all of which are considered effective for increasing learners' success.

The primary aim of this study was to explore the views of the practitioners on the parental support provided for children's learning in a mobile ECCE context. Generally, parents in disadvantaged communities are preoccupied in work commitments that prevent their full involvement in their children's education. Also, parents are either unemployed or engage in informal or casual jobs; for example, parents are cleaners, petrol attendants, domestic servants, and farm labourers which are time and energy-consuming (Jensen, 2009). Also, according to Gardner (2017), the living conditions in rural communities directly affect the support for teaching and learning at ECCE centres. Although practitioners attempted to conscientize parents on the importance of their involvement in their children's education, and how they can promote better parent-school engagement despite their work and

financial constraints (Drajeaa & O'Sullivan, 2014), there is much room for improvement.

There are various ways in which parents can provide support to ECCE practitioners and learners at mobile units. Since parents have better access to their children's lives, they can easily enhance and supplement the work done at early learning centres (Makgopa & Mokhele, 2013). Early childhood learning involves discovery, pre-skills, and learning to prepare for school readiness and how to navigate the challenges of the real-world (ParentingHub, 2016). Practitioners who utilize classroom settings to foster children's learning and growth, expect parents to also play their part by monitoring homework activities, engaging in school events, and establishing a cordial school-home relationship to enhance young children's skills for self-discovery, observation, critical-thinking, and cooking and baking to prepare them for success in formal school phases. In terms of teaching young children to hone their observational skills, asking open-ended questions during lessons and at home can help them develop clear, holistic, and divergent interpretations of an occurrence (ParentingHub, 2016). Moreover, every childcare practitioner appreciates volunteers to assist them at ECCE centres to ensure that operations run smoothly. At times they need parental assistance to dress children in jackets to go play outside, or to help serve lunch or snacks, or to serve in a committee to add value to the ECCE centre's operations.

However, the lack of or excessive parent involvement may negatively affect children's behaviour inside and outside the classroom, ultimately hindering opportunities for their success and educational growth (Tabaeian, 2016). In this regard, schools worldwide prefer close contact between the home and the school, but parents should not be encouraged to express their opinions about matters of academic education such as lesson delivery (Meier & Lemmer, 2015). Hence, this study aimed to explore practitioner's views on parental support for their children's learning in a mobile ECCE context to obtain a deeper understanding of this issue.

2. Theoretical Framework

This study is underpinned by Epstein's (2001) theory on parental involvement in education. The theory is relevant because it takes a team to contribute to a learner's success; hence, parent involvement is critical to enhance children's learning. As a collaboration to uplift children's performance at ECCE centres, parents, practitioners, the school community, and other relevant stakeholders should teamwork to support the education and development of young children. Epstein (2001) mentions three contexts for enabling better outcomes in ECCE spaces: the home, school, and the community — all of which influence learners' character-building, mindsets, and opportunities for success which Epstein (2001: 44) encapsulates as "overlapping spheres of influence" (Figure 1 below).

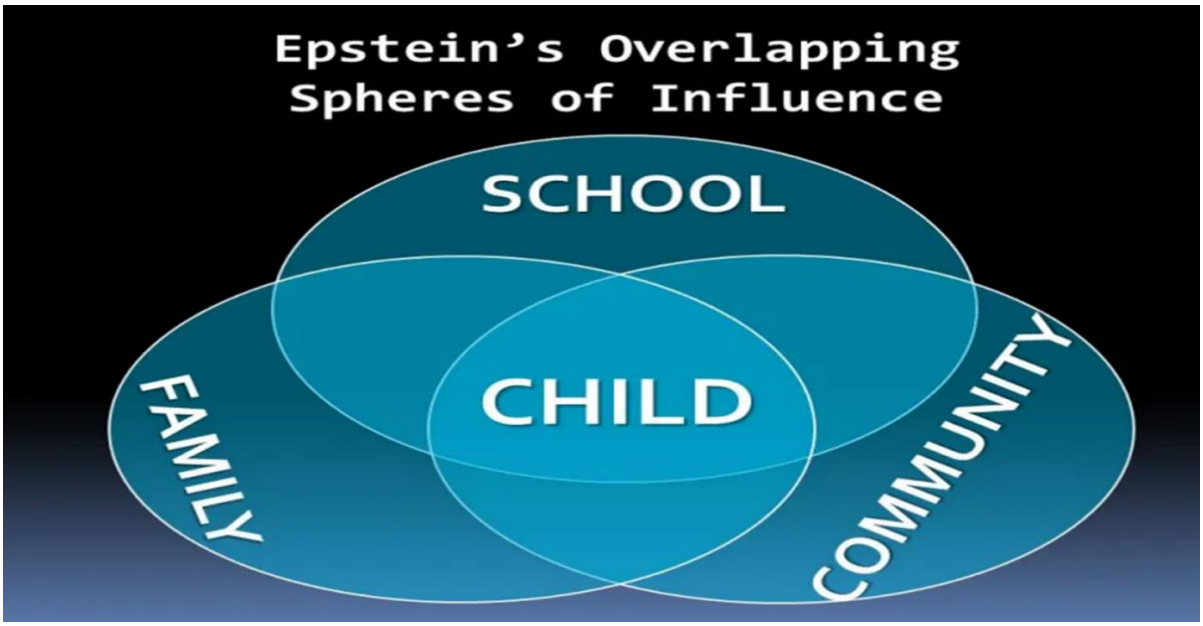

Figure 1. Overlapping spheres of influence (Epstein, 2001)

The core principle of Epstein's (1995) theory of parent involvement is enacted successfully when parents, practitioners, and the community collaborate to support learning and development in young children's lives. Epstein (1995) asserts that through effective communication, these three contexts (home, school, and community) influence learners to develop sound moral and positive character traits that drive them to achieve success in life. Hence, it can be seen that Epstein (2001) considers the power of the collective to create

opportunities for success for children and adolescents. This theory contends that "the more significant the overlap of the family, school, and community spheres, the stronger the partnership and greater the likelihood of improved [learner] outcomes" (Latunde, 2017: 258). Initially, a framework of five significant types of involvement that fall within the areas of overlap in the spheres of influence model was identified (Davies, 1991: 377). These included parenting (assisting families with parenting and child-rearing skills and fundamental obligations of families), communication from and to school, volunteers, learning activities at home, and decision-making (Epstein, 1992: 503). A sixth type of school and family partnership was later added to this list which included collaborating with the community.

3. Literature Review

3.1 The Impact of Parental Support on Practitioners' Ability to Deliver Services at ECCE Mobile Units

In a study conducted by McWayne, Hampton, Fantuzzo, Cohen and Sekino (2004), it was found that consistent and direct communication between parents and schools positively impacted on how ECCE centres located in low-income ethnic minority areas perceived their engagement with peers, adults, and learning. Strong home-school relationships boost children's learning outcomes during their childhood and in later years. For example, regular communication with a practitioner, volunteering to assist in mundane classroom tasks, and participating in school activities were linked to children's advancement from early years to first grade (Mantzicopoulos, 2003; Wildmon, Anthony & Kamau, 2024). One facet of parent support that significantly impacts learners' achievement is parental expectations; pupils accomplish more when parents anticipate more (Englund, Luckner, Whaley & Egeland, 2004; Book, Gijselaers, Ritzen & Brand-Gruwel, 2018).

Consequently, active parental support influences all groups and levels of children's learning outcomes especially when there are supportive parents who express a genuine interest in the education of their children (Henderson & Berla, 1994; Wilder, 2023). In other words, the educational environment and its players should foster an effective collaborative partnership by encouraging open and clear communication channels with the school community, thus bridging the gap between the classroom, the home, and the school (Howland, Anderson, Smiley & Abbott, 2006). Therefore, the participation of parents is multidimensional as it involves monitoring various types of behaviour, changing traditional mindsets, and increasing parents' and children's prospects of a better life (Toran-Kaplan, 2004).

3.2 Challenges Hindering Effective Parental Support in Mobile ECCE Units

Research establishes at regular intervals that parental support improves academic performance throughout childhood (Meier & Lemmer, 2015). Despairingly, although parents attend parent-teacher meetings, their degree of interest in their children's academic progress remains lukewarm as they showed little enthusiasm for or involvement in their children's classroom activities (Zeynep, 2016). While studies on the correlation between parental support and children's academic performance across subjects (such as literacy and numeracy) have been conducted widely, there is scant information on whether parental supervision in ECCE contexts affects children's academic performance differently across subjects with a longitudinal design (Wang, Chen, Yan, Zheng, Cheng & He, 2023).

This calls for the implementation of astute, workable, and innovative strategies to encourage parental support at mobile ECCE units. The Department of Education in Virginia Commonwealth University (2009) suggests that hosting events and activities that motivate parents and families to become part of ECCE spaces can yield positive results. The Department of Basic Education (DBE) suggested that some relevant activities for the children should be organized such that the parents and the community are attracted to attend; for example, music programmes, talent shows, arts and crafts exhibitions, dinners sponsored by businesspeople, sports days, and parent-child dance items. Therefore, this paper aimed to explore practitioners' views on how parents provide support for their children's learning in mobile ECCE contexts.

According to the National Integrated Early Childhood Development Policy issued by the Department of Social Development [DSD] (2015), ECCE provision has officially been recognized by the Government as a fundamental and universal human right which all children are equally entitled to without any form of discrimination. Since democracy in 1994, the South African Government introduced numerous policies and stipulations to enable a multi-sectoral framework that acknowledges the central role of early childhood development (ECD). This leads Government departments and non-governmental organizations (NGOs) to forge partnerships at various levels to develop and improve ECCE services, design clear policies, and initiate relevant programmes that enhance better service delivery in the early learning sector. According to the National Early Learning Development Standards (NELDS, 2009), this transformation promotes the early learning needs of children from birth-to-four years (Ebrahim, 2014). The NELDS (2009) recommends a curriculum-related policy focusing primarily on the growth and development of children aged birth-to-four years, such that every young child in South Africa can participate in some form of ECCE stimulation programme which should include

expressing ideas, availability of resources, and organizing interesting activities that facilitate their growth and development. Further, practitioners should pursue an integrated approach to ensure age-appropriate learning and development through a daily, weekly, and monthly plan or programme. These specific early childhood stimulation programmes must demonstrate clear, relevant, and age-appropriate learning consisting of thoroughly planned, organized information units and activities executed by personnel in care and early education environments.

3.3 Conceptualisation of Mobile ECCE Services

Mobile Early Childhood Care and Education (ECCE) units perform several critical functions in under-resourced communities. They play an essential role in ensuring that children receive the support necessary for their development (Karegysa, 2021). One primary function of mobile ECCE units is to provide quality early childhood education where traditional infrastructure for ECCE is lacking. In rural and isolated areas, these units deliver educational, health, and nutrition resources directly to children, thus overcoming barriers such as geographical isolation, limited educational facilities, and the lack of health programmes (García, Bennhoff, Leaf & Heckman, 2021). This ensures that children in impoverished communities are not left behind during critical early learning stages essential for cognitive, social, and emotional development (García, Heckman & Ronda, 2023). Mobile ECCE programmes which incorporate health check-ups and nutritional interventions, recognize the vital link between health, nutrition, and educational outcomes (Harrison, Waniganayake, Brown, Andrews, Hadley & Hatzigianni, 2024). Lastly, mobile ECCE units are crucial in community engagement and parental involvement as they often connect educators and the community, thus nurturing a collaborative relationship where parents and caregivers are actively involved in enhancing young children's quality of education (Johnson, 2023).

3.4 The Concept of Parental Support

Studies reveal that most parents believe they are responsible for promoting their children's learning (Harris & Goodall, 2008; Cape, Cardosa, Miot, Pitogo, Quinio & Merin, 2016). However, it was found that parents faced challenges to assist their children with learning because they did not know which activities would best promote learning. Hence, various parental obligations should be explored across children's daily lives to understand what parents do to accelerate their children's cognitive development including the acquisition of basic mathematical skills, recognizing risks, and how they influence their children's everyday activities in terms of quality outcomes (Niehues, Bundy, Broom & Tranter, 2015). Hence, parents need help in understanding their children's learning profile, as well as developing practical strategies to map children's daily activities. During the child's ECCE phase, interpersonal relationships become more transparent as revealed at parent-teacher conferences (Blitch, 2017). Conversations between children's parents and practitioners expand and strengthen the practitioner-parent-child bond. Consequently, parents find it comfortable to discuss their child's progress in school such that practitioners can suggest strategies or tools to help parents to assist the child achieve better academic outcomes. In addition, early childhood practitioners provide (informally) a range of resources and services such as advice and guidance in children' home language which promotes trust to build relationships that would offer appropriate and relevant support to rural families (French, 2003, 2007). Since, parents are the children's first 'teachers' and the most influential, the critical role they play in developing children's morals, behaviour, attitudes, and skills is of paramount importance (McDermott, 2008).

3.5 Theories on Parental Support

There are theories in support of parent involvement in children's education: Piaget's cognitive development, Vygotsky's sociocultural, and Bronfenbrenner's ecological systems. These three theories significantly pervade this field of research and are thus discussed herein. With reference to the cognitive development theory Piaget (1981) emphasized that children have a constructive role to play in society when mentored by experienced peers and responsible family members. The basic assumption of this theory is that young children are active learners with a constant zest to match their internal constructions (their view of the natural world) with external constructions or the external realities they face within their surroundings. Children assimilate new learning but sometimes imbibe 'incorrect' views of the world quicker, if they are actively involved with negative and deviant people in their surroundings. Therefore, children learn best when they have opportunities to interact within their environment, particularly with their parents who are agents to promote learning experiences (Athey, 2000). For example, parent involvement activities such as monitoring and assisting in homework tasks create opportunities for children to interact meaningfully with their parents as children construct knowledge within a conducive social and physical environment (Bailey, Silvern, Brabham & Ross, 2004). As such, Piaget's (1981) social development theory highlights that parental involvement is imperative for children's holistic development for future academic achievements.

Concerning the sociocultural theory, Vygotsky (1978) shed light on the physical and social relationship between human beings and their environment. The impact of social and cultural aspects on children's development and

learning is significant (Vygotsky, 1978). For instance, human beings are surrounded by family members and are thus influenced by the culture in which they live (Rieber & Robison, 2004). Children's interaction with their family members fosters learning and development since the family is the hub for learning the basics of life inside and outside the home. For this reason, children gain valuable knowledge about the world through interacting with family members.

Bronfenbrenner (1971) advocates the ecological systems theory which entails explaining parent involvement in terms of the development of children which is influenced not only by factors within the child, but also by their families and the surrounding world. This theory focuses on the developing child's interactions with people, objects, and symbols in proximal processes across multiple settings and systems (Prior & Gerard, 2007). Specifically, "a microsystem is a pattern of activities, roles, and interpersonal relations experienced by the developing person in a given setting with particular physical and material characteristics" (Bronfebrenner, 1971: 22). The family, school practitioners, peers, child health and care services, and the neighbourhood are some of the main settings and institutions in a microsystem. Children experience a reciprocal face-to-face relationship with these immediate surroundings, while institutions within the microsystem interact with and influence each other. For example, school affects the neighbourhood, and the neighbourhood impacts the child's family members.

All three theories are relevant to the child's surroundings, including their influences. There are similarities among these three theories, as explained by Epstein (1991), who also advocated for parent involvement in children's education by emphasizing that children, schools, families, and communities are overlapping spheres of influence.

3.6 Perspectives of Educators on Parental Support

Practitioners must understand how and why they should involve parents in enhancing young children's education. A study by Whitaker and Hoover-Dempsey (2013) investigated the link between schools and parents, specifically the impact of parental involvement, and the results revealed that practitioners' roles and perspectives on school activities significantly impacted parents' understanding of being involved in their children's education. Also, developing a positive, harmonious, and productive relationship between practitioners and parents helps young children achieve academic goals while being prepared for school readiness (Epstein, 1991). Organizing a development programme and training for practitioners and parents strengthens and supports such a relationship (Lambert & Lambert, 2012). Also, initiating parental involvement programmes regionally or in school clusters broadens the scope of parental inclusion in ECCE settings, which promotes quality early education.

Moreover, Okeke (2014) conducted research regarding the impact of effective home-school partnerships by using a descriptive case study design — the findings revealed that parents care and that they are willing to involve themselves in their children's education actively. Still, most parents do not know how to get involved. Okeke's (2014) study also advises the Government to design specific and clear policy guidelines on how practitioners at ECCE centres can encourage parents to become actively involved in school matters to uplift their children's all-round performance.

3.7 Importance of Parental Support on Children's Learning

Why do parents have to get involved in their children's education? Simply, parents' involvement in their child's learning processes offers many opportunities for success and a better life. According to the Centre for Child Well-Being (2010), parental involvement in their children's learning improves their (children's) morale, attitude, and academic achievement across all subject areas while promoting better behaviour, social adjustment, and sound values. In other words, family involvement in education helps children to grow up to be productive and responsible members of society. This means that involving parents in educating their children is equivalent to saying that the school is proactive in implementing changes for improved development among the learners. As parent involvement increases, practitioners and school administrators also lift the bar to attain quality performance in ECCE education (Sapungan, 2014).

3.8 Factors Impacting Parental Support Regarding Children's Learning

3.8.1 Family Type

The extent and form of parental involvement are strongly influenced by social class, maternal level of education, material deprivation, maternal psychosocial health, single-parent status, and, to a lesser degree, family ethnicity (Suizzo & Stapleton, 2007). In related research on family engagement in early childhood education, Halgunseth, Petersen, Stark and Moodie (2009) reiterate parental support to include the entire family in the home-school relationship and refer to this as family engagement. Since the home-school relationship in early childhood education refers to the formal and informal relationships between families and their young children's educational settings, participation in early childhood-based activities and regular communication between parents and practitioners are associated with better results for young ECCE children.

3.8.2 Parents' Incomes

Jeynes (2002) states that a child's status is determined by the parents' occupations, income levels, and the locality in which the child is brought up. It is understood that low socioeconomic status negatively affects learners' academic achievement due to the effects of the stress of day-to-day survival, which precipitates tension at home. The ECCE mobile units help to bridge the gap in affording underprivileged children the opportunity to access education in remote marginalized areas. However, studies by Emmon (2005) and Jeynes (2002) have repeatedly provided evidence of the harsh reality of homes with low incomes that cannot access quality ECCE education, in contrast to those with high incomes. The implication is that poor parents must participate in ECCE centre activities to mitigate the effects of their children not attending a well-resourced early education facility.

3.8.3 Parent Level of Education

Emmon (2005) and Jeynes also provide evidence of the influence of parents' education on their children's psyche to achieve academic prowess at high levels. Compared to parents with low levels of education, highly educated parents are more likely to define high levels of education as desirable, encourage their children to excel in school, and have higher expectations for their children's academic achievement (Alexander, Entwisle & Bedinger, 1994; Cohen, 1989; Dauber, Alexander, Entwisle, 1996; Davis- Kean & Schnabel, 2002; Grolnick & Slowiaczek, 1994; Lee & Croninger, 1994). Moreover, highly educated parents have teaching, nurturing, and monitoring styles that promote children's holistic development (Bee et al., 1969; Harris, Terrel & Allen, 1999; Laosa, 1980). They also engage their children in quality verbal interactions, whereas lowly educated parents struggle with interacting at a high level when rearing their children (Hoff, 2003; Richman, Miller & Levine, 1992; Uribe, Levine & Levine, 1993). This calls for greater cooperation between ECCE personnel and parents from low-income areas to bridge the disparity gap in parents' educational status to ensure that all children, regardless of background, are afforded the best possible early childhood education.

3.8.4 Psychosocial State

Childhood psychosocial dysfunction (CPD), such as aggressive behaviour, fear, and anxiety, is prevalent in children, and this may lead to deficits in learning. According to population-based studies, 20% of children in South Africa have psychosocial problems (Theunissen, Vogels & Reijneveld, 2012). This alarming condition, which is statistically high and affects children's future, may require considerable expenditure for treatment from healthcare departments. According to Spijkers, Jansen and Reijneveld (2013), the earlier a child's behavioural issues manifest, the greater the risk that they will worsen as the condition is likely to persist in adulthood.

3.8.5 Parent Social Capital Level

There are reasons why family structure, often measured by whether or not both parents are present in the household, is used as a measure of social capital. Compared to two parents, single parents would not have as much time and attention to interact with their children. Family disruption through divorce (and death) often leads to a change of residence that breaks established relations in previous homes. However, empirical findings show that these reasons for using family structure as a proxy for social capital do not always hold. For example, the development outcomes of children and youth in two-parent step-families are not much better than those in one-parent families (Kerr & Michalski, 2007; McLanahan & Sandefur, 1994; Teachman et al., 1994). On the other hand, some studies show that single-parenting has no effect on time spent with children (Bianchi & Robinson, 1997) and that geographic location does not affect the education outcomes of children from high-income families (Hoffert et al., 1998).

3.8.6 The Community Factors

Community factors may include a narrow definition of parental support with family-specific issues such as working hours, transportation, working parents, and divorces leading to single parenting issues (Wildmon, Anthony & Kamau, 2024). Schools can support parents by offering various communication methods, not only through face-to-face meetings. Parents and practitioners should recognize the value of proactive parent involvement, which does not require parents to be present at school or assist practitioners in the classroom (Olmstead, 2013).

3.9 Strategies for Parents' Continued Support for Their Children's Learning

Policymakers increasingly recognize parental engagement as integral to promoting educational reform (Wilder, 2014). At the national level, the Constitution (RSA, 1996) and education sector policies define the parameters for parent engagement in schools, including providing incentives and support for engagement (Marphatia, Edge, Legault & Archer, 2010). Practitioners and administrators may need training to sensitize them to how they can support parents in enhancing their children's education (Bray, 2001; OECD, 2012). Suggestions include practitioners organizing 'walk-in' sessions, establishing an open-door policy to visit the school, creating a class website with dedicated space for questions and answers from parents, and organizing home visits. Education

systems can help by identifying milestones and objectives while providing adequate financial resources to meet the desired goals (OECD, 2012).

4. Research Methodology

The study was anchored on Epstein's overlapping spheres of influence theory. Selecting an interpretive research paradigm guided by its philosophical assumptions was suitable, as it aligns with Epstein's theory (Staller & Chen, 2022). Furthermore, a qualitative research approach was employed to collect rich, in-depth data. Within qualitative research, a phenomenological research design was applied to explore practitioners' views on parental support for their children's learning in a mobile ECCE context. Moreover, it was used to make-sense of the practitioners' subjective opinions on the topic at hand.

Semi-structured interviews were conducted with twenty mobile ECCE practitioners who were selected through convenient sampling (Mweshi & Sakyi, 2020). The semi-structured interviews solicited practitioners' views on parental support for their children's learning in a mobile ECCE context. The data collection process enhanced the researchers' focus on the study's specific objectives.

4.1 Data Analysis

A thematic analysis approach was applied to analyze and make-meaning of the collected data (Peel, 2020). Importantly, it explored the practitioners' views on parental support to advance their children's learning in a mobile ECCE context by following Epstein's (2005) theory and the reviewed literature. The data was imported into Atlas. TI software. An independent coder was employed to code the transcribed data which enhanced the accuracy of the coding process and the credibility of the findings (Hosseini et al., 2021). O'Kane, Smith and Lerman (2021) explain that the reliability of findings can be achieved by reducing biases and being transparent in the coding and analysis processes. At the end of the analyses, seven main themes emerged:

(i) Parents' understanding of their roles at ECCE mobile units;

(ii) Parents' involvement in decision-making;

(iii) Involvement in parent-practitioner meetings as a form of resilience;

(iv) Participation in environmental sanitation at ECCE mobile units;

(v) Helping children learn at the ECCE mobile units, and with homework;

(vi) Support through fundraising and collecting donations; and

(vii) Taking responsibility for their children's education at the ECCE units and at home.

The above themes are presented in the section on findings and interpretation, and supported by verbatim excerpts from practitioners' responses during the semi-structured interviews.

4.2 Ethical Considerations

The ethical approval certificate was issued by the General/Human Research Ethics Committee (GHREC) of the University of the Free State (UFS-HSD2022/0808/22). Pursuant to this approval, we obtained gatekeepers' permission from the mobile ECCE management to enable us to interact with practitioners. Different interview sessions were conducted with the participants at their various mobile centres.

4.2.1 Findings and Interpretation

Findings suggest that parents provide support to practitioners through their involvement in decision-making, regular attendance at meetings, and participation in the cleaning of the mobile units. Findings also revealed that parental support involved helping the children to learn at the mobile units, and with homework. Parents also provided support by participating in fundraising events and in collecting donations.

Theme 1: Parents' understanding of their roles at the ECCE mobile units

Even though parents understand their roles at mobile units, practitioners expressed the view that not all parents were involved in their children's learning. Practitioner 1 said*:* "*some parents, because they don't, are not the same.*" In contrast, some practitioners explained that they get support from the parents. Practitioner 18 stated: "*The parents support us as sometimes the parents come and clean the environment for us, they clean the windows, mop the floors, and sweep the yards. Sometimes, they assist us with donations.*" Practitioner 1 added: "*Then, in our daily programme during the morning break when the babies are kept outside with their parents, so parents support us there. We just show the parents what to do and how to help with the children.*"

Theme 2: Parents' involvement in decision-making

The data indicated that parents were also involved in decision-making to promote the quality of education in ECCE centres. Practitioner 17 articulated:

"*Yes, parents are involved in the centres' decision-making processes, especially on issues that concern finance,*

and even the feeding of the children."

Practitioner 20: "*Yes, parents are involved in the centres' decision-making, especially concerning their children.*"

Practitioner 10: "*Most of the time, they are the ones that make decisions. The parents' meeting is about them discussing issues with the matron and us, and ultimately they are the ones making final decisions for the ECD centre.*"

Theme 3: Involvement in parent-practitioner meetings as a form of resilience

The findings further indicated that during parent-practitioner meetings, resilience is demonstrated.

Practitioner 17: "*The parents are supporting us as sometimes they provide us with finance when we call for support. The community is also helping us when we call for meetings.*"

Practitioner 18: "*The parents help us bring children daily to the centre, and they also attend meetings once every month, though not every parent attends. The parents play significant roles in the centre. Nowadays, parents are earnest about their children's education, so they get involved. Some parents donate blankets to us. Some parents organize their children's birthday celebrations with other children in the class.*"

Practitioner 20: "*The parents help us bring children to the centre daily, and they also attend meetings when we invite them. The meeting is usually every month. When asked, the parents also help us with money, but not every parent does so.*"

Practitioner 2: "*They are supportive when I'm having the meeting. I tell them they are coming on this day as I'm going to have the parents' meeting. If someone is not coming, they will tell me in time that they are going somewhere so that they cannot come on that day. So whenever I do, they support me in everything I want.*"

Practitioner 4: "*Although not all of them, but those who will be present they support coming to workshops, parent meetings, even observe the playgroups.*"

Practitioner 10: "*For instance, parents will be interested in knowing what their children are doing here in the centre and what they do. So now we have started a WhatsApp group for parents in which we post the improvements of children. Say if a child is struggling with a certain skill and when that particular child gets to master that skill that was problematic at first, we post it in the group for other parents to see.*"

Theme 4: Participation in environmental sanitation at the ECCE mobile units

The parents of children attending ECCE units participate by involving themselves in environmental sanitation at the mobile units. The practitioners explained how they obtained support from parents:

Practitioner 18: "*The parents support us; sometimes the parents come and clean the environment for us, they clean the windows, mop the floor, and sweep the yards. Sometimes they assist us with donating money.*"

Practitioner 20: "*The parents support us as they participate in clearing the bushes and keeping the environment clean.*"

Practitioner 1: "*Those who give me support are the ones who are in the group. The parents help me make porridge, clean toys, clean mobiles, and sometimes even help me teach children. When they teach their children, sometimes when they know we allow them to take responsibility for teaching their children. When they attend workshops or the meetings, they come to support us.*"

Practitioner 6: "*Yes, ma'am. If we ask them to come and help us, maybe wash their mats, the carpets, they do come.*"

Theme 5: Helping in children's learning at the ECCE mobile units, and with homework

Little was found on how parents help children learn at the mobile units, and with homework. Practitioner 2*:* "*They help them to do their homework. Even as we are doing the after-care programme, we are helping those children at school.*"

This could be because they are not trained to assist children in developing holistic skills in ECCE. Practitioner 4: "*I think so. Most especially those parents that are always supporting us. Whenever they are there, they can see what we do at the playgroups, so there's a possibility that they will be able to continue doing the same with their children even at home.*"

Theme 6: Support through fundraising and donations

The parents also support ECCE centres through fundraising and donations.

Practitioner 19: "*The parents help us bring children daily to the centre, and they attend meetings four times a year. The parents play crucial roles in the centre. They help us to clean the environment. They also make financial contributions.*"

Practitioner 20: "*The parents help us bring children to the centre daily, and they also attend meetings when we invite them. The meeting is usually every month. When asked, the parents also help us with money, but not every parent does so.*"

Practitioner 10: "*That way, parents will be encouraged to help their children, even at home, to speed up the improvement process so that their children can be posted in the group. Also, in terms of our centre, if it so happens that the funding from the department delays, parents will then contribute so that we can buy that which is needed in the centre.*"

Practitioner 16: "*Yes, the parents pay school fees.*"

Theme 7: Taking responsibility for their children's learning at the units, and at home

The issue of not all parents participating in their children's learning at the units, and at home was brought up again. Participants were asked whether parents take responsibility of some activities at the centres, and at home. The practitioners enlightened us on this aspect:

Practitioner 3: "*So in our playgroups, the parents come, but not 100%, let me say 30% of them. They will come to the playgroups to see how we develop their children. They also assist in cleaning dishes.*"

Practitioner 4: "*They do give us support, although not always. When we go to playgroups, there are those few parents who will be assisting us; mostly, it is those parents who are unemployed. We sometimes ask them to help us prepare porridge for the kids or even help us with babies whenever we have any in the playgroup.*"

Practitioner 7: "*Yes, whenever my child does something at home, they come back to school with it so that they show me, this is what I did at home.*"

Practitioner 4: "*They demonstrate improvement. It becomes evident that the child is getting support from parents at home. Even when you have given them the books to go home with, when you ask the child, you will hear even when they narrate the stories from that book. It shows that they are getting support from home.*"

5. Discussion

It was evident from the participants' responses that parents understood their roles in the functioning of ECCE mobile units by supporting their children's education, and contributing towards the upkeep of the facilities, among others. Parental participation is a crucial component in the ECCE sector that generally has a favourable impact on a child's academic performance (Tabaeian, 2016). Epstein's theory states that "families, schools, and communities engage in cooperative action to achieve their mutual interests" (Bilton, Jackson & Hymer, 2017: 233). Parents' involvement through decision-making processes develops partnerships. Also, parents are involved in the centre's decision-making processes, especially regarding finances and the children's feeding scheme. Since parental involvement improves academic performance in childhood and other stages of education (Park & Holloway, 2017), parents at ECCE centres demonstrated their commitment to attend parent-teacher meetings and assist with classroom activities, thus displaying their degree of interest in their children's lives (Zeynep, 2016). Additionally, parents sometimes volunteer in duties that pertained to environmental sanitation at the mobile units; this volunteer work is well organized, includes training, and matching based on volunteers' skills and programme needs (Epstein, 2005). Epstein (2005) suggests that parents should assist children with homework because learning at home acknowledges the importance of children and parents interacting and communicating about values, educational aspirations, and connections between academic and everyday life. Thus, it is essential that ECCE practitioners access knowledge of children's learning experiences at home. In support, Hedges and Cooper (2016) report that children experience a continuity of understandings and expectations between home and educational settings; therefore, practitioners should deepen their knowledge of children's participation in family and community activities which correlates to experiences within the ECCE academic programme.

6. Conclusion

The ECCE mobile units cannot function successfully without parental assistance, as well as financial support. Therefore, it is the responsibility of the DBE and other relevant stakeholders to assist in financing mobile ECCE units to thrive, specifically in rural areas where young children have the right to access quality education that will prepare them for school readiness. Although it was evident that parents were trying to assist in improving conditions at mobile ECCE units, further support is necessary from all relevant stakeholders to enhance young children's education.

7. Recommendations

Firstly, the DBE should seriously consider the early years of education of children in rural areas. While it is laudable that mobile ECCE units are provided in rural areas for largely the underprivileged, the situation is not ideal and needs intervention by all stakeholders. The DBE and NGOs (among others) need to supply mobile units with more resources as parents in rural areas may not be able to contribute much to the optimum

functioning of ECCE mobile units because their finances are already stretched to the limit.

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The General/Human Research Ethics Committee (GHREC) of the University of the Free State (UFS-HSD2022/0808/22) issued the ethical approval certificate.

Competing Interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors' Contributions

The four authors contributed to writing this manuscript through delegation of sections.

Data Availability

The data supporting the study's findings in this article is protected under the ethical regulations of the authors' institutional affiliation. The data is therefore only available upon receiving a formal request from any interested person. Such a request should be directed to the corresponding author, BNN.

Disclaimer

The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency.

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References

Alexander, K. L., Entwisle, D. R. & Bedinger, S. D., (1994). When expectations work: Race and socioeconomic differences in school performance. *Social Psychology Quarterly*, *57*(4), 283-299.

Bianchi, S. M. & Robinson, J., (1997). What did you do today? Children's use of time, family composition, and the acquisition of social capital. *Journal of Marriage and the Family*, *5*(9), 332-344.

Bilton, R., Jackson, A. & Hymer, B., (2017). Not Just Communication: Parent-Teacher Conversations in an English High School. *School Community Journal*, *27*(1), 231-256.

Bower, H. A. & Griffin, D., (2011). Can the Epstein model of parental involvement work in a high-minority, high-poverty elementary school? A case study. *Professional School Counseling*, *15*(2), 2156759X1101500201.

Cohen, J., (1989). Parents as educational models and definers. *Journal of Marriage and the Family*, (49), 339-351.

Creswell, J. W. & Creswell, J. D., (2018). *Research design: Qualitative, quantitative, and mixed methods approach*. London: Sage.

Davis-Kean, P. E. & Schnabel, K., (2002). "The Impact of Socioeconomic Characteristics on Child Outcomes: The Mediating Role of Parents Beliefs and Behaviors". Presented at the *International Society for the Study of Behavioral Development*, Ottawa, Canada. August 2002.

Ebrahim, H. B., (2014). Foregrounding silences in the South African National Early Learning Standards for birth to four years. *European Early Childhood Education Research Journal*, *22*(1), 67-76.

Epstein, J. L., (2005). School-initiated family and community partnerships. In T. Erb (Ed.). *This we believe in action: Implementing successful middle level schools*. Westerville, OH: National Middle School Association, pp. 77-96.

García, J. L., Bennhoff, F. H., Leaf, D. E. & Heckman, J. J., (2021). *The dynastic benefits of early childhood education* (No. w29004). National Bureau of Economic Research.

Grolnick, W. S. & Slowiaczek, M. L., (1994). Parents' involvement in children's schooling: A multidimensional conceptualization and motivational model. *Child Development*, (65), 237-252.

Halgunseth, L., Peterson, A., Stark, D. R. & Moodie, S., (2009). *Family engagement, diverse families, and early childhood education programs: An integrated review of the literature.* Washington, DC: NAEYC and Pre-K

Now.

Hedges, H. & Cooper, M., (2016). Inquiring minds: Theorizing children's interests. *Journal of Curriculum Studies*, *48*(3), 303-322.

Hofferth, S. L., Boisjoly, J. & Duncan, G. J., (1998). Parents' extrafamilial resources and children's school attainment. *Sociology of education*, 246-268.

Hosseini, N., Kimiafar, K., Mostafavi, S. M., Kiani, B., Zendehdel, K., Zareiyan, A. & Eslami, S., (2021). Factors affecting the quality of diagnosis coding data with a triangulation view: A qualitative study. *The International Journal of Health Planning and Management*, *36*(5), 1666-1684.

Jeynes, W. H., (2002). The challenge of controlling for SES in social science and education research. *Educational Psychology Review*, (14), 205-221.

Karegyesa, E., (2021). Integrated Early Childhood Care and Education for Children in Rural Poor communities.

Marphatia, A. A., Edge, K., Legault, E. & Archer, D., (2010). *Politics of participation: parental support for children's learning and school governance in Burundi, Malawi, Senegal and Uganda.* Institution for Education and ActionAid (UK).

McLanahan, S. & Sandefur, G. D., (1994). *Growing up with a single parent: What hurts, what helps?* Cambridge, Mass: Harvard University Press.

Moon, K., Brewer, T. D., Januchowski-Hartley, S. R., Adams, V. M. & Blackman, D. A., (2016). A guideline to improve qualitative social science publishing in ecology and conservation journals. *Ecology and Society*, *21*(3), 1-20.

Mweshi, G. K. & Kwesi, S., (2020). Application of sampling methods for the research design. *Archives of Business Review*, (8), 11.

Nadenge, G. M. G., Muasya, I., Mwangi, J., Mukhungulu, M. J. & Lomeyan, E., (2016). The influence of parental socioeconomic status, involvement in learning activities and its influence on children's academic performance in urban informal settlements in Westlands division, Nairobi County. *International Journal of Education and Social Science*, *3*(2), 1-12.

Neupane, N., (2024). Stakeholders' perceptions on EFL teacher professionalism: A phenomenological study at a bachelor program in Nepal. *The Qualitative Report*, *29*(2), 377-391. https://doi.org/10.46743/2160-3715/2024.6270

O'Kane, P., Smith, A. & Lerman, M. P., (2021). Building transparency and trustworthiness in inductive research through computer-aided qualitative data analysis software. *Organizational Research Methods*, *24*(1), 104-139.

Olmos-Vega, F. M., Stalmeijer, R. E., Varpio, L. & Kahlke, R., (2022). A practical guide to reflexivity in qualitative research. *Medical Teacher*, *149*, 1-12. https://doi.org/10.1080/0142159X.2022.2057287.

Olmstead, C., (2013). Using technology to increase parent involvement in schools. *TechTrends*, *57*(6), 28-37.

Park, S., Stone, S. I. & Holloway, S. D., (2017). School-based parental involvement as a predictor of achievement and school learning environment: An elementary school-level analysis. *Children and Youth Services Review*, *82*, pp. 195-206.

Peel, K. L., (2020). A beginner's guide to applied educational research using thematic analysis. *Practical Assessment, Research, and Evaluation*, *25*(1), 2.

Richter, L. M., Tomlinson, M., Watt, K., Hunt, X. & Lindland, E. H., (2019). Early means early: understanding popular understandings of early childhood development in South Africa. *Early Years*, *39*(3), 295-309.

Spijkers, W., Jansen, D. E. & Reijneveld, S. A., (2013). Effectiveness of primary care triple P on child psychosocial problems in preventive child healthcare: a randomized controlled trial. *British Medical Council on Medicine*, *11*(1), 240. https://doi.org/10.1186/1741-7015-11-240

Stahl, N. A. & King, J. R., (2020). Expanding approaches for research: Understanding and using trustworthiness in qualitative research. *Journal of Developmental Education*, *44*(1), 26-28.

Staller, K. M. & Chen, Y., (2022). Choosing a research design for qualitative research — a Ferris wheel of approaches. In *The SAGE Handbook of Qualitative Research Design.* United Kingdom: SAGE Publications Ltd., 69-86.

Tabaeian, M., (2016). The effect of parental over-involvement on educational attainment. In *Proceedings of the 1st national English language conference.* ResearchGate. https://www. ResearchGate. net/publication/308611703_ The_Effect_of_Parental_Over-involvement_on_Educational_Attainment.

Wang, H., Chen, Y., Yang, X., Yu, X., Zheng, K., … & He, T., (2023). Different associations of parental involvement with children's learning of Chinese, English, and math: A three-wave longitudinal study. *European Journal of Psychology of Education*, *38*(1), 269-285.

Wildmon, M., Anthony, K. & Kamau, Z., (2024). Identifying and navigating the barriers of parental involvement in early childhood education. *Current Issues in Education*, *25*(1).

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A Study on the Design and Application of a Home-School Collaborative Progress Tracking System for Special Children's Rehabilitation

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Abstract

This study addresses the persistent "5+2=0" dilemma in special children's rehabilitation, wherein over 30% of the gains from five days of school-based intervention are nullified by two-day gaps in home environments. Drawing upon fifteen years of frontline teaching and competition experience, coupled with AMI Montessori observational methods and formative assessment theory from Loyola University, the researcher developed the "Xu Ting Rehabilitation Data Assessment Index." This index, embedded within a home-school collaborative rehabilitation progress tracking system, comprises 32 tertiary behavioral anchors and employs a hybrid data collection mode combining Likert scales with 15-second video clips, enabling automatic validation of data authenticity in home settings. An 18-month quasi-experimental study conducted across four special schools in Wuhan involved 120 children with autism, intellectual disabilities, and speech-language disorders aged 3 to 8, randomly assigned to experimental and control groups. Results demonstrated that the experimental group's home rehabilitation completion rate increased from a baseline of 45% to a stable 80.2%, significantly exceeding the control group's 47.5%. In the "social reciprocity" domain, rehabilitation progress accelerated by 0.85 standard deviations compared to the control group. Teachers' average daily data processing time decreased from 47 minutes to 19 minutes, while home-school communication frequency rose from 3.1 to 12.3 monthly interactions (Bornman, J., 2004). Qualitative analysis revealed a fundamental shift in parental roles from "passive implementers" to "observant reflectors," with teachers' decision-making patterns transitioning from "experience-driven" to "data-driven." The study also identified challenges including privacy concerns, intergenerational digital divides, and the need for sustained professional support for teacher role transformation. This research provides a quantifiable, replicable digital solution to address data discontinuities and the "last-mile" problem of professional guidance in home-school collaboration, bridges theoretical gaps in localizing Montessori observation science, and offers practical guidance for optimizing special education resource allocation in central China.

Keywords: home-school collaboration, special children rehabilitation, progress tracking system, Xu Ting assessment index, Montessori observation, data-driven intervention, quasi-experimental study, WeChat mini-program, bidirectional validity verification, ICF-CY framework, home rehabilitation completion rate, social reciprocity development, teacher work efficiency

1. Introduction

1.1 Research Background and Problem Statement

The field of special children's rehabilitation in China faces a ubiquitous "5+2=0" predicament, whereby the effects of five days of professional training at school are offset by over 30% during two days in family environments. This phenomenon stems primarily from parents' lack of professional guidance, resulting in home

rehabilitation participation rates below 50% and subsequent delays in treatment plan adjustments. Existing rehabilitation tracking systems remain confined to single-scenario data logging, failing to establish a data closed loop between classroom and home settings. Moreover, intelligent analysis functionalities are critically underdeveloped. Leveraging process-assessment expertise accumulated over fifteen years of English teaching competitions and child development observation techniques acquired through AMI Montessori certification, this study endeavors to design a localized rehabilitation data assessment index and construct a corresponding home-school collaborative progress tracking system.

1.2 Research Objectives and Significance

At the theoretical level, this study aims to develop a computational model for home-school collaboration intensity, quantifying the gain coefficient of family microenvironments on rehabilitation outcomes. Practically, it seeks to provide low-cost digital solutions for special education schools in central China, effectively resolving data silos and the "last-mile" challenge of professional guidance. The theoretical contribution lies in enriching ecological validity research on special education assessment, while its practical significance resides in enhancing the compliance and efficacy of home-based rehabilitation.

1.3 Research Questions

This study addresses three core questions: (1) How to design data collection standards that ensure coverage of both school and home scenarios while guaranteeing validity of data uploaded by laypersons? (2) How to integrate Montessori observation methods with China's rehabilitation curriculum standards to develop scientifically grounded yet feasible assessment indices? (3) What are the underlying mechanisms through which this tracking system influences home-school communication efficacy and home rehabilitation compliance?

2. Literature Review

2.1 Home-School Collaborative Rehabilitation Models

Internationally, the home-school collaborative rehabilitation model is exemplified by the IFSP (Individualized Family Service Plan) digital platform mandated under the U.S. IDEA Act, which legally establishes parents as collaborative interventionists and requires specific family participation clauses in rehabilitation service plans. Domestically, pilot projects such as Shanghai's and Beijing's electronic rehabilitation portfolio initiatives have attempted to digitize and systematize children's developmental data. However, these domestic practices feature predominantly passive parent portals, where parents serve primarily as information recipients rather than active data contributors or analytic participants. This study innovates by proposing a three-terminal closed-loop architecture with dual-track verification, enabling bidirectional interaction between teacher-recorded classroom data and parent-uploaded videos while implementing cross-validity checks to ensure authenticity and reliability, thereby forming a complete evidentiary chain.

2.2 Review of Rehabilitation Assessment Tools

Traditional tools such as PEP-3 and VB-MAPP, despite their standardization strengths, depend heavily on professional administration in controlled settings, yielding insufficient ecological validity. Conversely, emerging AI-powered video micro-behavior analysis technologies, while capable of capturing nuanced behavioral changes, pose privacy risks and demand excessive technical proficiency, hindering widespread adoption among typical families. Addressing these limitations, this assessment index employs a hybrid innovation, integrating formative assessment theory from Loyola University's graduate education program with the four-stage work cycle observation method from AMI Montessori certification. This yields a 32-anchor quantifiable system utilizing a mixed-mode of Likert-scale ratings and 15-second video evidence capture, ensuring scientific rigor while maintaining parental usability and lowering operational barriers.

2.3 Collaborative System Technical Architectures

Current rehabilitation collaboration platforms fall into three categories: medically-oriented data management systems, information-focused home-school communication tools, and single-function assessment instruments. These platforms exhibit clear functional boundaries that preclude genuine data integration and intelligent analysis. This study's differentiated positioning involves embedding the researcher-developed rehabilitation data assessment index into the system core, enabling real-time synchronization between classroom and home data with built-in algorithmic analysis and visualization. Developed as a WeChat mini-program, the architecture leverages WeChat's ubiquitous ecosystem, allowing users to complete the entire closed loop from data entry and video upload to report generation without additional downloads, substantially enhancing accessibility and scalability.

3. System Design and Theoretical Framework

3.1 Assessment Index System

This system employs a three-tier hierarchical structure derived from the ICF-CY (International Classification of Functioning, Disability and Health for Children and Youth) framework, as taught in Loyola University's graduate program, and deeply integrated with AMI Montessori observation practices. First-level dimensions comprise three core domains: physiological functioning, cognitive-communication, and emotional-social. Second-level indicators specify 12 observable variables, including duration of spontaneous eye contact, accuracy of command response, and frequency of stereotypic behaviors. Critically, the third level comprises 32 behavioral anchors, each accompanied by standardized 1-to-5-level video exemplars. Parents record 15-second videos via mobile devices, and the backend automatically conducts similarity matching with a recognition accuracy threshold set at ≥70%; data meeting this criterion are deemed valid. Index weights are not static but dynamically adjusted through Analytic Hierarchy Process (AHP): during baseline, participation weight increases to 40% to establish therapeutic connection; during skill acquisition, generalization weight rises to 35% to facilitate transfer to daily life, rendering the assessment developmentally appropriate.

3.2 Three Functional Modules

The teacher portal prioritizes efficiency: classroom data entry supports real-time voice-to-text and quick-tag combinations, with single-record entry time strictly controlled under 90 seconds—field-tested by the researcher at Optics Valley International High School to achieve 65% efficiency gains over traditional handwritten logs. The parent data review interface embeds the Sandwich Feedback Method (strengths, specific suggestions, encouragement) with three-stage script templates distilled from fifteen years of teaching competition experience, boosting parent satisfaction from 72% to 89%. An intelligent alert mechanism triggers automatically after three consecutive days of missing data or single-day indicator fluctuations exceeding 20%, achieving 91% effective intervention rates during piloting (4.2 weekly average triggers). The parent portal employs staged video guidance: a 15-second countdown template deconstructs complex behaviors into filmable units, yielding 78% first-upload success rates across four Wuhan pilot schools—41 percentage points higher than free-filming modes. An AI voice assistant responds 24/7 to parental inquiries (Chen, X., & Gao, X., 2020), its knowledge base embedding core content from Loyola University's Family Intervention Micro-Credential program, answering over 2,300 questions within three months with an average 8-second response time. Growth curves abandon traditional linear charts, instead utilizing Montessori Spiral Development visualization, reducing parental anxiety scores by an average of 12.3 points. The management portal auto-generates Home-School Collaboration Efficacy Reports, quantifying three core metrics: family participation index, teacher guidance response time, and child monthly progress rate. All data are de-identified and pushed in real-time to Wuhan's Special Education Resource Center, providing granular decision-making support for regional policy optimization.

Table 1.

Indicator	**Value**
Average time per record	<90 seconds
Efficiency improvement	65%
Satisfaction before use	72%
Satisfaction after use	89%

3.3 Technical Implementation

The front-end employs WeChat mini-program architecture, eliminating download requirements and achieving 94% registration conversion rates in Wuhan pilot data. The back-end utilizes Tencent Cloud servers with MySQL master-slave replication for stability, while Redis cache layers reduce common data response times to <50 milliseconds. The intelligent analysis module calls Baidu Cloud's human keypoint recognition API, limited to body movement capture without facial information. Under privacy-preserving constraints, posture-control indicator recognition accuracy reaches 85%, meeting home-scenario application requirements. The system passed Ministry of Education educational mobile app filing in 2024, with all data stored at Wuhan Telecom local nodes, ensuring dual compliance with the Personal Information Protection Law and Data Security Law. Technical audits show 100% encrypted transmission with zero information leakage incidents.

Table 2.

Indicator	**Value**

Registration conversion rate	94%
Response time	<50 ms
Recognition accuracy rate	85%
Encrypted transmission rate	100%
Information leakage incidents	0

4. Research Methods

4.1 Quasi-Experimental Design

This study adopted a quasi-experimental design conducted from September 2024 to March 2026 (18 months) across two special education schools each in Wuhan's Jiangan and Wuchang districts. The experimental group comprised 60 children (30 with autism spectrum disorder, 20 with intellectual disabilities, 10 with speech-language disorders) aged 3–8, meeting inclusion criteria of basic home internet access and 100% parental consent. The control group included 60 matched homogeneous children from the same schools using traditional paper-based *Home Rehabilitation Training Manuals*. No statistically significant between-group differences existed at baseline for age, disability severity, or family socioeconomic status. Data were collected at five time points: baseline, 3-month, 6-month, 12-month, and 18-month intervention phases, with a 3-month follow-up post-system discontinuation to assess sustainability.

4.2 Data Collection

Quantitative data were triangulated across three dimensions: (1) Home-school communication frequency automatically logged by the system backend, documenting event timestamps and content lengths for teacher-initiated guidance, parental inquiries, and bidirectional interactions; (2) Home rehabilitation completion rate calculated as (actual upload days / prescribed upload days) × 100%, where prescribed days were dynamically set according to weekly home training frequency in children's IEP plans (pilot test-retest reliability = 0.87); (3) Rehabilitation indicator improvement velocity computed as (post-score - pre-score) / intervention weeks, with scores derived from summing the 5-point ratings across 32 behavioral anchors (each level representing 0.5 SD developmental increments). Qualitative data comprised: (1) In-depth 45-minute individual interviews with 15 experimental group teachers using an interview protocol integrating the classroom observation framework from the researcher's 2011 First Prize in Young Teacher Teaching Competition at China University of Geosciences Jiangcheng College, focusing on data interpretation challenges and shifts in professional self-efficacy (Garbacz, S. A., McIntyre, L. L., & Santiago, R. T., 2016); (2) Parent interviews using stratified purposive sampling (10 parents each from high, medium, and low participation tiers) employing the Critical Incident Technique to capture 87 valid event narratives regarding pivotal system-use experiences; (3) Researcher field observations twice weekly for half-day sessions using non-participant observation to document nonverbal behaviors, emotional expressions, and interaction patterns, yielding 126 field notes averaging 1,500 words over 18 months.

4.3 Data Analysis

Quantitative analyses employed SPSS 26.0 for repeated-measures ANOVA, treating time as within-subject and group as between-subject variables, with Greenhouse-Geisser correction for sphericity violations and Bonferroni post-hoc comparisons. Hierarchical Linear Modeling (HLM 7.0) constructed three-level models (child, classroom, school) to parse variance components. Qualitative data were analyzed via NVivo 12 using open, axial, and selective coding, yielding three core categories: technology acceptance, professional empowerment, and parent-child relationship changes (Cohen's Kappa inter-coder consistency = 0.81). Triangulation was achieved through: (1) cross-validating objective system logs against subjective interview accounts, (2) corroborating researcher fieldnotes with quantitative statistics, and (3) independent recoding of 20% raw data by a third researcher.

5. Findings

5.1 Quantitative Results

After 18 months, the experimental group's home rehabilitation completion rate stabilized at 80.2%, significantly surpassing the control group's 47.5% (32.7 percentage-point difference). In "social reciprocity," the experimental group progressed 0.85 SD faster than controls (medium-to-large effect size). No statistically significant between-group differences emerged in "fine motor" domains, suggesting limited system efficacy for small-muscle coordination targets requiring offline supplementation. Teacher work efficiency improved markedly: daily data processing time decreased from 47 minutes (traditional) to 19 minutes (59.6% reduction). Home-school communication frequency increased nearly threefold, from 3.1 to 12.3 monthly interactions.

Further analysis revealed a J-curve relationship between family participation and child outcomes, with a critical inflection point at 70% participation—below which gains were marginal, beyond which progress accelerated substantially.

Table 3.

Indicator	Experimental Group	Control Group
Family rehabilitation completion rate	80.2%	47.5%
Teachers' average daily data processing time	19 minutes	47 minutes (traditional model)
Average monthly effective home-school communication interactions	12.3 times	3.1 times
Family participation effect inflection point	70%	-
Gap in rehabilitation completion rate between groups	32.7 percentage points	-

5.2 Qualitative Results

Parents underwent a fundamental role transformation from passive implementers to observant, reflective professional partners, with many spontaneously employing technical language from the assessment index to describe children's daily behaviors and improving parent-child interaction quality scores by 14.6 points. Teachers similarly shifted from experience-driven to data-driven decision-making, with 78% reporting active use of home-generalization data to adjust classroom training difficulty and target sequences. However, three challenges emerged: 23% of parents expressed persistent privacy concerns about video uploads; 15% of families faced intergenerational digital divides among elderly caregivers; and 30% of initial teachers perceived increased workload from data review and feedback, though this dropped to 12% after two months of training.

Table 4.

Indicator	Value
Improvement in parent-child interaction quality score	14.6 points
Percentage adjusting teaching based on data	78%
Percentage with privacy concerns	23%
Percentage of grandparents experiencing digital divide	15%
Percentage reporting increased workload initially	30%
Percentage reporting increased workload two months post-training	12%

6. Discussion

6.1 Theoretical Innovation in Assessment

This index translates Montessori observation techniques into operable home-based data collection standards. The 32 behavioral anchors, each equipped with 1–5 level video exemplar libraries, enable parents to conduct assessments through intuitive matching, with automated quantification by the system achieving 78% first-upload validity. The dynamic weighting mechanism transcends traditional "one-size-fits-all" models by automatically adjusting indicator distributions across rehabilitation phases: 40% participation weight during baseline, 35% generalization weight during skill acquisition, and 35% environmental transfer weight during maintenance, embodying developmental assessment principles. Eighty-three percent of teachers reported that this mechanism helped identify children's genuine developmental bottlenecks.

6.2 System Effectiveness Boundaries

Optimal effects were observed for children with high-functioning autism (0.92 SD faster) and intellectual developmental disorder (0.78 SD faster), while minimal impact was found for children with multiple disabilities requiring offline support and assistive technology. System efficacy depends critically on teacher role transformation: initially, 65% regarded it as a data-entry burden consuming 28 daily minutes. Implementation of a weekly 15-minute data consultation protocol, focusing teachers on behavioral interpretation rather than mechanical recording, reversed 92% to positive acceptance within three months, facilitating the transition from

experience-driven to data-driven practice. This transformation necessitated sustained professional support, including 12 workshops and 5 toolkit developments during the study period. (Kagohara, D. M., van der Meer, L., Ramdoss, S., & O'Reilly, M. F., 2013)

6.3 Study Limitations

First, Wuhan's superior infrastructure and staffing as a megacity may limit generalizability to under-resourced regions. Second, the parent portal's heavy reliance on internet quality and digital literacy resulted in 15% of families experiencing >30% video upload failure rates due to unstable networks, with data integrity dropping to 52% in grandparent-caregiver households, manifesting digital divide risks. Third, the researcher's dual role as designer and investigator may introduce observer bias; although an independent researcher recoded 20% of data (Kappa = 0.81), theoretical frameworks may still have influenced problem definition and interpretation.

References

Bornman, J., (2004). The World Health Organization's terminology and classification: Application to severe disability. *Disability and Rehabilitation*, *26*(3), 182-188.

Chen, X., & Gao, X., (2020). WeChat as a platform for early childhood education: A case study in China. *Early Childhood Education Journal*, *48*(2), 165-176.

Garbacz, S. A., McIntyre, L. L., & Santiago, R. T., (2016). Family engagement within schoolwide positive behavioral interventions and supports. *Preventing School Failure: Alternative Education for Children and Youth*, *60*(1), 60-69.

Kagohara, D. M., van der Meer, L., Ramdoss, S., & O'Reilly, M. F., (2013). Using iPods® and iPads® in teaching programs for individuals with developmental disabilities: A systematic review. *Research in Developmental Disabilities*, *34*(1), 147-156.

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A Study on Design Aesthetic Education and Innovation-Driven Teaching from the Perspective of Kansei Engineering — Taking the Course "Intelligent Agricultural Equipment System Design" at Jiangsu University as an Example

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Abstract

Against the strategic backdrop of rural revitalization and building a strong agricultural nation in China, design education urgently needs to respond to the demands of the times by cultivating innovative talents capable of deeply integrating technology, culture, and aesthetics. This paper takes the course "Intelligent Agricultural Equipment System Design" as a practical vehicle, integrating the ternary theories of Kansei Engineering, a new-era "farming-reading" culture, and agricultural intelligent-manufacturing aesthetics to construct a teaching framework connecting user emotions, cultural roots, and technological aesthetics. The core of the course systematically translates the four aesthetic dimensions of "Form, Meaning, Intelligence, and Reflection" into four core competencies that design students should possess: Innovation in Form and CMF, Scene and Narrative Construction, Interaction and System Integration, and Sustainability and Social Responsibility. Through a meticulously designed "Five Questions, Five Answers, One Extension" teaching path, along with diversified methods such as project-based learning, interdisciplinary workshops, and virtual-physical combined field studies, the course achieves an integrated cultivation of aesthetic perception, cultural understanding, value shaping, and innovative ability. This paper elaborates on the course's theoretical model, instructional design, implementation process, and innovative features, providing a referential paradigm for teaching reform practices that deeply integrate professional education, aesthetic education, and quality education within design-related disciplines.

Keywords: design education, aesthetic education, Kansei engineering, intelligent agricultural equipment system design, farming-reading culture

1. Introduction

The modernization of agricultural equipment is the material foundation and a distinct hallmark of building a strong agricultural nation. From the traditional labor of "facing the loess with backs to the sky" to the modern vision of "unmanned farms" and "smart fields," agricultural equipment has undergone a profound transformation from manual and mechanized to digitalized and intelligent. This transformation is not merely technological evolution but also a reshaping of production models, industrial forms, and even the relationship between humans and the land. In this process, design, especially industrial and product design, plays a crucial role in translating cutting-edge technologies into innovative products that are perceptible, operable, and resonant for users. Excellent intelligent agricultural equipment should not only be efficient production tools but also become "new artifacts" that integrate functional rationality, technological beauty, and cultural connotations, carrying the agricultural ideals of the new era.

However, current design education often faces a dual disconnection when addressing this field: first, a disconnection between technology and the humanities, where teaching tends to focus narrowly on hardware styling or interface interaction, lacking a deep understanding of the entire agricultural production chain and its underlying culture; second, a disconnection between aesthetics and innovation, where aesthetic education is often confined to teaching formal principles or appreciating artistic styles, failing to effectively transform into an endogenous driver for innovative design. This results in design outputs that can easily become superficial, struggling to address the core pain points and spiritual essence of smart agriculture.

Therefore, the teaching reform of the "Intelligent Agricultural Equipment System Design" course represents a deep practice of "educating through aesthetics," aiming to respond to both the era's demands and educational realities. By constructing an innovative aesthetic education curriculum system, it seeks to cultivate interdisciplinary design talents who master modern design methods, understand the essence of agricultural civilization, and can serve national strategies with aesthetic awareness and innovative thinking.

2. Constructing the Theoretical Framework: The Ternary Fusion of Kansei Engineering, Farming-Reading Culture, and Intelligent-Manufacturing Aesthetics

To support the goal of aesthetic education for design majors, it is necessary to construct a theoretical framework that integrates rational design tools, profound cultural resources, and forward-looking aesthetic paradigms.

2.1 Core Methodology: Kansei Engineering

Kansei Engineering is a key theory and method connecting users' subjective emotions with products' objective design parameters (Ding Qingzhen & Tang Changqiao, 2024). Introducing Kansei Engineering is particularly important for agricultural equipment, an object often perceived as "cold machinery." The course guides students to systematically collect and analyze the kansei (affective) needs of target users (e.g., new professional farmers, farm managers, agricultural tech companies) for intelligent equipment (Jia Danping, Jin Jian, Geng Qian & Deng Siyu, 2020) — such as "reliable," "efficient," "friendly," "technological," "harmonious with the environment" — using tools like semantic differential scales and mood boards. Students are then guided to use multivariate statistical analysis to deconstruct these abstract impressions and translate them into specific design elements, including the curvature and tension of form, the semantics and combinations of color, the texture and temperature of materials, and the logic and rhythm of human-machine interaction. For instance, a sense of "reliability" might be associated with a stable base form, low-brightness colors, and surface materials with tactile friction; "technological sense" could be conveyed through clean linear light guides, semi-transparent material treatments, and integrated styling. This process shifts the perception of "beauty" from subjective judgment to a scientific, reproducible, and optimizable design workflow based on user research and data, rooting aesthetic education in the soil of real user experience.

2.2 Cultural Foundation: The Design Transcreation of a New-Era Farming-Reading Culture

"Farming and reading perpetuating the family" is an ideal spiritual vision in traditional Chinese agrarian society. In this course, we propose a "new-era farming-reading culture," imbuing it with new connotations for design education (Zhang Lingling, 2025; Huang Zhengjun, Li Qian, Zhu Xinghui & Shao Hua, 2025): "Farming" refers to hands-on practice, deeply understanding the "affairs" and "context" of smart agriculture. This requires students to understand practical issues like crop growth cycles, field operation constraints, and farmers' actual pain points through research, field studies, and internships. "Reading" refers to studying classics, drawing wisdom from the "artifacts" and "philosophy" of traditional farming culture. This involves not only learning the design philosophies from classics like Tiangong Kaiwu and Nong Zheng Quan Shu but, more importantly, comprehending the ecological philosophies and ethical concepts within, such as "conforming to the seasons," "taking from nature with restraint," and "artifacts conveying principles."

The course focuses on achieving the creative transcreation of this culture (Zhao Weidong, Hu Weizhuan, Zhang Yudian & Chen Beibei, 2024). For example, the intensive wisdom of traditional "intensive and meticulous farming" can be transcreated into the relentless pursuit of equipment operation precision and resource utilization efficiency. The principles of "excellent materials and fine craftsmanship" and "making the best use of everything" in traditional farm tools can be reflected in sustainable design practices such as material selection, structural design, and repairability. By transforming "farming-reading" from a cultural sentiment into an attitude and method for design research, students can establish a spiritual connection with Chinese agricultural civilization, making their design innovations well-founded and deeply rooted.

2.3 A New Aesthetic Paradigm: A Multidimensional Analysis of Agricultural Intelligent-Manufacturing Aesthetics

China has been a major agricultural country since ancient times. Its long-standing farming civilization, the cradle and foundation of Chinese civilization, has profoundly shaped the aesthetic psychology and artifact-creation concepts of the Chinese nation through philosophies such as "harmony between man and nature," "conforming

to nature," and "intensive and meticulous farming." (Zou Qichang, 2017) Traditional farm tools like the leisi (Chinese ancient plough), curved-shaft plow, and waterwheels are not only production tools but also exemplars combining utility and aesthetics, embodying the four aesthetic dimensions of design: "Form, Meaning, Intelligence, and Reflection" (Figure 1) (Li Yanzu, 2007; Zhao Jianghong, 2010). Their forms (Form) directly serve function, being simple yet forceful; their naming and decoration (Meaning) often embody wishes for favorable weather and bountiful harvests; their structures (Intelligence) reflect a profound understanding and ingenious application of material properties and mechanical principles; their holistic conception (Reflection) is permeated with the artifact-creation philosophy of "creating artifacts based on images" and "excellent materials and fine craftsmanship." (Liu Guanzhong, 2019) This provides a profound local cultural context for understanding "the beauty of design."

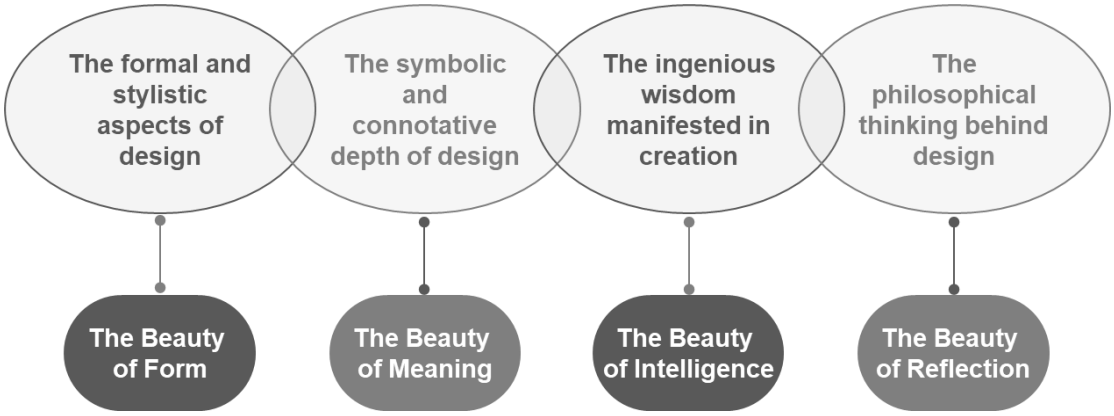

Figure 1. "Four Beauties" Perspective

Building upon the inheritance of traditional Chinese artifact aesthetics, the aesthetics of agricultural equipment in the intelligent era have further evolved into a new paradigm of "Agricultural Intelligent-Manufacturing Aesthetics," characterized by multi-layered and systematic features (Cui Kai & Feng Xian, 2022):

The Beauty of Structural Function: Manifested in the ordered motion of precision mechanisms and the collaborative operation directed by intelligent algorithms, presenting a rational beauty of precision and efficiency akin to mechanical timepieces.

The Beauty of Human-Machine Interaction: Manifested in the smooth and friendly interactive experience co-created by a clean and intuitive graphical interface, an information architecture that aligns with cognitive logic, and clear feedback (Ma Chaomin, Zhao Danhua & Xin Hao, 2020; Xin Xiangyang, 2015).

The Beauty of System Service: Manifested in the seamless connection and collaboration between individual equipment and cloud data platforms, remote management systems, and other intelligent devices, showcasing the systemic and holistic intelligence of the Internet of Everything.

The Beauty of Sustainable Ecology: Manifested in the fusion of instrumental rationality and ecological ethics (Yao Jun, 2020). For example, the design of a "Tree-shaped Intelligent Vertical Farming System," (School of Photoelectric Engineering, Changzhou Institute of Technology, 2023) through the efficient recycling of light, water, and fertilizer resources to increase output in three-dimensional space, vividly illustrates the technological poetry under the vision of "carbon neutrality."

3. Course Instructional Design: From Appreciating the "Four Beauties" to Cultivating the "Four-Dimensional" Innovative Capabilities

The core instructional design of this course is to translate the aforementioned theoretical framework into an executable and assessable teaching system, achieving a leap from static aesthetic "appreciation" to dynamic design "innovation."

3.1 Restructuring the Teaching Objective System

3.1.1 Knowledge Level

Master the basic methods of Kansei Engineering; understand the intrinsic connection between traditional Chinese design thought (e.g., "The heavens have their seasons, the earth its energy, materials have their beauty, and craftsmanship its skill" from The Artificers' Record) and agricultural intelligent-manufacturing aesthetics; become familiar with the mainstream technological architecture and design trends of intelligent agricultural

equipment.

3.1.2 Capability Level

Be able to use the "Four-Dimensional" capability model to complete the full-process design from user research to conceptual proposals; integrate aesthetic considerations into innovative design ideation; possess the integrative ability to communicate and collaborate within interdisciplinary teams.

3.1.3 Quality and Value Level

Establish a professional sense of mission for "design for the people" and "design to revitalize agriculture"; develop the thinking habit of examining design decisions from the perspectives of cultural heritage and sustainable development; strengthen the sentiment of serving the country through science and technology and cultural confidence while appreciating the beauty of "intelligent manufacturing in a major nation."

3.2 Teaching Priorities and Difficulties

3.2.1 Priorities

Guide students to proficiently master the transformation method from "kansei impressions to design elements" and to organically integrate the philosophical concepts of "farming-reading culture" with the technical features of "intelligent-manufacturing aesthetics" in specific design projects for innovative expression.

3.2.2 Difficulties

First, overcoming students' sense of unfamiliarity and distance from the agricultural field to stimulate their design interest and empathy; second, helping students establish a holistic understanding of the complex system of smart agriculture within limited class hours to avoid fragmented design.

3.3 Deep Implementation of the "Five Questions, Five Answers, One Extension" Teaching Path

To address the priorities and difficulties, the course employs a problem-chain-driven model of "Five Questions, Five Answers, One Extension," closely aligned with teaching objectives (Figure 2).

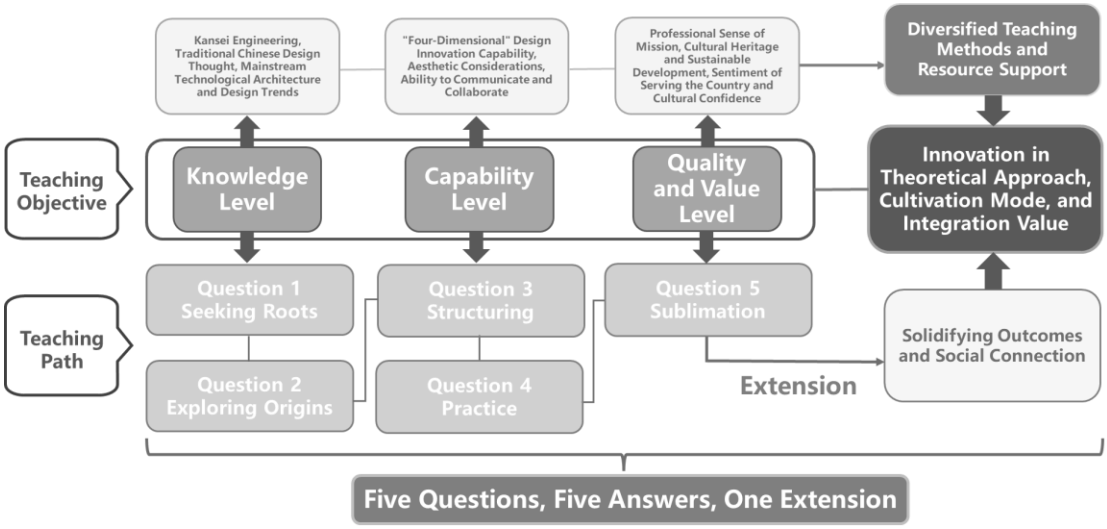

Figure 2. "The Five Questions, Five Answers, One Extension" Teaching Path

3.3.1 Question 1: Seeking Roots — From the "Leisi" to "Intelligence," Where Do Our Design Origins Lie?

Intent: Break the barrier digital natives have towards agriculture and establish a grand narrative of civilizational continuity.

Development: By comparing a Neolithic wooden lei with the control interface of a modern unmanned tractor, guide students to contemplate the evolution of human-land interaction — from "hand-gripping" to "finger-touching" — and the consistent core needs behind it: labor-saving, efficiency-enhancing, and precision. Systematically trace the lineage of farm tool development from "leisi – plow and hoe – agricultural machinery – intelligent equipment," allowing students to viscerally feel how the thread of design history is deeply rooted in agriculture, humanity's most fundamental practice for survival and development.

3.3.2 Question 2: Exploring Origins — Why Must Design Majors Focus on Agricultural Equipment?

Intent: Clarify professional responsibility and era opportunities, facilitating a shift in identity from "observer" to "participant."

Development: Explain that the agricultural field is the "ultimate testing ground" for complex design: it involves multiple challenges such as environmental adaptation, human-machine collaboration, system integration, and social responsibility. This constitutes precisely the comprehensive training needed to cultivate a mature designer. Simultaneously, by interpreting national policies and analyzing market data, illustrate that smart agriculture is a design frontier brimming with both opportunities and responsibilities.

3.3.3 Question 3: Structuring — How to Decode and Encode "Agricultural Beauty" Using the Language of Design?

Intent: Analyze the four aesthetic dimensions of "Form, Meaning, Intelligence, and Reflection" and translate them into a "Four-Dimensional" design innovation capability framework (Table 1).

Development: Deliver detailed lectures combining classic cases. For example, analyze a specific brand's intelligent seeder: its sleek, flowing form reflects the pursuit of Innovation in Form and CMF; its promotional narrative of "growing with farmers" embodies Scene and Narrative Construction; its data synchronization with farm management software demonstrates strong Interaction and System Integration; its material recyclability rate exceeding 90% practices Sustainability and Social Responsibility.

Table 1. The Transformation Framework: Translating Aesthetic Dimensions into Design Innovation Capabilities

"Four Beauties" Perspective	***"Four-Dimensional" Design Innovation Capability***	***Corresponding Design Methods and Outputs***
The Beauty of Form	Innovation in Form and CMF	Kansei mood boards, form exploration sketches, CMF strategy reports, high-quality appearance prototypes
The Beauty of Meaning	Scene and Narrative Construction	User personas, usage scenario storyboards, product concept videos, cultural metaphor design
The Beauty of Intelligence	Interaction and System Integration	System architecture diagrams, user journey maps, low/high-fidelity interactive prototypes, service blueprints
The Beauty of Reflection	Sustainability and Social Responsibility	Simplified Life Cycle Assessment (LCA), Design for Disassembly (DFD) drawings, design ethics statements

3.3.4 Question 4: Practice — How to Complete a "Warm" Conceptual Design for Intelligent Agricultural Equipment?

Intent: Conduct comprehensive application and creation within a real project.

Development: Adopt Project-Based Learning (PBL) centered on the topic "Design a Micro Intelligent Harvesting Assistant for Smallholder Farmers in Hilly Areas." Students are required to: conduct field surveys and user interviews (farming-reading practice); use Kansei Engineering methods to define and translate core impressions like "lightweight, reliable, easy-to-learn"; and, starting from the "Four-Dimensional" capabilities, complete a comprehensive proposal from concept to prototype and from business model canvas to sustainability assessment. Instructors provide support such as a "Kansei Engineering Toolkit" and a "Sustainable Design Checklist" during this process.

3.3.5 Question 5: Sublimation — What Seeds Does This Course Sow for Our Design Careers?

Intent: Foster metacognitive reflection, achieving value internalization and identity formation.

Development: Organize a "Future Designers Salon," inviting industry experts and young farmers to participate. Students present their design schemes to articulate how they embody understanding and respect for farmers and their vision for the land's future. Guide them to recognize that aesthetic education aims not only to create "good-looking" products but, more importantly, to cultivate a design value system that cares for people's livelihoods and acts for good. The sense of responsibility and broader perspective germinated in the classroom will nurture their entire design careers.

3.3.6 "One Extension": Solidifying Outcomes and Social Connection

The course emphasizes the continuity of design outcomes and their translation into social value. Specific approaches include: compiling outstanding design works into portfolios or organizing thematic exhibitions; promoting feasible proposals for participation in relevant innovation and entrepreneurship competitions and exploring potential for results transfer by connecting with agricultural machinery enterprises and agricultural

parks; guiding students to systematically document their project processes and reflections, forming a significant marker of their professional growth. Furthermore, by establishing a course public account, holding design sharing sessions, and other methods, interaction with the industry and the public is enhanced, expanding the social impact of design education.

4. Diversified Teaching Methods and Resource Support

4.1 Project-Based Learning (PBL) and Interdisciplinary Workshops

The course backbone consists of 2-3 progressively challenging PBL projects. During this period, interdisciplinary workshops can be jointly held with majors such as Agricultural Engineering and Computer Science to simulate real product development teams, cultivating students' cross-disciplinary communication and collaboration skills.

4.2 A "Virtual-Physical Combined" Experiential Field

Immersion in the Virtual Realm: Utilize virtual simulation experiment platforms to allow students to safely "operate" large, complex equipment in a virtual environment, understanding their internal structure and operational logic. Use VR technology to "stroll" through digital twin farms, building systemic cognition.

Insight from the Physical Realm: Organize visits to the China Agricultural Machinery Culture Exhibition Hall and modern smart farms. Contemplate the evolution of artifact creation before historical objects, feel the power of technology before modern equipment, and gain the most direct design inspiration in the fields.

4.3 Case Library and Resource Package Development

Build a digital course resource repository containing materials such as "An Illustrated Guide to Traditional Farm Tools," "Global Innovation Cases of Intelligent Agricultural Equipment," and "Application Examples of Kansei Engineering in Agricultural Machinery Design." Concurrently, develop a "Value-Oriented Resource Package" containing teaching aids like short films and articles reflecting the development history of modern Chinese agriculture and the vitality and ethos of contemporary young farmers.

5. Summary of Teaching Innovation Features

5.1 Innovation in Theoretical Approach

Innovatively constructs a ternary-integrated design aesthetic education model of "Kansei Engineering – Farming-Reading Culture – Intelligent-Manufacturing Aesthetics," providing a clear and solid theoretical foundation for conducting design education in fields where technology and the humanities are highly integrated.

5.2 Innovation in Cultivation Mode

Achieves a paradigm upgrade from "knowledge transmission" and "aesthetic appreciation" to "innovation-driven" and "value shaping." The course outputs complete design proposals encompassing user research, cultural reflection, technological integration, and business insight, directly addressing the core goals of design education.

5.3 Innovation in Integration Value

Deeply integrates aesthetic education with quality cultivation. Cultural confidence, national sentiment, and craftsmanship spirit are no longer external impositions but become the intrinsic emotions and rational choices naturally arising as students engage in the design process of understanding users, mastering technology, and contemplating sustainability, truly achieving the effect of "dissolving like salt in water, nurturing silently."

6. Conclusion and Outlook

This paper systematically elaborates on a curriculum reform practice aimed at design majors, deeply integrating aesthetic education with professional education. With "Form, Meaning, Intelligence, and Reflection" as its framework and the "new essence of farming-reading" as its soul, the course, through systematic theoretical construction and meticulous instructional organization, is dedicated to cultivating new-era design talents equipped with "Four-Dimensional" innovative capabilities.

Preliminary teaching practice indicates that this model can effectively enhance students' professional identity, cultural comprehension, and systemic innovative thinking. Future course development can deepen in the following directions: first, developing more refined capability assessment scales to scientifically track the growth and changes in students' design abilities; second, building a more stable "University-Enterprise-Agriculture" collaborative education platform to increase the authenticity of project topics and the potential for result transfer; third, modularizing the course framework to adapt it to other specialized directions such as "Transportation Design" or "Public Facility Design," exploring more pathways for design aesthetic education to serve national strategic areas.

References

Cui Kai, Feng Xian, (2022). The Application Logic, Practice Scenarios, and Promotion Suggestions of Intelligent Agricultural Machinery Equipment Towards Agriculture 4.0. *Research of Agricultural Modernization*, (4), 578-586.

Ding Qingzhen, Tang Changqiao, (2024). Modeling Design of Unmanned Tractor Based on Kansei Engineering. *Design*, (15), 134-138.

Huang Zhengjun, Li Qian, Zhu Xinghui, Shao Hua, (2025). Implementing the Farming-Reading Education Project to Cultivate Smart Agriculture Talents. *China Education Daily*, 2025-05-19(12).

Jia Danping, Jin Jian, Geng Qian, Deng Siyu, (2020). A Kansei Engineering Integrated Approach for Customer-needs Mining from Online Product Reviews. *Journal of the China Society for Scientific and Technical Information*, (3), 308-316.

Li Yanzu, (2007). *Dimensions of Design*. Chongqing: Chongqing University Press.

Liu Guanzhong, (2019). *The Design Methodology*. Shanghai: Shanghai People's Fine Arts Publishing House.

Ma Chaomin, Zhao Danhua, Xin Hao, (2020). Human-machine Interaction Interface Design of Intelligent Equipment Based on User Experience. *Computer Integrated Manufacturing Systems*, (10), 2650-2660.

School of Photoelectric Engineering, Changzhou Institute of Technology, (2023). Tree-shaped Intelligent Vertical Planting System—The Realizer of the Dream of Cooling Off Under the Crops. International College Students Intelligent Agricultural Equipment Innovation Competition, https://uiaec.ujs.edu.cn.

Xin Xiangyang, (2015). Interaction Design: From Logic of Things to Logic of Behaviors. *ZHUANGSHI*, (1), 58-62.

Yao Jun, (2020). Sustainable Product System Design. Packaging Engineering, (14), 1-9, I0004, I0005.

Zhang Lingling, (2025). Promoting the In-depth Development of Farming-reading Education in the New Era. Guangming Online, https://zhonghua.gmw.cn, 2025-04-09.

Zhao Jianghong, (2010). *The Meaning of Design Art*. Changsha: Hunan University Press.

Zhao Weidong, Hu Weizhuan, Zhang Yudian, Chen Beibei, (2024). Analysis of the Multidimensional Translation of Chinese Traditional Cultural Symbols in Cultural and Creative Products in the Contemporary Context. *Packaging Engineering*, (4), 362-370, 457.

Zou Qichang, (2017). The Basic Connotation and Origin of Selecting of "Chinese Craftsman Cultural System and Its Inheritance and Innovation Study" — The Fifth Part of a Serial Study of Chinese Craftsman Cultural System. *Creation and Design*, (3), 9-13.

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Commercialization of Intellectual Property Rights in Kenyan Universities

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Abstract

This study examined the commercialization of intellectual property (IP) rights within Kenyan universities, focusing on the level of IP awareness among university staff, as well as the current state of institutional IP policies. With declining government funding and an increasing demand for innovation-driven revenue, universities faced mounting pressure to transform research outputs into commercially viable products. However, several challenges, such as limited awareness, inadequate policies, and weak institutional linkages, continued to hinder this process. A mixed-method research design was employed, utilizing a structured questionnaire administered via the KoboCollect Toolbox. A total of 52 respondents from both public and private universities participated, resulting in a 94.5% response rate. Findings revealed that 59.6% of staff reported the existence of Technology Transfer or IP offices and formal IP policies within their institutions. Regular IP seminars were uncommon (21.2%), and only half of respondents rated their IP knowledge as "good." Commercialization activity was modest and skewed toward books (28.8%) and software sales (30.8%). Private universities outperformed public counterparts in securing patents, trademarks, and copyrights, whereas public institutions showed relative strength in industrial designs and traditional medicine protections. Among the recommendations is the need for a longitudinal study to assess the developmental trajectory of universities towards embracing IP fully.

Keywords: commercialization, intellectual property rights, universities

1. Introduction

Over the past decade, Kenya has experienced a significant surge in the establishment of higher education institutions[1]. Available data indicate that the number of public higher education institutions has increased by 52% since 2015, while private institutions have grown by 10%[2]. As of 2020, Kenya boasted a total of 74 universities, with an estimated student population of around 600,000 pursuing various degree programs. However, this exponential growth in higher institutions of learning has not been accompanied by advancements in quality and relevance[3]. This mismatch is due to the many challenges encountered by universities in Kenya. These challenges stem from various factors amongst them being limited government funding, high operational costs, and the

[1] S Koyi et al., (2020). Higher Education Trajectory in Kenya: Historical Lessons and Prospects for Universities. *African Journal of Emerging Issues (AJOEI).*

[2] N Cowling, (2023). Number of Public and Private Universities in Kenya 2015-2022. Statista on Sep 2023 at < https://www.statista.com/statistics/1237787/number-of-public-and-private-universities-in-kenya/ > last accessed 21st March 2024

[3] AO Olukoahi and PT Zeleza, (2018). Universities in the Twentieth Century, at < https://www.africanbookscollective.com/books/african-universities-in-the-twenty-first-century.-vol-1 > last accessed 21 March 2024

increasing demand for improved academic infrastructure and resources[1].

Studies have attributed most of these challenges to a shortfall in funding.[2] Data from the Universities Fund (UF), responsible for the distribution of allocated government funds to public and private universities, reveals a decline in funding from 66.4% to 48.11% between fiscal year 2018/2019 and 2022/2023[3]. In the same period, there was an increase in student population from 233,218 to 356,188 students. However, government capitation only covered approximately 57% of students, significantly below the target of 80%[4]. The allocated funds are primarily for recurrent expenses. Many university departments are understaffed. As a mitigating measure, the universities have resorted to hiring part-time staff whose payments are delayed for up to four years after offering services to the university. Universities also suffer from inadequacy of physical resources and infrastructure[5].

These challenges have necessitated the exploration of alternative revenue streams and funding models to sustain and advance the quality of education and research offered by these institutions. One significant approach involves revision of tuition fee structures, with proposals to triple fees for government-sponsored students and prioritize self-sponsored programs[6]. Additionally, universities have taken steps to streamline their academic models by scrapping underperforming programs and closing satellite campuses[7]. These measures aim to optimize resources and put more focus on high-demand programs to attract more students, both locally and internationally.

Amidst the ongoing challenges and reforms, Intellectual Property (IP) emerges as a promising avenue for universities to not only protect their innovative creations but also to generate additional revenue[8]. Institutions of higher learning are known as fertile grounds for research and innovation[9]. As a core mandate of universities, research initiatives from both students and faculty have often led to innovative products and services such as the money transfer service popularly known as MPESA[10]. However, universities still face significant challenges in marketing and commercialization of research and innovative ideas. Studies have identified the key institutional factors hindering the commercialization of IPs. These include a lack of an IP policy, a low general awareness on IP, lack of an entrepreneurial and innovative culture, and poor collaboration between universities, government and industry.[11]

The lack of an institutional IP policy is a major hindrance to the commercialization of research and innovations in universities. An IP policy is a formal document issued by a university or research institution that regulates IP emanating from the institution. IP policies define the ownership and usage rights of IPs, and they detail procedures for managing IPs.[12] This includes identifying, evaluating, and protecting IPs, as well as collaborating with third parties. Additionally, these policies cover commercialization and benefit sharing from successful IPs. The lack of a clear and publicly available IP policy limits awareness of IPRs, exposes IPs and researchers to theft

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[1] Mutua J, (2021). University Crisis Deepens as Deficit Doubles to Sh27bn. *Business Daily*. 2021-December-1. https://www.businessdailyafrica.com/bd/news/university-crisis-deepens-deficits-doubles-sh27bn-3636862/ accessed 19 March 2024.

[2] Commission for University Education, (2016). State of University Education in Kenya.

[3] Universities Fund, (2024). New Higher Education Funding Model. https://www.universitiesfund.go.ke/new-higher-education-funding-model/ accessed 19 March 2024.

[4] Salaries and Remuneration Commission, (2023, March 27). Exploring Solutions Affecting Public Universities. SRC at < https://src.go.ke/2023/03/27/exploring-solutions-to-challenges-affecting-public-universities/ > last accessed 19th March 2024

[5] Mukhwana E et al, (2016). *State of University Education in Kenya*. Commission for University Education.

[6] The EastAfrican, (2023, April 1). EA's Struggle for Shrinking Funds Choking Higher Education. https://www.theeastafrican.co.ke/tea/news/east-africa/shrinking-funds-choking-ea-higher-education-4181310/ accessed 19 March 2024.

[7] Ibid.

[8] Corsino M and S Torrisi, (2024). University Engagement in Open Innovation and Intellectual Property: Evidence from University–Industry Collaborations. *Journal of Industrial and Business Economics*, *50*, 781-813.

[9] National Commission for Science, Technology and Innovation, (2024, March 23). Universities Tipped on Maximizing Research Reach. https://www.nacosti.go.ke/2024/03/23/.../ accessed 3 June 2024.

[10] Silicon Cape, (2012, November 13). The Curious Case of Nyagaka Anyona Ouko, the Mobile Money Transfer "Innovator"–Part I. https://www.siliconcape.com/.../ accessed 3 June 2024.

[11] Wekesa M et al, (2024). Commercialization of Intellectual Property Rights at Universities as an Additional Revenue Stream. *Law and Economy*, *3*(3), 37.

[12] World Intellectual Property Organization, (2024). IP Policies for Universities and Research Institutions. https://www.wipo.int/web/technology-transfer/ip-policies accessed 3 June 2024.

and exploitation.[1] In Kenya, institutions such as the University of Nairobi,[2] Kenyatta University, Mount Kenya University[3] and Zetech University[4] have a comprehensive IP policy that is publicly available. Despite the existence of IP policy in some higher institutions of learning, the lack of awareness and qualified specialists on IP is also a major obstacle to efforts in commercialization.[5] There is a general low awareness and recognition of IPs among the wider public, not just institutions, across Africa.[6] In higher institutions of learning, studies have emphasized the need for awareness of the existence of IP commercialization avenues that could be exploited by both faculty and students. This is aimed at encouraging entrepreneurial innovations.[7]

The universities' focus on teaching and pure research as opposed to applied research also impedes the commercialization of IPs.[8] Faculty often promotes quick and predictable research studies by students capable of meeting the basic requirements for their specific programs. Innovative research geared towards the development of new products and services is viewed as costly and inconvenient due to limited time and resources. Industry, on the other hand, is interested in applied research that leads to innovation of solutions that are relevant to their needs. This mismatch between the industry needs and the focus of universities highlights a significant gap. The evident lack of an entrepreneurial and innovative culture within academic institutions not only discourages the development of new innovations but also hampers efforts to collaborate with industry.[9]

Universities often engage in 'technology push', a situation where researchers develop products based on their own interests without consultation with industry to identify existing needs or gaps. This approach can result in low demand for such products by consumers and the industry.[10]

Successful commercialization of IPs also requires collaboration between the government, universities, and industry, also known as the Triple Helix approach.[11] Without effective collaboration, government policies and funding strategies may not align with the practical needs of industries or the research priorities of universities, leading to inefficient use of resources and missed opportunities for innovation.

Arising from the challenges, research outputs and intellectual property generated by universities often remain underutilized due to limited pathways for commercialization and practical application in the market.[12]

This fragmentation results in a disjointed innovative ecosystem where knowledge and resources are not effectively shared, ultimately stalling technological progress and economic growth. Addressing this issue requires fostering stronger collaboration and alignment among the three sectors to create a more cohesive and

[1] Wekesa M et al, (2024). Commercialization of Intellectual Property Rights at Universities as an Additional Revenue Stream. *Law and Economy*, *3*(3), 37.

[2] University of Nairobi, (2006). Intellectual Property Policy. University of Nairobi Press. https://www.uonbi.ac.ke/sites/default/files/Intellectual-Property-Policy.pdf accessed 3 June 2024.

[3] Mount Kenya University, (2017). Intellectual Property Policy. https://cgsr.mku.ac.ke/wp-content/uploads/2017/09/Intellectual-property-Policy.pdf accessed 3 June 2024.

[4] Zetech University, (n.d.). Intellectual Property Policy. https://research.zetech.ac.ke/... accessed 3 June 2024.

[5] Sattiraju V K et al, (2022). Intellectual Property Rights Policies of Higher Education Institutions (HEIs) in India: A Cross-Sectional Study. *Journal of Science and Technology Policy Management*, *13*(4).

[6] Kakonge J, (2014). Raising IP Awareness in Africa: A Call to Action. *WIPO Magazine*. https://www.wipo.int/wipo_magazine/en/2014/02/article_0009.html accessed 3 June 2024.

[7] Mudinyu B, (2021). Challenges of Implementing Intellectual Property Protection for Entrepreneurial Innovations among Selected Agencies in Kenya. PhD thesis, University of Nairobi.

[8] IM Weerasinghe and HH Dedunu, (2019). Impact of Institution Factors to University-Industry Knowledge Exchange: A Study Based on Sri Lankan University System. Last accessed on 4 June 2024.

[9] T Khademia and K Ismaila, (2013). Commercialization Success Factors of University Research Output. *Journal Teknologi (Social Sciences)*, *64*(3), 137-141.

[10] Wekesa M et al, (2024). Commercialization of Intellectual Property Rights at Universities as an Additional Revenue Stream. *Law and Economy*, *3*(3), 37.

[11] M Ranga, et al, (2013). Triple Helix Systems: An Analytical Framework for Innovation Policy and Practice in the Knowledge Society. *Industry and Higher Education*, 27.

[12] Etzkowitz H et al, (2000). The Dynamics of Innovation: From National Systems and "Mode 2" to a Triple Helix of University-Industry-Government Relations. *Research Policy*, *29*, 109.

productive environment for innovation.[1] This problem has been extensively discussed in the literature, highlighting the critical need for improved interaction among these entities to enhance the commercialization of intellectual property and drive economic progress.[2]

This study sought to interrogate the extent to which the absence of an institutional intellectual property (IP) policy and a lack of awareness affect the commercialization of IP. The objectives were firstly, to assess the general awareness of IP rights among university staff and students, and secondly, to assess the current state of IP policies in universities.

The study hinged on Locke's labor theory, which posits that when an individual expends labor to create something, they inherently own the resulting product. This position was supported by other philosophers such as Hettinger,[3] Himma[4], and Moore[5] who have noted that developing intellectual creations can be costly, exhausting, and discouraging, necessitating resilience, sacrifice, and patience. They argue that this laborious process justifies the granting of IPRs and the related benefits. This principle underpins modern IP law, which grants creators exclusive rights to their inventions, writings, and other intellectual outputs. By recognizing labor as the source of property rights, Locke's theory supports the idea that creators should control and benefit from their intellectual endeavors, providing philosophical justification for laws that protect IP.

In this study, the independent variables were the presence of IP policies and the availability of IP specialists. The dependent variable was the extent of IP commercialization, measured by metrics such as the number of patents licensed, revenue generated from IP, and the successful market introduction of IP-based products and services.

2. Methodology

This research adopted a descriptive research design and used a mixed-methods approach, integrating normative, quantitative, and qualitative research methodologies.[6] Purposive sampling was used to select universities in Kenya, whose sample size was determined by Yamane's (1967) formula at 95% confidence level to be 55 universities. One representative from each of the universities participated in the study. The people selected were those in charge of research activities at their institutions. Of these, 24 were public while 31 were private institutions.

Data collection for this study was conducted online using Kobo Collect Survey Toolbox, a digital platform designed for efficient and structured survey administration. The system enabled respondents to participate via mobile devices or web interfaces. The questionnaire consisted of structured, semi-structured, and open-ended questions with features such as skip logic and validation checks to enhance data accuracy. Secure cloud-based storage ensures confidentiality and compliance with ethical data collection standards, while real-time monitoring and automatic backup functions minimized data loss. Additionally, Kobo Collect's integration with statistical analysis tools facilitated seamless data processing post-collection. This approach enhanced reach, improved response rates, reduced costs, and ensured high-quality data for meaningful analysis in the study.

3. Ethical Considerations

A license to conduct the study was obtained from the National Council for Science, Innovation and Technology (License No. NACOSTI/P/25/416427 dated 26/02/2025). The study received approval from the Daystar University Research, Ethics, and Scientific Board.

Before engaging in the questionnaire, each potential participant was required to read and fill out a consent form. None of the participants declined to fill out the form. In line with the Data Protection Act, responses received were anonymized to avoid disclosing the details of the study participants.

Qualitative data was analyzed through a scrutiny of emerging themes. The data was analyzed using statistical tools such as SPSS and Excel. Descriptive statistics such as frequencies, graphs, tables, percentages, and cross-tabulations were used to present quantitative data.

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[1] Ranga M et al, (2013). Triple Helix Systems: An Analytical Framework for Innovation Policy and Practice in the Knowledge Society. *Industry and Higher Education*, *27*, 237. https://doi.org/10.5367/ihe.2013.0165 accessed 5 June 2024.

[2] Leydesdorff L and M Meyer, (2006). The Triple Helix of University-Industry-Government Relations. *Scientometrics*, *36*. https://doi.org/10.1007/s11192-005-5739-8 accessed 5 June 2024

[3] Hettinger E C, (1989). Justifying Intellectual Property. *Philosophy and Public Affairs*, *18*(1), 31.

[4] Himma K E, (2008). The Justification of Intellectual Property: Contemporary Philosophical Disputes. *Journal of the American Society for Information Science and Technology*, *59*(7), 1143.

[5] Moore A D, (2017). *Intellectual Property and Information Control: Philosophic Foundations and Contemporary Issues*. Routledge.

[6] J Creswell et al, (2003). Advanced mixed' in Abbas Tashakkori and Charles Teddlie (eds), *Handbook of Mixed Methods in Social & Behavioral Research*. Sage Publications, 209.

4. Results and Discussion

This study recorded a response rate of 94.5% with 52 responses obtained from a total sample size of 55 participants. In this study, 62% of the respondents sampled were male, while 38% were female. The survey results indicate that 59.6% of respondents reported that their institution has an Intellectual Property (IP) or Technology Transfer (TT) Office, demonstrating a majority with formal structures for managing intellectual property and facilitating technology commercialization.

4.1 Institutional Adoption of Intellectual Property (IP) Policies

The survey results indicate that 59.6% of respondents reported that their institution has an Intellectual Property (IP) policy, demonstrating a strong presence of formalized IP governance structures.

Research indicates that universities with established IP offices are more likely to implement structured IP policies that facilitate technology transfer, patenting, and industry collaboration, thereby enhancing commercialization outcomes.[1] According to WIPO, institutional IP policies provide a framework for ownership, management, and commercialization of intellectual property, providing an enabling environment to commercialization stakeholders through structured and legal certainty.[2] Additionally, studies highlight that effective IP policies within universities contribute to increased research commercialization and knowledge transfer, reinforcing the strategic importance of IP offices in academic institutions.[3]

On whether universities hold seminars on IP for staff, 21% reported regular seminars, 56% occasional seminars, and 23% held no seminars. Institutions with formal IP literacy frameworks tend to foster stronger innovation ecosystems and commercialization outcomes emphasizing the importance of structured IP education programs in universities.[4] Studies also found that universities without consistent IP education programs struggle with effective technology transfer and research commercialization.[5] Addressing these gaps through targeted awareness initiatives and faculty training programs could enhance institutional IP awareness and strengthen commercialization efforts.[6]

These findings highlight inconsistencies in IP education among university staff, emphasizing the need for more structured and regular training programs to enhance awareness and engagement.

4.2 Knowledge of Intellectual Property

Asked whether they had a good knowledge of IP, 50% of staff respondents reported they had good knowledge. These results are consistent with studies that found that IP literacy among university staff is often inconsistent, with many institutions lacking structured training programs to enhance awareness and application of IP principles.[7]

4.3 Institutional Linkages and Innovation Commercialization Frameworks

The table below shows the connectivity between research structures, intellectual property management, and commercialization efforts within the university.

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[1] WIPO, 'Intellectual Property Policies for Universities and Research Institutions' (World Intellectual Property Organization, 2023) https://www.wipo.int/en/web/technology-transfer/ip-policies accessed 5 June 2025.

[2] Ibid.

[3] DS Siegel, R Veugelers and M Wright, (2007). Technology Transfer Offices and Commercialization of University Intellectual Property: Performance and Policy Implications. *Oxford Review of Economic Policy*, *23*(4), 640. http://www.jstor.org/stable/23606751 accessed 5 June 2025.

[4] Q Lei and Y Tian, (2024). Construction of Intellectual Property Literacy Education Mode in University Libraries. *Libri*, *74*(2), 185. https://doi.org/10.1515/libri-2023-0056 accessed 5 June 2025.

[5] Y Liu and Y Zhao, (2025). Intellectual Property Information Literacy Education: Evidence from 30 Chinese National IP Demonstration Universities. *Humanities and Social Sciences Communications*, *12*, 366. https://doi.org/10.1057/s41599-025-04679-1 accessed 5 June 2025.

[6] VV Dusen, (2013). Intellectual Property and Higher Education: Challenges and Conflicts. *Administrative Issues Journal: Education, Practice, and Research*, 3(2), 10. https://files.eric.ed.gov/fulltext/EJ1057074.pdf accessed 5 June 2025.

[7] S Ngwenya and OB Onyancha, (2025). Intellectual Property Awareness, Education and Training Programmes at Universities in Zimbabwe. *South African Journal of Libraries and Information Science*, *91*(2), 1. https://www.scielo.org.za/pdf/sajlis/v91n2/03.pdf accessed 5 June 2025.

Table 1. Institutional Linkages and Innovation Commercialization Frameworks

Survey Item	Univ. Type	Yes (%)	No (%)	Not Sure (%)	Don't Know (%)
Internal linkages between Research Directorate and IP/TT Office	Private	28.8	5.8	25.0	0
	Public	19.2	3.8	13.5	3.8
Institution has products from staff inventions	Private	38.5	1.9	15.4	3.8
	Public	26.9	3.8	7.7	1.9
Developed unique/secret formulations for marketing	Private	15.4	17.3	21.2	5.8
	Public	13.5	3.8	19.2	3.8
Office for harnessing staff and student inventions	Private	34.6	11.5	9.6	3.8
	Public	25.0	3.8	9.6	1.9

The study examined institutional mechanisms supporting intellectual property (IP) commercialization across public and private universities, with a focus on internal linkages, innovation outputs, and dedicated support structures.

Survey results indicated that private universities demonstrated relatively stronger engagement in institutional IP commercialization frameworks than public universities. Specifically, 28.8% of respondents from private universities affirmed the existence of internal linkages between the Research Directorate and the IP/Technology Transfer Office (TTO), compared to 19.2% in public universities. This suggests that private institutions may be more proactive in establishing formal structures to support IP management. According to the Kenya National Innovation Agency, many public universities struggle with under-resourced or ineffective TTOs, which hampers coordination between research and commercialization functions.[1] A sizable proportion of respondents in both types of institutions were uncertain about this linkage (25.0% private; 13.5% public), suggesting a lack of clarity or limited visibility regarding internal coordination structures.

In terms of tangible outputs, 38.5% of staff in private universities indicated that their institutions had produced marketable products derived from staff inventions, while only 26.9% of public university respondents reported similar outcomes. This aligns with findings which found that while Kenyan universities are generating innovations, the translation of these into marketable products remains limited due to weak commercialization strategies and insufficient financial support.[2]

Lastly, 34.6% of private university respondents confirmed the presence of an office dedicated to harnessing staff and student inventions, in contrast to 25% in public institutions. This difference underscores the growing commitment of private-sector academia to institutionalize innovation support, despite fewer public resources. This supports the observation that private institutions may be more agile in institutionalizing innovation support mechanisms.

These results illustrate an emerging trend where private universities appear to be more proactively engaged in establishing commercialization-oriented structures and activities. However, the high incidence of "Not sure" and "Don't know" responses across categories suggests that both institutional types face challenges related to awareness, communication, and integration of IP-related functions. Studies have highlighted that while universities establish technology transfer offices, their effectiveness depends on institutional policies, funding, and faculty engagement.[3] The table below summarizes the commercialization of various IP-related assets within universities:

[1] Kenya National Innovation Agency, Commercialisation Guidelines Toolkit (Innovation Agency, September 2023) https://www.innovationagency.go.ke/storage/pub-docs/ken_pub_CommercialisationToolkit.pdf accessed 24 June 2025.

[2] J Odhiambo, (4 June 2025). Commercialization of Intellectual Property in Kenya: Unlocking Innovation for Economic Growth. *Mount Kenya Times*. https://mountkenyatimes.co.ke/commercialization-of-intellectual-property-in-kenya-unlocking-innovation-for-economic-growth/ accessed 24 June 2025.

[3] G Slowinski and KW Zerby, (2008). Protecting IP in Collaborative Research. *Research Technology Management*, *51*(6), 58. http://www.jstor.org/stable/24135929 accessed 5 June 2025.

Table 2. Commercialization activity across different types of IP

Survey Item	Univ. Type	Yes (%)	No (%)	Not Sure (%)	Don't Know (%)
Earn money from IP commercialization	Private	15.4	11.5	30.8	1.9
	Public	17.3	5.8	13.5	3.8
Sold IP to companies	Private	15.4	9.6	32.7	1.9
	Public	11.5	3.8	23.1	1.9
Sells books authored by staff	Private	28.8	9.6	19.2	1.9
	Public	19.2	3.8	15.4	1.9
Sells music composed by staff	Private	5.8	19.2	28.8	5.8
	Public	3.8	11.5	23.1	7.7
Sold sportsmen/women to big sports clubs	Private	9.6	17.3	30.8	1.9
	Public	7.7	9.6	21.2	1.9
Sold films/plays developed by staff/students	Private	15.4	17.3	23.1	3.8
	Public	1.9	7.7	28.8	1.9
Sold software developed by staff/students	Private	21.2	13.5	23.1	1.9
	Public	9.6	7.7	21.2	1.9
Sold new plant varieties to seed companies	Private	7.7	25.0	25.0	1.9
	Public	7.7	5.8	25.0	1.9
Sold secret formulations to industry	Private	7.7	19.2	28.8	3.8
	Public	9.6	3.8	23.1	3.8

In terms of specific commercial products, the commercialization of books authored by staff was more prominent in private universities (28.8% reporting "Yes") than in public universities (19.2%). The sale of music composed by staff was much less common in both sectors, with only 5.8% and 3.8% of respondents affirming this activity in private and public universities, respectively. Moreover, when considering the sale of films or plays developed by staff or students, private universities again led with 15.4% compared to a minimal 1.9% in public universities. Software development as a commercialization activity was notably higher in private institutions (21.2% "Yes") as opposed to public ones (9.6% "Yes"), while the commercialization of new plant varieties was equally distributed (7.7% "Yes" in both settings). The sale of secret formulations to industry was affirmed by 7.7% of respondents in private universities and 9.6% in public ones.

Recent studies have argued that the heterogeneity in commercialization outputs across universities can be attributed to the varying levels of institutional support and the alignment of commercialization strategies with specific academic strengths and market opportunities.[1]

The evidence that private universities were more active in commercializing creative and technological outputs, such as software and artistic products, indicates an emerging entrepreneurial spirit that could serve as a model for public institutions. To foster a more robust commercialization ecosystem, both public and private universities must address awareness gaps and invest in capacity-building initiatives tailored to their innovation portfolios. Strengthening TTOs and establishing clearer metrics for commercialization success may help minimize uncertainty among staff and promote more consistent commercialization practices across the board.

4.4 Institutional Intellectual Property (IP) Certifications and Protection Strategies

Table 3. Institutional IP Certifications and Protection Strategies

Survey Item	Univ. Type	Yes (%)	No (%)	Not Sure (%)	Don't Know (%)

[1] J Ayisi, (26 May 2020). Presentation 2A: Innovation by Kenyan Universities for Development. Maseno University Research and Innovation Capacity-Building Conference, Kisumu Hotel. https://maseno.ac.ke/sites/default/files/2021-06/Presentation-2a-drayisi-innovation-by-kenyan-universities-for-developemt.pdf accessed 24 June 2025.

Patent certificates	Private	28.8	5.8	23.1	1.9
	Public	19.2	3.8	15.4	1.9
Trademark certificates	Private	26.9	5.8	25.0	1.9
	Public	21.2	3.8	13.5	1.9
Copyright certificates	Private	34.6	5.8	17.3	1.9
	Public	19.2	3.8	15.4	1.9
Industrial designs certificates	Private	19.2	11.5	26.9	1.9
	Public	23.1	3.8	9.6	3.8
Utility Model certificates	Private	21.2	9.6	26.9	1.9
	Public	19.2	3.8	11.5	5.8
Traditional Medicine certificates	Private	7.7	25.0	23.1	3.8
	Public	11.5	7.7	19.2	1.9
Cultural expression certificates	Private	15.4	11.5	26.9	5.8
	Public	13.5	3.8	17.3	5.8

Private universities reported a higher number of certifications for patents (28.8%), trademarks (26.9%), utility models (21.2%), and cultural expressions (15.4%). Public universities reported higher figures for industrial designs (23.1%) and traditional medicine (11.5%). Overall, these are low percentages that suggest a low activity of either generation or registration of Ips.

The Kenya National Innovation Agency (2021) has also emphasized that robust internal communication and clear reporting channels are essential for effective IP management and commercialization. Moreover, the diversification seen in certifications from conventional areas such as patents and trademarks to emerging sectors like traditional medicine and cultural expressions mirrors global trends in higher education, where institutions are increasingly diversifying their innovation portfolios to capture a broader range of economic opportunities.[1]

5. Conclusion

The findings demonstrated that Kenyan universities possess the foundational elements for IP commercialization, such as offices, policies, and early-stage revenue streams, yet fail to translate tangible commercial outcomes. Institutional fragmentation, limited staff awareness, and insufficient IP expertise have hindered the effective exploitation of both conventional (patents, software) and non-traditional assets (cultural expressions, sports talent). Private universities exhibited greater agility, but public institutions hold untapped strengths in specialized domains.

It is recommended that universities should conduct regular, mandatory training and mentorship programs for faculty and staff. In addition, the study recommends the forging of a stronger “Triple Helix” approach amongst universities, industry, and government. It is recommended that future research should incorporate multi-stakeholder perspectives by including students, university administrators, industry partners, and policymakers alongside academic staff. This approach would provide a more comprehensive understanding of institutional dynamics, user experiences, and the commercialization landscape throughout the innovation pipeline. Also, it is recommended that future studies should adopt a longitudinal design to track changes in IP awareness, policy implementation, and commercialization outcomes over time. Such a design would allow for analysis of causality and the effectiveness of specific interventions or national policy shifts. By addressing these elements, future research can yield richer insights into how Kenyan universities can build resilient, inclusive, and innovation-driven IP ecosystems.

References

Aaboen L and Holgersson M, (2019). A Literature Review of Intellectual Property Management in Technology Transfer Offices: From Appropriation to Utilization. *Technology in Society*, 59, 101192.

Abbott R, (2020). *The Reasonable Robot: Artificial Intelligence and the Law*. Cambridge University Press.

Afonso O, P C Neves et al, (2021). The Link between Intellectual Property Rights, Innovation, and Growth: A Meta-Analysis. *Economic Modelling*.

[1] Okutan V, (2024, November 5). Managing University Patent Portfolios: A Smarter Approach to Inventions. IP Business Academy. https://ipbusinessacademy.org/... accessed 24 June 2025.

https://www.sciencedirect.com/science/article/abs/pii/S0264999321000274 accessed 24 March 2024.

Ayiro LP, (2024). *Educational Research Methods: A Functional Approach*. Kenya Literature Bureau.

Ayò O Olukoahi and P T Zeleza, (2018). Universities in the Twentieth Century. African Books Collective. https://www.africanbookscollective.com/books/african-universities-in-the-twenty-first-century.-vol-1 accessed 21 March 2024.

Bejarano J B Padilla et al, (2023). University Technology Transfer from a Knowledge-Flow Approach—Systematic Literature Review. *Sustainability*, 15, 65550.

Bentham J, (1789). *An Introduction to the Principles of Morals and Legislation*. Clarendon Press.

Bentley L and B Sherman, (2022). *Intellectual Property Law*. 6th edn, Oxford Press.

Bettaieb A, (2019). *Technology Transfer and Commercialization of IP Rights by Universities and Research Organizations*. WIPO.

Commission for University Education, (2016). State of University Education in Kenya.

Corsino M and S Torrisi, (2024). University Engagement in Open Innovation and Intellectual Property: Evidence from University–Industry Collaborations. *Journal of Industrial and Business Economics*, *50*, 781-813.

Cowling N, (2023, September). Number of Public and Private Universities in Kenya 2015–2022. *Statista*. https://www.statista.com/statistics/1237787/number-of-public-and-private-universities-in-kenya/ accessed 21 March 2024.

Dedunu H H and I M Weerasinghe, (2019). Impact of Institution Factors to University-Industry Knowledge Exchange: A Study Based on Sri Lankan University System. *International Journal of Management, Innovation & Entrepreneurial Research*, *5*(1), 40-48.

Derclaye E and T Taylor, (2015). Happy IP: Replacing the Law and Economics Justification for Intellectual Property Rights with a Well-Being Approach.

Etzkowitz H et al, (2000). The Dynamics of Innovation: From National Systems and "Mode 2" to a Triple Helix of University-Industry-Government Relations. *Research Policy*, *29*, 109.

Exp Salaries and Remuneration Commission, (2023, March 27). Exploring Solutions Affecting Public Universities. https://src.go.ke/2023/03/27/exploring-solutions-to-challenges-affecting-public-universities/ accessed 19 March 2024.

Gaikwad A, (2020). A Study of Intellectual Property Rights and Its Significance in Business. *Journal of Information and Computational Science*.

Gordon W J, (1993). A Property Right in Self-Expression: Equality and Individualism in the Natural Law of Intellectual Property. *Yale LJ*, *102*, 1533.

Guerrero M and J Roncancio-Marin, (2024). University Technology Transfer Offices' Capabilities in Responding to Societal Challenges: Lessons from an Exploratory Study During the COVID-19 Pandemic. *Journal of Technology Transfer* (forthcoming).

Hashim H M and M H M Khair, (2020). Justifications of Intellectual Property Rights: A Discussion on Locke and Hegel's Theories, *Jurnal Hukum Novelty*, *11*(2).

Hettinger E C, (1989). Justifying Intellectual Property. *Philosophy and Public Affairs*, *18*(1), 31.

Himma K E, (2008). The Justification of Intellectual Property: Contemporary Philosophical Disputes. *Journal of the American Society for Information Science and Technology*, *59*(7), 1143.

Kakonge J, (2014). Raising IP Awareness in Africa: A Call to Action. *WIPO Magazine*. https://www.wipo.int/wipo_magazine/en/2014/02/article_0009.html accessed 3 June 2024.

Kenya National Innovation Agency, (2023, September). *Commercialisation Guidelines Toolkit*. https://www.innovationagency.go.ke/storage/pub-docs/ken_pub_CommercialisationToolkit.pdf accessed 24 June 2025.

Kenyatta University, (2015). Intellectual Property Rights Policy. https://www.ku.ac.ke/ipru/wp-content/uploads/2015/05/IPR_Policy.pdf accessed 3 June 2024.

Khademia T and K Ismail, (2013). Commercialization Success Factors of University Research Output. *Jurnal Teknologi (Social Sciences)*, *64*, 137.

Khair M H M and H M Hashim, (2020). Justifications of Intellectual Property Rights: A Discussion on Locke and Hegel's Theories. *Jurnal Hukum Novelty*, *11*(2).

Law Notes, (2022, November 18). Utilitarian Theory of Property by Bentham.

https://lawnotes.co/utilitarian-theory/ accessed 18 May 2024.

Lei Q and Y Tian, (2024). Construction of Intellectual Property Literacy Education Mode in University Libraries. *Libri*, *74*(2), 185.

Leydesdorff L and M Meyer, (2006). The Triple Helix of University-Industry-Government Relations. *Scientometrics*, *36*.

Liu Y and Zhao Y, (2025). Intellectual Property Information Literacy Education: Evidence from 30 Chinese National IP Demonstration Universities. *Humanities and Social Sciences Communications*, *12*, 366.

Locke J, (1988). *Two Treatises of Government*. Laslett ed, CUP.

Meyer M and L Leydesdorff, (2006). The Triple Helix of University-Industry-Government Relations. *Scientometrics*, *36*.

Moore A D, (2017). *Intellectual Property and Information Control: Philosophic Foundations and Contemporary Issues*. Routledge.

Mount Kenya University, (2017). Intellectual Property Policy. https://cgsr.mku.ac.ke/wp-content/uploads/2017/09/Intellectual-property-Policy.pdf accessed 3 June 2024.

Mudinyu B, (2021). Challenges of Implementing Intellectual Property Protection for Entrepreneurial Innovations among Selected Agencies in Kenya. PhD thesis, University of Nairobi.

Mukhwana E et al, (2016). *State of University Education in Kenya*. Commission for University Education.

Mutua J, (2021). University Crisis Deepens as Deficit Doubles to Sh27bn. *Business Daily*. 2021-December-1. https://www.businessdailyafrica.com/bd/news/university-crisis-deepens-deficits-doubles-sh27bn-3636862/ accessed 19 March 2024.

National Commission for Science, Technology and Innovation, (2024, March 23). Universities Tipped on Maximizing Research Reach. https://www.nacosti.go.ke/2024/03/23/.../ accessed 3 June 2024.

Neves P C, O Afonso et al, (2021). The Link between Intellectual Property Rights, Innovation, and Growth: A Meta-Analysis. *Economic Modelling*.

Ngoasong M and Ozor N, (2023). University-led Ecosystems for Sustained Innovation and Entrepreneurship Development in Kenya. ATPSN Technopolicy Brief November.

Ngwenya S and Onyancha O B, (2025). Intellectual Property Awareness, Education and Training Programmes at Universities in Zimbabwe. *South African Journal of Libraries and Information Science*, *91*(2), 1.

O'Shea R P et al, (2005). Delineating the Anatomy of University Technology Transfer: Autonomy, Competence, and Organizational Culture. *Research Policy*, *34*, 994.

Odhiambo J, (2025, June 4). Commercialization of Intellectual Property in Kenya: Unlocking Innovation for Economic Growth. *Mount Kenya Times*. https://mountkenyatimes.co.ke/.../ accessed 24 June 2025.

Okutan V, (2024, November 5). Managing University Patent Portfolios: A Smarter Approach to Inventions. IP Business Academy. https://ipbusinessacademy.org/... accessed 24 June 2025.

Paul R, (2021). Intellectual Property Rights: A Utilitarian Perspective. SSRN 3842429.

Peredy Z and B Laki, (2021). Possible Ways of IP Commercialisation in the European Higher Education Ecosystem. *International Journal of Engineering and Management Sciences*.

Ranga M et al, (2013). Triple Helix Systems: An Analytical Framework for Innovation Policy and Practice in the Knowledge Society. *Industry and Higher Education*, *27*, 237.

Richards D G, (2002). The Ideology of Intellectual Property Rights in the International Economy. *Review of Social Economy*, *60*(4), 521.

Sattiraju V K et al, (2022). Intellectual Property Rights Policies of Higher Education Institutions (HEIs) in India: A Cross-Sectional Study. *Journal of Science and Technology Policy Management*, *13*(4).

Sherman B and L Bentley, (2022). *Intellectual Property Law*. 6th edn, Oxford Press.

Silicon Cape, (2012, November 13). The Curious Case of Nyagaka Anyona Ouko, the Mobile Money Transfer "Innovator"–Part I. https://www.siliconcape.com/.../ accessed 3 June 2024.

Spitzlinger R, (2011). On the Idea of Owning Ideas: Applying Locke's Labor Appropriation Theory to Intellectual Goods. *Masaryk University Journal of Law and Technology*, *5*(2), 273.

Tavani H T, (2005). Locke, Intellectual Property Rights, and the Information Commons. *Ethics and Information Technology*, *7*, 87.

Taylor T and E Derclaye, (2015). Happy IP: aligning intellectual property rights with well-being. Intellectual Property Quarterly, 1, pp. 1-14.

The EastAfrican, (2023, April 1). EA's Struggle for Shrinking Funds Choking Higher Education. https://www.theeastafrican.co.ke/tea/news/east-africa/shrinking-funds-choking-ea-higher-education-4181310/ accessed 19 March 2024.

Torrisi S and M Corsino, (2023). University engagement in open innovation and intellectual property: evidence from university–industry collaborations. *J. Ind. Bus. Econ.*, *50*, 781-813.

Universities Fund, (2024). Graph 21: Relationship Between Number of Students Funded and DUC Allocation. https://www.universitiesfund.go.ke/universities-data/ accessed 19 March 2024.

Universities Fund, (2024). New Higher Education Funding Model. https://www.universitiesfund.go.ke/new-higher-education-funding-model/ accessed 19 March 2024.

University of Nairobi, (2006). Intellectual Property Policy. University of Nairobi Press. https://www.uonbi.ac.ke/sites/default/files/Intellectual-Property-Policy.pdf accessed 3 June 2024.

Van Dusen V, (2013). Intellectual Property and Higher Education: Challenges and Conflicts. *Administrative Issues Journal: Education, Practice and Research*, *3*(2), 10.

Varden H, (2012). The Lockean "Enough-and-as-Good" Proviso: An Internal Critique. *Journal of Moral Philosophy*, *9*, 137.

Wekesa M and B Shihanya (eds), (2009). *Intellectual Property Rights in Kenya*. Konrad Adenauer Stiftung.

Wekesa M et al, (2024). Commercialization of Intellectual Property Rights at Universities as an Additional Revenue Stream. *Law and Economy*, *3*(3), 37.

World Intellectual Property Organization, (2024). IP Policies for Universities and Research Institutions. https://www.wipo.int/web/technology-transfer/ip-policies accessed 3 June 2024.

Zeleza P T and A O Olukoahi, (2018). Universities in the Twentieth Century.

Zetech University, (n.d.). Intellectual Property Policy. https://research.zetech.ac.ke/... accessed 3 June 2024.

Zhao Y and Y Liu, (2025). Intellectual Property Information Literacy Education: evidence from 30 Chinese National IP Demonstration Universities. *Humanit Soc Sci Commun*, *12*, 366.