

# Technical and Vocational Education and Training College Lecturers and 21st-Century Skills: Awareness and Implications for Teaching Practices

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## Abstract

The increasing demand for 21st-century skills in the workforce places new expectations on educators, including TVET lecturers, who play a critical role in preparing students for evolving industry needs. This study explored the awareness and understanding of 21st-century skills among TVET lecturers and examined how this awareness influences their teaching practices. A mixed-methods approach was employed, incorporating surveys, interviews, classroom observations, and document analysis. Results indicate that while lecturers are aware of critical skills such as communication, collaboration, creativity, and critical thinking, their practical application in teaching practices varies due to challenges such as curriculum rigidity, lack of resources, and insufficient professional development opportunities. The study concludes with strategic recommendations for professional development and curriculum adjustments necessary to foster 21st-century skills among lecturers.

## 1. Introduction

The global economy's rapid evolution has intensified the demand for a workforce equipped with 21st-century skills (Bedir, 2019). Technical and Vocational Education and Training (TVET) serves as a cornerstone in developing this workforce by providing essential knowledge and skills for employment across various industries (Salleh & Sulaiman, 2020; Mboya, 2023). To remain effective, TVET teaching practices must adapt to emphasise critical thinking, communication, collaboration, and creativity—collectively known as the '4Cs' of 21st-century skills (UNESCO, 2017; Paryono, 2017).

While educators widely acknowledge the importance of integrating these skills into curricula, a significant gap persists between recognition and classroom implementation (Partnership for 21st Century Skills, 2019). This disparity is particularly notable in the African context, where research on TVET lecturers' perception and integration of these skills remains limited (Okolie et al., 2020). As key agents of educational transformation, lecturers' awareness and understanding of 21st-century skills directly shape student learning experiences (Kim et al., 2019). Therefore, examining TVET lecturers' awareness of these skills and its implications for teaching practices is crucial for advancing educational effectiveness.

This study holds significant importance for several compelling reasons. First, it addresses a critical knowledge gap in understanding TVET lecturers' awareness and implementation of 21st-century skills, particularly within the African context, where such research is notably scarce. Second, by examining the relationship between lecturers' awareness and their teaching practices, the study will provide valuable insights for developing targeted

professional development programmes and curriculum reforms in TVET institutions. Third, the findings will contribute to bridging the documented gap between the recognition of 21st-century skills' importance and their practical implementation in TVET classrooms. Ultimately, this research has practical implications for enhancing the quality of TVET education, thereby better preparing students for the demands of the modern workforce. The insights gained from this study can inform policy recommendations, institutional strategies, and pedagogical frameworks that support the effective integration of 21st-century skills in TVET education.

Based on the above rationale, the study sets out to achieve the following specific objectives: (1) the extent of lecturers' familiarity with the 21st-century skills and knowledge of these critical skills and (2) the implications of this awareness on their pedagogical methods, classroom practices, and curriculum delivery.

## 1.1 21st-century Skills in Education

The integration of 21st-century skills into educational contexts has become a focal point of educational reforms to prepare students for a rapidly changing global workforce. These skills, commonly called the '4Cs' (Critical thinking, Communication, Collaboration, and Creativity) – are deemed essential for equipping students with the abilities they need to navigate modern industries (Kivunja, 2015). According to Kain et al. (2024), TVET, which focuses on equipping students with both theoretical and practical competencies for specific industries, plays a critical role in fostering these essential skills alongside technical proficiency. This section reviews the existing literature on the importance of 21st-century skills, challenges in their implementation within TVET, and the roles of lecturers in facilitating these skills in teaching practices.

## 1.2 The Importance of 21st-century Skills in TVET

21st-century skills are considered foundational for preparing students for the demands of modern industries. According to Kain et al. (2024), these skills are not only necessary for navigating today's complex work environments but are also vital for promoting lifelong learning and adaptability. The growing importance of these skills is underscored by the increasing digitisation of the workplace, where employees must continuously adapt to new technologies, collaborate in diverse teams, and solve complex problems creatively (Poláková et al., 2023; Vuchkovski et al., 2023). In this context, TVET institutions must evolve from the traditional focus on technical skills to incorporating the 4Cs into their curricula, enabling students to become more versatile in their professional roles (Selane & Odeku, 2024).

Although TVET programmes are designed to equip students with practical and technical knowledge, there is a growing recognition of the need to integrate 21st-century skills to enhance their employability (UNESCO, 2015). UNESCO (2017) argues that for TVET graduates to be competitive in the global job market, they must possess not only technical proficiency but also strong cognitive and socio-emotional skills. Studies conducted by Saimon et al. (2023) highlight that industries increasingly seek employees who can communicate effectively, collaborate across teams, and think critically. However, integrating these skills into TVET curricula presents challenges due to the traditionally rigid structure of vocational education, which tends to prioritise technical over cognitive skills development (Terblanche & Bitzer, 2018).

## 1.3 Challenges in Implementing 21st-century Skills in TVET

Despite the recognised importance of 21st-century skills, TVET institutions often struggle with their implementation. One key challenge is the misalignment between curriculum design and the practical application of these skills in classrooms (OECD, 2018). TVET curricula are often focused on specific technical competencies, leaving little room for lecturers to integrate broader skill sets (Kana & Letaba, 2024). Moreover, there is limited professional development available for TVET lecturers to effectively teach 21st-century skills, which are often seen as being outside their traditional subject expertise (Herlinawati et al., 2024; Varma & Malik, 2023).

Likewise, TVET institutions in Africa face several structural and operational challenges that impact their effectiveness in preparing students for the 21st-century workforce. Powell and McGrath (2019) highlight that many TVET institutions in Africa struggle with outdated curricula, insufficient resources, and inadequate professional development opportunities for lecturers.

### 1.3.1 Curriculum Rigidity and Relevance

Many TVET programmes continue to emphasise traditional technical skills without integrating 21st-century competencies such as critical thinking, problem-solving, and digital literacy (Kana & Letaba, 2024). The limited flexibility in curriculum design prevents lecturers from incorporating innovative teaching methods and industry-aligned skills (Terblanche & Bitzer, 2018).

### 1.3.2 Resource Constraints and Infrastructure

The lack of adequate infrastructure, modern equipment, and access to digital tools hinders the effective teaching of both technical and transversal skills. Studies indicate that in many African countries, TVET institutions operate with outdated machinery and insufficient digital resources, limiting students' ability to develop practical, industry-relevant competencies (Varma & Malik, 2023).

### 1.3.3 Inadequate Professional Development Opportunities

A critical challenge in the African TVET sector is the limited capacity of lecturers to effectively integrate 21st-century skills into their instruction. Many lecturers lack the pedagogical training and support needed to facilitate skills such as critical thinking, creativity, communication, collaboration, and digital literacy (Mulaudzi & Maluka, 2024). Professional development opportunities are often insufficient or misaligned with the need to shift from traditional, teacher-centred approaches to more student-centred, competency-based education.

### 1.3.4 The Imperative for Change

The context of rapid technological change, globalisation, and the need for economic diversification in Africa makes the integration of 21st-century skills in TVET not just desirable but essential. TVET institutions must evolve to produce graduates who are not only technically proficient but also adaptable, innovative, and capable of contributing to economic growth and social development. Research that investigates how to effectively integrate these skills, such as this study, is crucial for informing policy and practice.

## 1.4 TVET Lecturers' Role in Developing 21st-century Skills

TVET lecturers play a pivotal role in the integration of 21st-century skills within their teaching practices. According to Kim et al. (2019), the awareness and understanding of these skills among lecturers are essential for their successful implementation in classrooms. Lecturers who recognise the importance of the 4Cs are more likely to create learning environments that foster these competencies, whether through project-based learning, collaborative tasks, or problem-solving activities (Somphol et al., 2022; Saimon et al., 2023). However, the level of awareness among TVET lecturers varies, and many feel ill-equipped to teach these skills due to a lack of training and professional development opportunities (Holler et al., 2023). Research by Varma and Malik (2023) highlights the need for targeted professional development programmes to help TVET lecturers understand how to integrate 21st-century skills into their technical instruction, emphasising that without training, the full benefits of these skills may not be realised.

## 2. Rationale for the Current Study

While the global importance of 21st-century skills in education is well-established (Roshid & Haider, 2024), and TVET's critical role in workforce development is widely acknowledged (Salleh & Sulaiman, 2020), the specific dynamics of integrating these skills within African TVET contexts remain under-researched. This gap is significant due to the unique developmental challenges and opportunities that characterise the African continent, where TVET plays a crucial role in addressing unemployment, fostering economic growth, and promoting social inclusion (African Union, 2015; Shefiu & Ayika, 2019).

### 2.1 The Development Context of TVET in Africa

TVET in Africa is at a critical juncture. It is increasingly recognised as a key lever for achieving the Sustainable Development Goals and driving industrialisation (McGrath & Powell, 2016). However, its development has been shaped by a complex interplay of historical, economic, and socio-political factors.

- **Historical legacy:** Many African TVET systems were initially designed to supply labour for colonial economies, often focusing on narrow technical skills that are no longer relevant in today's diversified economies (Oketch, 2015). This historical legacy has contributed to persistent challenges in curriculum relevance and responsiveness.
- **Economic transformation:** Africa's economies are undergoing rapid transformation, driven by factors such as technological advancements, globalisation, and the growth of the informal sector. TVET systems are under pressure to adapt and equip graduates with skills that match the demands of these evolving labour markets. 21st-century skills are particularly crucial in this context, as they enable adaptability, innovation, and entrepreneurship (World Bank, 2019).
- **Youth unemployment:** Africa has the world's youngest and fastest-growing population, but youth unemployment remains a major challenge. TVET is seen as a potential solution, but its effectiveness

depends on its ability to provide relevant and high-quality training that leads to gainful employment. Integrating 21st-century skills is essential for enhancing the employability of TVET graduates (ILO, 2020).

## 2.2 Justification for the Research

Given the developmental context of TVET in Africa, there is a compelling need for research that examines the integration of 21st-century skills. This research is necessary for several reasons:

- Addressing relevance gaps: Research is needed to understand how TVET curricula and pedagogy can be reformed to better align with the demands of the 21st-century workforce. This includes investigating how 21st-century skills can be effectively integrated into technical training to enhance graduate employability and bridge the skills gap (Mulaudzi & Maluka, 2024).
- Enhancing TVET quality: Studies are required to explore how 21st-century skills can be used to improve the quality of TVET provision in Africa. This includes examining the role of educators in facilitating these skills, the effectiveness of different pedagogical approaches, and the impact of institutional factors on implementation (Kholifah et al., 2024).
- Informing policy and practice: Research can provide valuable evidence to inform policy and practice in African TVET. This includes identifying effective strategies for curriculum development, teacher training, and resource allocation that support the integration of 21st-century skills (UNESCO-UNEVOC, 2020).
- Contributing to Developmental Goals: Ultimately, research on 21st-century skills in African TVET is essential for maximising the contribution of TVET to broader development goals. By equipping graduates with the skills they need to succeed in the modern economy, TVET can play a key role in poverty reduction, economic growth, and social development (African Development Bank, 2022).

This study aims to contribute to this body of knowledge by examining TVET lecturers' awareness and implementation of 21st-century skills. By focusing on the perspectives and practices of lecturers, this research can provide valuable insights into the challenges and opportunities for integrating 21st-century skills in African TVET settings.

## 3. Methodology

A mixed methods approach was employed to explore the dual focus of the study: assessing lecturers' awareness of 21st-century skills and understanding the practical implications for their teaching practices. A mixed-methods design allowed for a comprehensive analysis by combining quantitative data, which provides generalisable insights, with qualitative data, which offers in-depth perspectives on lecturers' experiences and perceptions (Creswell & Plano Clark, 2017).

### 3.1 Sampling

The study targeted TVET lecturers in a multi-site TVET College in Limpopo Province of South Africa, to capture a diverse range of experiences and teaching environments. A purposive sampling method was employed to select participants who were actively involved in teaching and curriculum design, as their roles are directly influenced by awareness and application of 21st-century skills (Palinkas et al., 2015). From this sample, 105 lecturers were chosen to participate in the quantitative survey, while a smaller subset of 14 lecturers was selected for follow-up qualitative interviews, ensuring a balance between breadth and depth of data.

### 3.2 Data Collection

A structured questionnaire was designed to quantify TVET lecturers' level of awareness of 21st-century skills, using Likert-scale questions to measure familiarity with specific competencies such as critical thinking, collaboration, communication, and creativity. This survey method provided a broad, statistical overview of awareness levels across a significant sample (Bryman, 2016). Semi-structured interviews, classroom observations, and document analysis were conducted with a subset of 14 lecturers to explore the nuanced implications of 21st-century skills awareness on their teaching practices. This approach allowed participants to discuss how their awareness (or lack thereof) influences their curriculum design, classroom interactions, and student engagement (Kvale & Brinkmann, 2015). The semi-structured format facilitated a guided but flexible dialogue, encouraging lecturers to share detailed examples and insights.

### 3.3 Data Analysis

The survey responses were analysed using descriptive statistics to identify general trends in awareness levels and potential correlations between lecturers' awareness and factors such as years of experience, institutional support, or professional development access. Statistical Package for the Social Sciences (SPSS) version 2024 was used to analyse the data, providing quantitative insights into the prevalence and distribution of 21st-century skills

awareness among the lecturers (Field, 2018). The interview data were analysed using thematic analysis to identify recurring themes related to lecturers' perceptions and teaching practices. The coding process was iterative, with themes reviewed and refined to ensure consistency and depth of analysis.

## 4. Results

### 4.1 Respondents Demographics

The target sample for the study consisted of 105 TVET lecturers from one multi-sited TVET College, who were expected to complete the questionnaire. Of the distributed questionnaires, 73 were returned, resulting in a response rate of 69.5%, while 32 (30.5%) remained unreturned. The outstanding questionnaires were not recovered despite multiple follow-up attempts, including sending additional copies to non-respondents. The demographic breakdown in Table 1 below offers insights into the respondents' profiles, essential for contextualising the study's findings on awareness and integration of 21st-century skills.

**Table 1** Respondents' demographics

Demographic variable	Category	Frequency (n)	Percentage (%)
Gender	Male	42	58%
	Female	31	42%
Age	26 – 30 years	4	6%
	31 – 35 years	8	11%
	36 – 40 years	8	11%
	41 – 45 years	17	23%
	46 – 50 years	17	23%
	51 – 55 years	9	12%
	56 years and above	10	14%
Educational qualifications	Diploma	11	15%
	Bachelor's Degree	33	45%
	Honour's Degree	18	25%
	Master's Degree	10	14%
	Doctoral Degree	1	1%
Work experience	0 – 5 years	14	19%
	6 – 10 years	26	36%
	11 – 15 years	18	25%
	16 – 20 years	9	12%
	21 years and more	6	8%

The respondent demographics in Table 1 represented a broad age range, with the largest age groups being 41 – 45 years (23%) and 46 – 50 years (23%), indicating a mature workforce with significant professional experience. Lecturers aged 56 and above comprised 14% of the sample, while those aged 26 – 30 were the smallest group at 6%. The gender distribution of the sample showed a higher proportion of males (58%) compared to females (42%). This gender imbalance provides insight into how awareness and application of 21st-century skills

may vary across gender lines within the TVET context. The majority of lecturers held a bachelor's degree (45%), followed by Honour's degree holders (25%) and master's degree holders (14%). A small percentage of lecturers held a Doctoral degree (1%), while 15% had a diploma as their highest qualification. The diversity in educational attainment among lecturers highlights the range of academic backgrounds influencing the delivery of 21st-century skills in teaching practices. In terms of professional experience, 36% of respondents had between 0 – 10 years of teaching experience. Followed by 25% with 11 – 15 years. Lecturers with 0 – 5 years of experience comprised 19%, suggesting a mix of seasoned and newer professionals. Only 8% of lecturers had more than 21 years of experience, reflecting the evolving demographics within TVET institutions.

## 4.2 Awareness of 21st-century Skills

Table 2 below presents descriptive statistics (n, Mean, and Standard Deviation) for lecturers' knowledge of 21st-century skills, reported teaching practices, and perceived professional development needs. The results provide insight into the alignment between lecturers' awareness and their ability to implement student-centred pedagogies effectively.

### 4.2.1 Lecturers' Knowledge of 21st-century Skills

The mean score for lecturers' knowledge of 21st-century skills is 3.84, with a standard deviation of 0.82. This suggests that while lecturers have moderate to high levels of awareness of 21st-century skills, there is variability in their responses. Some may have a strong understanding, while others may lack confidence in their knowledge.

### 4.2.2 Teaching Practices

The data show that lecturers frequently implement student-centred pedagogies aligned with 21st-century skills, as reflected in the high mean scores across different teaching strategies.

- The frequency of problem-solving activities has the highest mean ( $M = 4.62$ ,  $SD = 0.49$ ), closely followed by the frequency of collaboration activities ( $M = 4.55$ ,  $SD = 0.53$ ) and the frequency of critical thinking activities ( $M = 4.34$ ,  $SD = 0.58$ ). These high ratings suggest that lecturers generally acknowledge the importance of active learning strategies in fostering 21st-century skills.
- The frequency of creativity-promoting activities ( $M = 4.21$ ,  $SD = 0.69$ ) and the frequency of innovation-promoting activities ( $M = 4.18$ ,  $SD = 0.77$ ) have slightly lower means, suggesting that these practices are also used frequently, but perhaps to a lesser extent than problem-solving, collaboration, and critical thinking. The ability to assess 21st-century skills mastery has the lowest mean ( $M = 3.64$ ,  $SD = 0.83$ ) among the teaching practices. This is noticeably lower than other teaching practices, implying that while lecturers frequently use student-centred methods, they may struggle to evaluate students' proficiency in these skills. The relatively high SD suggests variability in confidence levels regarding assessment.
- The comfort level with technology for 21st-century skills has a mean of 3.84 and the highest standard deviation of 1.03, indicating a wide range of comfort levels among lecturers in using technology to teach 21st-century skills. Some may be highly confident, while others require more training.

### 4.2.3 Professional Development Needs

Table 2 also highlights the lecturers' strong agreement on their need for professional development related to 21st-century skills. The mean scores for all three professional development needs are very high:

- Need for PD to improve 21st-century skills understanding ( $M = 4.71$ ,  $SD = 0.49$ ),
- Need for PD to enhance 21st-century skills teaching ( $M = 4.64$ ,  $SD = 0.67$ ),
- Need for PD to enhance 21st-century skills assessment ( $M = 4.73$ ,  $SD = 0.61$ ).

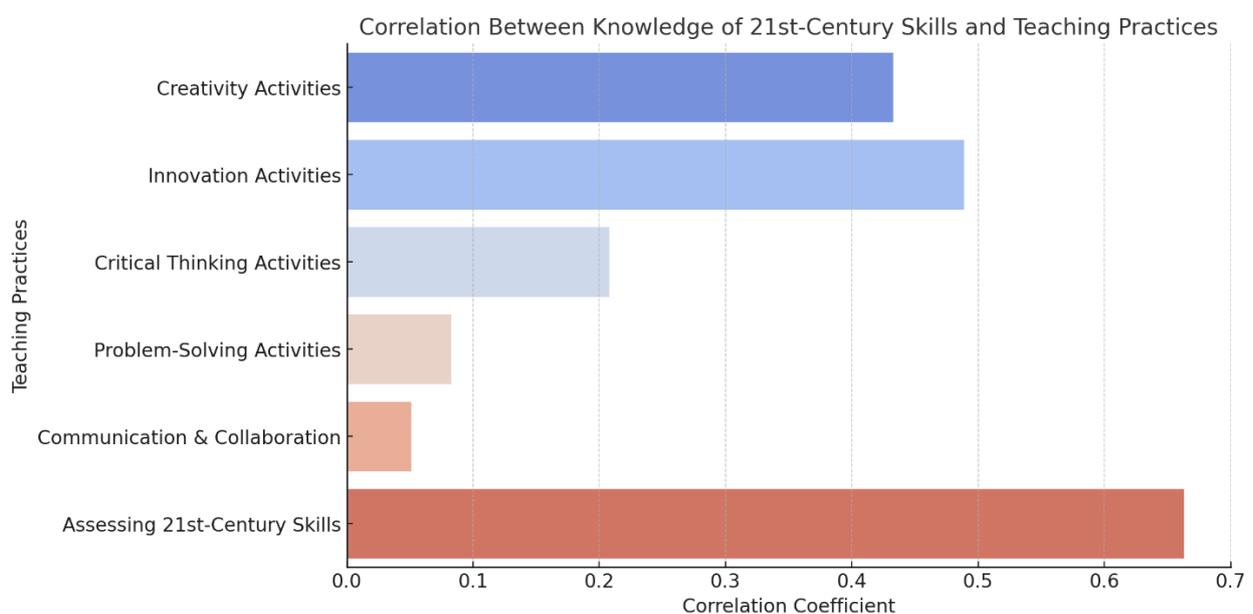
This indicates that lecturers recognise a significant need for further training and support in understanding, teaching, and assessing 21st-century skills. Table 2 shows the analysis of the mean scores for the survey responses regarding TVET lecturers' awareness of and practices related to 21st-century skills.

**Table 2** Descriptive statistics for activities promoting 21st-century skills

Variable	n	M	SD
Lecturers' Knowledge of 21st-Century Skills	73	3.84	0.82
<b>Teaching Practices</b>			
Frequency of Creativity-Promoting Activities	73	4.21	0.69
Frequency of Innovation-Promoting Activities	73	4.18	0.77
Frequency of Critical Thinking Activities	73	4.34	0.58
Frequency of Problem-Solving Activities	73	4.62	0.49
Frequency of Collaboration Activities	73	4.55	0.53
Ability to Assess 21st-Century Skills Mastery	73	3.64	0.83
Comfort Level with Technology for 21st-CS	73	3.84	1.03
<b>Professional Development Needs</b>			
Need for PD to Improve 21st-CS Understanding	73	4.71	0.49
Need for PD to Enhance 21st-Century Teaching	73	4.64	0.67
Need for PD to Enhance 21st-Century Assessment	73	4.73	0.61

The results suggest that lecturers generally have a high level of awareness of 21st-century skills, with only a few needing further support or training. The combined 82.8% agreement shows that most educators recognise the importance of these skills, which is a positive indication of curriculum development and integration. However, 17.2% of respondents (neutral and disagreeing groups) indicate a potential gap that institutions should address through professional development.

The correlation analysis was also conducted to examine the relationship between TVET lecturers' knowledge of 21st-century skills, various teaching activities, and their ability to assess students' mastery of these skills. The Pearson correlation coefficients ( $r$ ) were calculated along with their significance levels ( $p$ -values). Figure 1 depicts the correlation between lecturers' awareness of 21st-century skills and their teaching practices.

**Fig. 1** Correlations between knowledge of 21<sup>st</sup>-century skills and teaching practices

The bar chart (Figure 2) highlights the varying impact of lecturers' knowledge of 21st-century skills on different aspects of their teaching. The strong correlation observed between knowledge and assessment practices (correlation coefficient = 0.7) suggests that enhancing lecturers' understanding of 21st-century skills can lead to

improved assessment of students' proficiency. However, the weaker correlations with other teaching practices, such as those that promote critical thinking (correlation coefficient = 0.21), problem-solving (correlation coefficient = 0.08), and communication (correlation coefficient = 0.05), indicate that knowledge alone is not sufficient to drive pedagogical change. This finding underscores the importance of providing lecturers with practical strategies and resources to effectively integrate 21st-century skills into their teaching.

The above quantitative results are supported by interview data, which provided deeper insights into these findings. Some lecturers expressed a basic understanding of 21st-century skills but lacked in-depth knowledge of how to integrate them effectively into their teaching practices. For example, one participant (L1) noted,

*"We know that these skills are important, but our training has been mostly technical, and we are not well-prepared to teach these skills alongside our subject content."*

Another lecturer (L5) highlighted the challenge of keeping up with evolving skill demands:

*"We are aware of the skills students need today, but there is little guidance on how to include them in our lessons, especially when we are already overwhelmed by existing curriculum requirements."*

L4 remarked:

*"We now live in a technology-driven world where critical thinking and creativity are crucial. We teach students to advance technologically while being innovative, enabling them to apply classroom knowledge, such as starting businesses, in real-world contexts."*

### 4.3 Influence of Lecturers' Awareness on Their Pedagogical Practices

The survey data in Figure 2 below indicated that awareness of 21st-century skills had a measurable impact on teaching practices, although the extent of this impact varied. The majority of respondents reported a positive level of awareness and understanding across all 21st-century skills, with the highest percentage of lecturers falling within the "Agree" and "Strongly Agree" categories. While the overall trend is positive, there is some variation in the distribution of responses across different skills. For instance, skills like creativity and innovation show a higher proportion of "Strongly Agree" responses, suggesting a stronger level of awareness and understanding. On the other hand, skills like critical thinking and problem-solving have a slightly higher percentage of respondents selecting "Neither/Nor Agree." A small but noticeable portion of respondents, ranging from 3% to 10% indicated "Strongly Disagree" for some of the skills, highlighting areas where further development might be needed.

The high percentage of lecturers who strongly agreed was seen in problem-solving (61.6%), communication and collaboration (56.2%), and preparedness to collaborate (54.8%). This suggests that a majority of lecturers feel that they actively foster collaborative, problem-solving-oriented classrooms, reflecting constructivist and student-centred pedagogy. Only 9.6% strongly agreed that they were able to assess students' mastery of 21st-century skills. A relatively high neutral response (26.0%) was recorded here, suggesting uncertainty or a lack of confidence in assessment strategies. Innovation and creativity received positive feedback, but with slightly lower strong agreement scores (34.2% and 31.5%), indicating room for enhancement in these areas. Assessment of 21st-century skills has the highest disagreement overall (2.7% strongly disagree + 5.5% disagree). This could indicate a need for professional development in formative and summative assessment of 21st-century competencies. Figure 2 shows the distribution of responses across 21st-century skills.

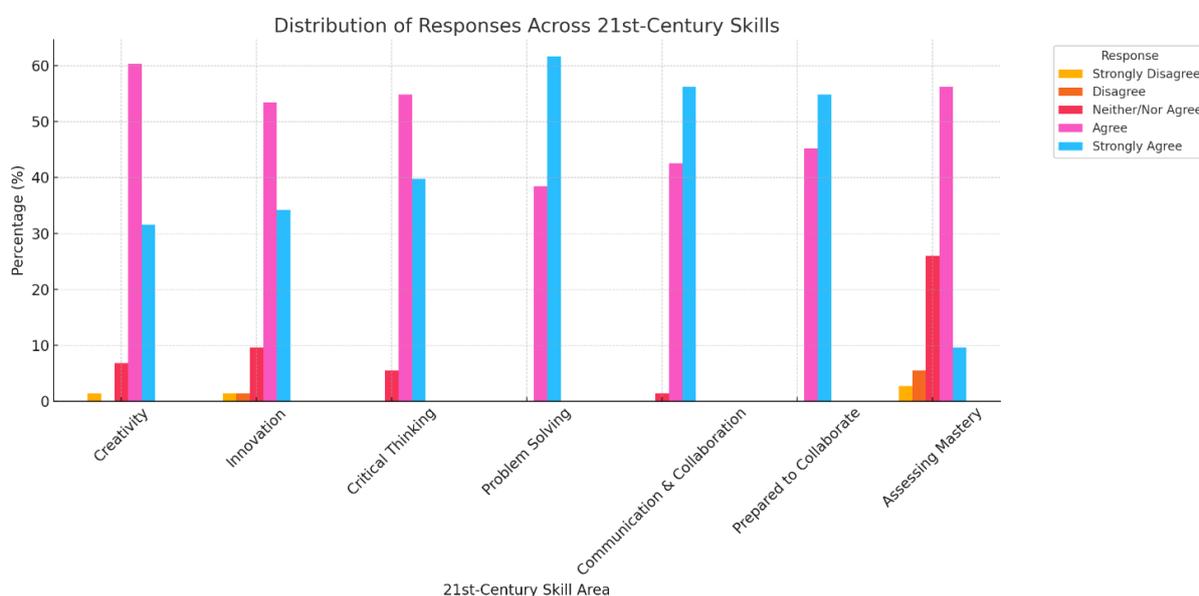


Fig. 2 Distribution of responses across 21st-century skills

However, the interview data revealed that two out of the five interviewed lecturers reported being knowledgeable about 21st-century skills, and they often adapted their teaching strategies to be more interactive and student-centred. For instance, one lecturer (L2) mentioned using group projects to foster collaboration and stimulate real-world work environments. The excerpt below speaks to this view:

*"In my classes, group projects are essential. They foster teamwork and prepare students for collaborative tasks they will face after graduation."*

Similarly, L4 described using real-world problem-solving tasks to encourage critical thinking and collaboration, stating:

*"When I design lessons that involve teamwork and problem-solving, students are more engaged and learn skills that are valuable in the workplace."*

Furthermore, it emerged from the interview feedback that lecturers who had participated in training workshops reported higher confidence and more innovative teaching methods. For example, one lecturer (L2), who had undergone professional development, shared:

*"After attending a workshop on online teaching, I started incorporating group projects and discussions, and I've noticed a positive change in how my students approach problem-solving."*

Interview participants unanimously stressed the need for continuous training and institutional support. For instance, L4 hinted:

*"Our teaching context is constantly changing, and we need to keep updating our skills to ensure that we are preparing our students for the future. Without proper training and resources, it's difficult to make these changes."*

Contrastingly, L1, L3, and L5 mainly depended on traditional lecture-based methods, resulting in little student interaction and few collaborative learning activities. Interview feedback revealed that these lecturers found it challenging to integrate 21st-century skills into their teaching practices, as they perceived these skills as secondary to technical skill acquisition. Their sentiments are well summarised below:

*"We need more training on how to teach these skills effectively. The focus is always on technical content, but we don't get enough support for teaching soft skills,"* stated L1.

*"The curriculum doesn't leave much room for experimentation. We have strict guidelines to follow, which makes it hard to include collaborative projects,"* said L3.

*"I understand the value of the 21st-century skills, but the curriculum and available time make it hard to focus on them,"* remarked L5.

Document analysis supported the above observations, showing that while some lesson plans focused on critical thinking and problem-solving, digital literacy and creativity were often neglected. Only L2's and L4's teaching portfolios showed consistent use of technology (e.g., data projectors) and collaborative tasks, whereas L1, L3, and L5 had minimal technology integration and relied on traditional resources such as textbooks and printed handouts, which hindered the development of digital literacy.

#### 4.4 Challenges in implementing 21st-century skills

Despite recognising the importance of 21st-century skills, lecturers faced barriers such as limited resources, institutional constraints, and curriculum rigidity. For instance, while 94.6% of lecturers agree that 21st-century skills are crucial, only 43.8% believe the curriculum encourages these competencies. This suggests that many curricula are still structured around traditional learning models that emphasise rote memorisation rather than critical thinking, creativity, collaboration, and communication. Mechanical Engineering lecturer L1 also reflected this view during the interview, stating:

*"I struggle to integrate project-based learning due to rigid syllabi focused on content coverage rather than problem-solving activities."*

Limited comfort and proficiency in using technology for teaching 21st-century skills is evident, as only 21.9% of lecturers strongly agree that they feel confident in doing so. The findings highlight that some lecturers lack digital literacy or are resistant to adopting new technological tools in teaching. This finding is echoed in the interview responses, particularly in the comment made by lecturer L1 from Mechanical Engineering:

*"I am expected to use 3D modelling software for my mechanical subjects, but I lack proper training or institutional support."*

This indicates a significant gap in both comfort and proficiency.

With over 70% of lecturers strongly agreeing that they require professional development for 21st-century skills, the results underscore a significant gap in current training provisions. This aligns with the findings from the interviews, where a Business Studies lecturer, L3, noted:

*"I struggle to incorporate critical thinking exercises into assessments without workshops or mentorship programmes."*

This finding suggests that many lecturers do not receive ongoing training on modern pedagogies, leaving them unprepared to effectively foster these skills in students.

It is also evident that assessing 21st-century skills remains a key challenge, as a significant 76.7% of lecturers strongly agree that they require training in this area. The survey data suggests that traditional assessment methods, such as multiple-choice tests, do not effectively measure skills like creativity, problem-solving, and collaboration. The interview data also reinforces this point, as noted by Office Practice lecturer L4, who stated:

*"I find it difficult to assess communication and teamwork skills in a written examination format."*

The quantitative results further indicate that many lecturers recognise technology as crucial (98.7%), but some still struggle to implement it due to resource constraints. In line with this, interview data reveals a similar observation by lecturer L1 from Mechanical Engineering:

*"It's frustrating when you have ideas to make learning more interactive, but you lack the basic resources to do so. For instance, when I want to use online simulations for my Mechanical Engineering subjects, I face issues like outdated software or slow internet."*

In summary, these challenges hindered lecturers' ability to fully integrate 21st-century skills into their teaching practices. The lecturers expressed concern over the limited flexibility in TVET curricula, which often prioritise technical skills over cognitive and interpersonal competencies. Moreover, interviewees frequently highlighted the absence of adequate resources and professional development opportunities as barriers to incorporating 21st-century skills.

## 5. Discussions

This study investigated TVET lecturers' awareness of 21st-century skills and the implications of this awareness on their pedagogical methods, classroom practices, and curriculum delivery. The findings provide critical insights into the current state of 21st-century skills integration in TVET and highlight areas for improvement.

### 5.1 Lecturers' Awareness of 21st-century Skills

The findings highlight a moderate level of self-reported awareness among TVET lecturers regarding 21st-century skills, as indicated by the mean score of 3.84. Lecturers generally recognise the importance of skills such as critical thinking, communication, collaboration, and creativity. However, the findings also suggest that there is room for enhancing their confidence and depth of knowledge in these areas.

The emphasis on integrating critical thinking and problem-solving into teaching practices suggests that these skills are relatively well-understood and prioritised within TVET contexts. This aligns with the nature of TVET, which often involves practical problem-solving and critical analysis in technical fields. However, the moderate understanding of 21st-century skills, in general, indicates that a more comprehensive approach is needed to ensure that lecturers are equipped to foster the full range of 21st-century competencies.

Kim et al. (2019) emphasise that lecturers' awareness and understanding of 21st-century skills are crucial for their successful implementation in classrooms. However, research indicates that the levels of awareness among TVET lecturers vary, with many feeling ill-equipped to teach these skills due to a lack of training and professional development opportunities (Holler et al., 2023).

This study revealed that lecturers who prioritised 21st-century skills reported shifting toward more student-centred teaching practices. For instance, L1 and L4 frequently use group projects and real-world problem-solving tasks, which foster active learning and better prepare students for workplace demands. As L1 described, group projects simulate real-world work environments, a teaching strategy supported by Tran et al. (2019), who emphasised the benefits of cooperative learning. L4's approach to using real-world scenarios aligns with Kolb's experiential learning theory, which posits that active engagement enhances knowledge retention and skills development (Kolb, 2014). However, lecturers like L2, L3, and L5 continued to rely on traditional lecture-based methods, highlighting a disparity between awareness and practice.

## 5.2 Influence of Lecturers' Awareness on Pedagogical Practices

The study's findings reveal that lecturers' awareness of 21st-century skills plays a significant role in their pedagogical practices, particularly in relation to assessing students' mastery and fostering creativity and innovation. Lecturers who are aware of the importance of 21st-century skills are more likely to adopt innovative instructional methods that promote these skills. This may include incorporating active learning environments, project-based learning, collaborative learning, and inquiry-based learning. The weaker correlations for communication and problem-solving may indicate a need for further professional development to support lecturers in integrating these skills into their teaching. This aligns with the existing literature, which suggests that while educators understand the relevance of these skills, they often face challenges in integrating them fully into their teaching practices (Care et al., 2018). The stronger correlation between creativity and innovation activities aligns with the findings that some lecturers actively foster engagement and experiential learning. This emphasis reflects the current educational discourse, which positions critical thinking and problem-solving as foundational skills for navigating complex work environments (McCormick et al., 2015; Phillips, 2023).

Active learning environments are important, where students are active participants in their learning process (Hernández-de-Menéndez et al., 2019). Studies have shown that project-based learning enhances critical thinking and collaboration (Trisdiono et al., 2019; Williamson, 2023). Other strategies include collaborative learning, where students work together to solve complex problems, and inquiry-based learning, which encourages creativity and problem-solving skills (Lu et al., 2021).

### 5.2.1 Implications for Classroom Practices

Lecturers' awareness of 21st-century skills also influences their classroom practices. Lecturers who recognise the importance of skills like communication, collaboration, and creativity tend to encourage these skills in their classrooms. They may foster these competencies through project-based learning, collaborative tasks, or problem-solving activities (Somphol et al., 2022; Saimon et al., 2023). This indicates that creating a learning environment that fosters 21st-century skills is crucial.

However, the study highlights challenges in the practical application of 21st-century skills in classrooms. These challenges may be attributed to factors such as curriculum rigidity, limited resources, and insufficient professional development opportunities. It emerged from the findings that some TVET lecturers feel ill-equipped to teach these skills due to a lack of training and professional development opportunities, resulting in gaps between their awareness and effective implementation. For example, the comment from participant L2 about lacking adequate preparation echoes findings from the Partnerships for 21st Century Skills (2019), which emphasises that many educators are underprepared to embed these competencies alongside technical content. As educational demands evolve, lecturers require comprehensive training that goes beyond content delivery to include instructional strategies that foster 21st-century skills. This is consistent with findings by Darling-Hammond et al. (2017), who argue that professional development is crucial for equipping educators with the skills needed to implement innovative teaching methods. L2's statement about insufficient training reflects a broader issue in educational systems, where professional development often falls short in addressing evolving teaching demands. Research by Varma and Malik (2023) highlights the need for targeted professional development programmes to help TVET lecturers understand how to integrate 21st-century skills into their technical instruction, emphasising that without training, the full benefit of these skills may not be realised.

### 5.2.2 Implications for Curriculum Delivery

The findings of this study have implications for curriculum delivery in TVET institutions. Integrating 21st-century skills into TVET curricula is essential for enhancing students' employability and preparing them for the demands of the modern workforce (Varma & Malik, 2023; Kana & Letaba, 2024). According to Tushabe and Ssempala (2024), TVET graduates need to develop both technical expertise and robust cognitive and socio-emotional skills to remain competitive in the global job market. Selane and Odeku (2024) highlight that TVET institutions should shift from solely emphasising technical skills to integrating the 4Cs into their curricula, allowing students to develop greater versatility in their professional roles.

However, the study reveals a misalignment between curriculum design and the practical application of 21st-century skills in classrooms. Institutional constraints such as rigid curricula and limited resources impeded the effective integration of these skills (OECD, 2018). About 57% of lecturers cited curriculum inflexibility as a significant challenge, which aligns with findings by Foster (2023), who argues that educational systems must be adapted to foster 21st-century competencies. Interview data revealed that the lack of adequate resources and training opportunities exacerbated these difficulties. L5's frustration over outdated equipment echoes literature emphasising the importance of resource availability for technology integration in education (Schlebusch et al., 2024). Kana and Letaba (2024) argue that the emphasis on specific technical skills in TVET curricula often restricts lecturers from integrating broader skill sets into their teaching. This highlights the need for curriculum reform to create a more enabling environment for the integration of 21st-century skills.

In summary, the insights gained from this study underscore the urgent need for targeted professional development initiatives. Training programmes should focus on equipping TVET lecturers with the tools and strategies necessary to teach 21st-century skills effectively. As noted in prior research, professional development that is ongoing, collaborative, and practice-oriented has the greatest impact on teacher efficacy (Darling-Hammond et al., 2017). Additionally, there is a need to revisit curriculum designs to allow more flexibility and integration of skills-based learning, aligning with global best practices in TVET education (OECD, 2018).

## 6. Conclusion

The study's conclusions are presented in alignment with the stated research objectives:

1. Objective 1: To explore the awareness and understanding of 21st-century skills among TVET lecturers.

The findings indicate that TVET lecturers generally possess an awareness of 21st-century skills, recognising the importance of skills such as communication, collaboration, creativity, and critical thinking. This is supported by survey data, where 80% of lecturers rated their understanding of these skills as 'high.'

2. Objective 2: To examine how this awareness influences their teaching practices.

Despite this awareness, the practical integration of 21st-century skills into teaching practices is inconsistent. Factors such as curriculum rigidity, limited access to resources, and insufficient professional development opportunities impede the effective application of these skills. For example, while interviews revealed a positive attitude toward innovative pedagogies, classroom observations showed that traditional lecture-based methods remain dominant in many classrooms.

To address the challenges identified in this study, the following policy adjustment is recommended:

- TVET institutions should implement a revised curriculum framework that explicitly integrates 21st-century skills.
  - This policy adjustment is primarily intended for curriculum developers and educational administrators within TVET institutions.
  - The study revealed that curriculum rigidity is a significant barrier to the adoption of 21st-century skills in the classroom, necessitating a review and update of the existing curriculum.
  - Curriculum developers should revise the existing curriculum to include explicit learning outcomes related to 21st-century skills, incorporating active learning methodologies and authentic assessment tasks. Educational administrators should allocate resources for professional development programmes focused on 21st-century skills pedagogy and establish communities of practice to support lecturers in implementing new teaching strategies.

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## Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

## Author Contribution

The authors confirm contribution to the paper as follows: **study conception and design:** Solomon Pharamela, Asheena Singh-Pillay; **literature review:** Asheena Singh-Pillay; **data collection:** Solomon Pharamela; **analysis and interpretation of results:** Solomon Pharamela, Asheena Singh-Pillay; **draft manuscript preparation:** Solomon Pharamela. Asheena Singh-Pillay reviewed the results and approved the final version of the manuscript.

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