

Exploring the Relationship between Authentic Assessment and Teaching Professional Competence Acquisition among Undergraduate Science Student-Teachers in Higher Education Institutions in Tanzania

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Article Info

Article Type

Original Research

Article History

Received:

07 March 2024

Accepted:

15 May 2024



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Abstract


Authentic assessment has garnered significant interest among scholars in Higher Education Institutions (HEIs) globally. This study investigated the relationship between authentic assessment and the acquisition of teaching professional competencies among undergraduate science student-teachers in HEIs in Tanzania. Utilizing a quantitative research approach with a descriptive survey research design, we sampled 231 third-year students enrolled in the Bachelor of Science with Education (BSC. ED) Programme. Data were collected through questionnaires and documentary review, and analyzed by using inferential statistics, specifically through multiple linear regressions. The findings indicate a positive relationship between authentic assessment and teaching professional competencies. Furthermore, the results demonstrate a positive relationship between authentic assessment tools such as portfolios, projects, teaching practice, and practical work, and specific competencies including content, pedagogical, and generic knowledge, albeit with variations depending on the tools employed. This study argues that the implementation of authentic assessment positively correlates with the acquisition of teaching professional competencies among undergraduate science student-teachers in HEIs. To ensure students attain teaching professional competence essential for navigating the labor market economy, course instructors must prioritize the utilization of authentic assessment tools.


Keywords:


Authentic assessment, Content competence, Pedagogical competence, Professional competence, Undergraduate Science student-teachers

Citation:

Nyinge, B. Matete, R., & William, F. K. (2024). Exploring the relationship between authentic assessment and teaching professional competence acquisition among undergraduate science student-teachers in higher education institutions in Tanzania. *International Journal of Current Education Studies (IJCES)*, 3(1), 14-27. <https://doi.org/10.5281/zenodo.12190361>

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Introduction

Authentic assessment has emerged as a focal point of interest among scholars within Higher Education Institutions (HEIs), driven by its perceived capacity to augment students' acquisition of essential competencies (Juanda, 2022; Karunanayaka & Naidu, 2021; Nicol et al., 2019; Tyas, 2020; Villarroel et al., 2018). This interest stems from the aspiration to witness graduates proficiently apply their acquired knowledge and skills in real-world scenarios post-graduation (Ghosh, 2018; Sewagegn & Diale, 2020; Vu & Dall'Alba, 2014). Authentic assessment has been acknowledged to foster the active students' engagement and cultivates a sense of responsibility for learning, through which one can find a crucial link between HEIs and the skill demands of the employment sector (Juanda, 2022; Quansah et al., 2019). The spectrum of competencies targeted by authentic assessment encompasses critical thinking, divergent thinking, problem-solving, creativity, communication, commitment, teamwork, social and civic competence. In addition, other competencies include Information and Computer Technology (ICT) proficiency, accountability, interpersonal skills, entrepreneurship, recognition and appreciation of diversity, leadership, cultural awareness, expressive abilities, and physical well-being (Davis & Gardner, 2012; Kivunja, 2015; Kong, 2015). The imperative for HEIs to equip graduates with such multifaceted competencies underscores the pivotal role of authentic assessment in curriculum planning and teaching methodologies (Rennert-Ariev, 2005).

Despite the widespread acknowledgment of authentic assessment's pivotal role in students' learning worldwide, the existing literature predominantly focuses on its utility for assessing learning outcomes or promoting 21st century employability competencies (Asamoah et al., 2022; Hobbins et al., 2021; Tyas, 2020; Wayan Suastra & Ristiati, 2019; Zakiah & Fajriadi, 2020; Fiore, 2020; Pereira et al., 2021; Villarroel et al., 2020). However, the link between authentic assessment and the acquisition of teaching professional competencies, encompassing content knowledge, pedagogical skills, and generic knowledge, remains relatively unexplored. In light of the evolving demands of the teaching profession and the importance to align HEI curricula with industry needs, understanding the role of authentic assessment in nurturing teaching professional competencies becomes increasingly crucial. Our study investigated the contribution of authentic assessment to the development of teaching professional competencies among undergraduate science student-teachers in Tanzanian HEIs. The key research question was: How does authentic assessment enhance teaching professional competencies among undergraduate science student-teachers?

What is Authentic Assessment?

Authentic assessment is conceptualized differently by various scholars, reflecting diverse perceptions. Gulikers et al. (2004, p. 69) define authentic assessment as requiring students to utilize competencies - knowledge, skills, and attitudes similar to those needed in professional settings. Mueller (2005, p. 2) characterizes it as a form of assessment where students perform real-world tasks demonstrating meaningful application of knowledge and skills. Swaffield (2011, p. 2) describes authentic assessment as evaluating learning through tasks situated in real-world contexts. Anderson (2003, p. 72) defines it as assessments featuring tasks connected to real-life situations or practical problems. In this study, authentic assessment refers to tasks that necessitate students to think critically



and take responsibility to acquire and demonstrate competencies and capabilities relevant to their professional domain.

The Meaning of Professional Competence

Similar to authentic assessment, professional competence is understood diversely in literature. Joanna et al. (2018) define it as competence associated with mastering knowledge. Greefrath et al. (2022) define professional competence as encompassing activities and tasks required to meet professional demands, including knowledge, skills, and attitudes. In this study, professional competence denotes the ability of prospective Science teachers to apply acquired knowledge and skills in real-world teaching contexts, distinguishing them from other professionals.

Types of Assessment

Assessment typically falls into two main categories: formative and summative assessments. Formative assessment entails tasks or activities providing feedback to students on their learning progress (Irons, 2008). It does not involve assigning grades for summative judgment, focusing instead on providing feedback to shape and develop teaching and learning activities (Black & Wiliam, 2009). Formative assessment, as explained by Bloxham and Boyd (Bloxham & Boyd, 2007) and Huang et al. (2023), aims to improve learning processes and identify areas of weakness. It fosters critical reflection and self-assessment skills among students, motivating them to engage in learning and develop competencies associated with the tasks. Summative assessment occurs at the end of a learning unit or program to certify students' learning achievements. It focuses on judging students' performance based on results after marking or grading their work (Irons, 2008). Summative assessment is termed as 'assessment of learning' (Bloxham & Boyd, 2007; Irons, 2008), determining students' competences for decision-making by teachers, policymakers, and employers (Hilden et al., 2022).

Rationales of Authentic Assessment in HEIs

The use of authentic assessment in Higher Education Institutions (HEIs) offers several benefits, including enhancing employability skills, minimizing cheating, and addressing criticisms against HEI graduates. Authentic assessment fosters the acquisition and application of employability skills, including communication, decision-making, and collaboration (Thambusamy et al., 2014). It prepares graduates for real-life experiences by equipping them with competencies required in the workforce (Kaider et al., 2017; Tay, 2018). Authentic assessment, through Learner-Centered Approach (LCA) pedagogies, actively engages learners in learning and promotes the development of employability skills (Tynjälä et al., 2016). Authentic assessment promotes deep learning and understanding by actively engaging students in tasks and promoting reflection (Karunanayaka & Naidu, 2021). It enhances learning by allowing students to carry out tasks collaboratively, resulting in competence acquisition (Mahasneh & Alwan, 2018). Authentic assessment discourages cheating by engaging learners in tasks and designing rubrics for task accomplishment (Wong & Zhang, 2020). Tasks reflecting real-life experiences, coupled with clear rubrics, reduce the likelihood of cheating among students. Authentic assessment addresses criticisms



regarding graduates' competencies by actively engaging them in tasks that facilitate skill acquisition (Pezer, 2015).

Education Assessment in Tanzania

The use of authentic assessment in Tanzanian HEIs is encouraged by the Tanzania Commission for Universities (TCU) under the University Qualification Framework (UQF) (TCU, 2012). HEIs are urged to adopt a learner-centered approach in teaching and assessment to enhance competence acquisition among graduates and prepare them for the job market. However, the extent to which instructors in Tanzanian HEIs utilize authentic assessment for competency acquisition remains an important area for further study.

Method

Research Approach and Design

In this study, a quantitative research approach was employed, utilizing a descriptive survey research design. The quantitative approach facilitated the collection of extensive data within a short timeframe (Lodico et al., 2010). The descriptive survey research design aimed to elucidate the relationship between authentic assessment tools, including portfolios, projects, practical work, and teaching practices, and learners' competencies. While the quantitative approach primarily focuses on numerical data, which may overlook individual nuances, it was imperative to provide comprehensive details to ensure clarity of communication.

Area of the Study and Sampling of the Participants

The study was conducted in two selected Higher Education Institutions (HEIs) in Tanzania. These institutions were selected based on their enrollment capacity compared to other institutions offering similar programs in Tanzania (TCU, 2021). The study sample comprised third-year students enrolled in the Bachelor of Science with Education Degree programs. Third-year undergraduate Science student teachers were chosen as participants due to their proximity to the completion of their studies and anticipated to have exposure to various assessment tasks throughout their academic journey. The selection of Science students was motivated by the field's significance in Tanzania's Vision 2025 and its contribution to socio-economic and political development (URT, 2000). Despite its importance, the number of students pursuing Science degrees remains relatively low compared to other fields (Drymiotou et al., 2021). Participants were selected through proportional stratified random sampling to ensure representation across genders. A total of 231 respondents were included in the sample, distributed across both institutions as indicated in Table 1.

Table 1. Demographic Characteristics of the Students (n= 231)

Institution	Gender	Frequency
A	Males	60
	Females	60
B	Males	56
	Females	55
Total		231



Steps of the Study

The study commenced with a comprehensive literature review to identify existing knowledge gaps. Subsequently, a proposal and data collection instrument were developed and presented for feedback at the departmental and College of Education levels. Inputs from reviewers and panelists were incorporated into the study design. The subsequent phase involved fieldwork visits to the selected universities, where questionnaires were personally administered to the participants. Following data collection, analysis commenced concurrently with report writing, with continuous refinement of the literature review and methodology sections based on fieldwork experiences. The final stage involved thorough review and refinement to ensure clarity and alignment with the research objectives.

Data Collection

Questionnaires

To gather insights from undergraduate prospective Science teacher students, we utilized questionnaires. Closed-ended questions, employing a Likert scale, were carefully crafted to extract information regarding the utilization of authentic assessment by course instructors and its impact on competency acquisition. The use of closed-ended questions allows for quantitative analysis, enabling us to quantify participants' responses and discern patterns across the sampled population. By utilizing the Likert scale, we could gauge the intensity of agreement or disagreement, thereby providing nuanced insights into participants' perceptions. Questionnaires, however, face the weakness of low response rates especially when they are mailed or posted through mails. To address such potential limitations, we opted for personal administration. This approach not only enhances the high response rate but also facilitates the clarifications and ensures the completeness of responses, and thus, bolstering the reliability and validity of our data.

Documentary Review

Complementing the insights garnered from questionnaires, documentary review served as another crucial data collection method in our research. This approach enabled us to delve deeper into authentic assessment practices by scrutinizing various documents, including curricula, course outlines, journal articles, and books. The process of documentary review involved systematically identifying relevant databases and conducting thorough searches using keywords pertinent to authentic assessment. By screening materials to ensure credibility, we maintained the integrity of the data collection process. The reviewed documents provided valuable contextual information and insights into authentic assessment, complementing the data collected through questionnaires. See Table 2 for the reviewed documents.

Data Analysis and Ethical Issues Considerations

The quantitative data collected through questionnaires were analyzed using inferential statistics, specifically employing a multiple linear regression model to investigate the relationship between authentic assessment tools



and teaching professional competencies. IBM SPSS Statistics version 23 and STATA were utilized as tools for data analysis to facilitate this process. Multiple regression analysis models were employed to examine the relationship between authentic assessment tools (independent variables) and teaching professional competencies (dependent variable). Ethical considerations were paramount throughout the study, with participants providing informed consent prior to questionnaire administration. Confidentiality of provided data was ensured, and precautions against plagiarism were observed, with proper citation of sources used in the study.

Table 2. Documents Reviewed

SN	Documents	Type of information
1.	Course outlines and Curriculum	Information on uses and tools of authentic assessment.
2.	Journal articles	The meaning, rationales and tools of authentic assessment, and relationship between tools of authentic assessment and competencies, and background information on authentic assessment
3.	Books	The meaning and tools of authentic assessment and research methods

Results

Relationship between Authentic Assessment and Content Competence

By using multiple linear regression analysis the results indicated that there was a positive relationship between authentic assessment tools and students' competencies in content, pedagogical, and generic knowledge and skills (Table 3). These tools were; portfolios, projects, practical work, teaching, and practice (TP). The relationship between authentic assessment tools and competencies was = R-squared 0.541. The explanatory variables in the model had also a significant influence on the content competence of students ($F = 28.879$, $P < 0.001$). The predictor variables (portfolio and project scores), however, did not significantly influence the content competence of the students, while the practical and teaching scores significantly influenced content competence.

Table 3. Authentic Assessment and Content Competence of Students

Content competence score	Coef.	St.Err.	t-value	p-value	[95% Conf Interval]	Sig	
Portfolio score	0.135	0.240	0.56	0.530	0.014	1.256	
Project score	0.254	0.402	0.63	0.642	0.028	0.157	
Practical score	0.083	-0.020	4.15	0.000	0.017	0.185	***
Teaching score	0.345	0.026	13.26	0.000	0.102	2.430	***
Constant	42.584	4.778	8.91	0.000	33.168	51.999	***
Mean dependent var		22.053	SD dependent var			5.817	
R-squared		0.541	Number of obs			228.000	
F-test		28.879	Prob > F			0.000	
Akaike crit. (AIC)		1363.792	Bayesian crit. (BIC)			1380.939	

*** $p < .01$, ** $p < .05$, * $p < .1$

The study also revealed that about 54.1 percent of content competence indicated variations in the explanatory variables. Practical score ($P < 0.001$) also significantly influenced the content competence of students. Since it had



a coefficient of 0.083, it implies that as the practical score increased by one unit, then the content competence would also increase by 0.083 scores. In other words, whenever the practical work was applied, the content competence tended to increase since it had a directly proportional relationship to each other. It was also revealed that the teaching practice score was significant at $P < 0.001$, and the coefficient was 0.345, meaning that as the teaching score increased by one score, then the content competence also increased by 0.345 scores. These results imply that teaching practice and content competence have a positive relationship because as the teaching practice was highly applied, the content competence among students tended to increase.

Authentic Assessment and Pedagogical Competence of Students

The study aimed to examine the relationship between authentic assessment and pedagogical competence among students. By using the multiple linear regressions the results indicated that independent variables were good predictors of the pedagogical competence of students with R-squared of 0.662. Results also indicated that explanatory variables had a significant influence on the pedagogical competence of students [$F = 31.552$, $P < 0.001$] [0.001] (Table 4). It was, however, found that practical works and project scores did not significantly influence the pedagogical competence of students, while portfolio and teaching practice scores significantly influenced the pedagogical competence of students.

The results indicated further that about 66 percent of the pedagogical competence indicated variations in the explanatory variables. Teaching practice scores significantly ($P < 0.001$) influenced the pedagogical competence of students. It had a coefficient of 0.041, implying that as the teaching practice scores increased by one unit then the pedagogical competence would increase by 0.041 scores. In other words, whenever the teaching practice was applied, the pedagogical competence tended to increase since it had a directly proportional relationship to each other. In addition, the results indicated that the portfolio score was significant at $P < 0.001$, and the coefficient was 0.221, implying that as the portfolio score increased by one unit, then pedagogical competence to students would increase by 0.221 scores. The results indicated that portfolio and pedagogical competence had a positive relationship, as the portfolios were highly applied the pedagogical competence of students tended to increase.

Table 4. Authentic Assessment and Pedagogical Competence to Students

Pedagogical competence Score	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Portfolio score	0.221	0.042	5.28	0.000	0.004	1.139	***
Project score	0.027	0.055	0.50	0.620	-0.081	0.135	
Practical score	0.012	0.095	0.13	0.899	-0.174	0.198	
Teaching score	0.401	0.047	8.60	0.000	0.093	2.310	***
Constant	43.579	5.001	8.71	0.000	33.723	53.436	***
Mean dependent var		20.533	SD dependent var			6.190	
R-squared		0.662	Number of obs			227.000	
F-test		31.552	Prob > F			0.000	
Akaike crit. (AIC)		1378.607	Bayesian crit. (BIC)			1395.732	

*** $p < .01$, ** $p < .05$, * $p < .1$



Authentic Assessment and Generic Competence

Multiple linear regressions were employed to examine the relationship between tools of authentic assessment, and the generic competence of students. Results indicated that independent variables were good predictors of generic competence to students with R-squared of 0.503. Results also indicated that explanatory variables had a significant influence on the generic competence of students [$F = 24.073$, $P < 0.001$] (Table 5). However, practical work did not significantly influence the generic competence of students, while portfolio, project, and teaching scores significantly influenced such competence in students.

Table 5. Authentic Assessment and Generic Competence

Generic competence Score	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Portfolio score	0.190	0.049	3.90	0.000	0.086	2.094	***
Project score	0.113	0.024	4.70	0.000	0.013	1.238	***
Practical score	0.030	0.012	2.50	0.034	-0.186	0.247	**
Teaching score	0.441	0.054	8.17	0.000	0.048	2.334	***
Constant	40.804	5.836	6.99	0.000	29.303	52.304	***
Mean dependent var		21.145	SD dependent var			6.876	
R-squared		0.503	Number of obs			227.000	
F-test		24.073	Prob > F			0.000	
Akaike crit. (AIC)		1446.761	Bayesian crit. (BIC)			1463.886	

*** $p < .01$, ** $p < .05$, * $p < .1$

It was revealed in this study that about 50.3 percent of generic competence indicated variations in the explanatory variables. Teaching practice scores significantly ($P < 0.001$) influenced the generic competence of the students. It had a coefficient of 0.441, implying that as the teaching practice scores increased by one unit, and then the generic competence would increase by 0.441 scores. The results also indicated that the portfolio score was significant at $P < 0.001$, and the coefficient was 0.190, implying that as the teaching score increased by one score, then generic competence to the students would increase by 0.190 scores (Table 5). Similarly, the results revealed that the project score was significant at $P < 0.001$ and the coefficient at 0.113, implying that as the project score increased by one score then generic competence to the students would also increase by 0.113 scores. In other words, project and generic competence had a positive relationship, as the project was highly applied the generic competence of students tended to increase. The implication is that portfolio and generic competence had a positive relationship because as the teaching practice was highly applied, the generic competence of students tended to increase.

Discussion

The results of this study reveal several significant associations between various educational factors and students' competence levels. Firstly, the results demonstrate a clear impact of practical scores on students' content competence. This indicates that engaging in practical activities correlates positively with the enhanced understanding of the subject matter. As students actively participate in practical tasks, their grasp of content improves, highlighting the beneficial relationship between practical work and content mastery. Similarly, teaching practice scores emerged as influential, suggesting that effective teaching methods contribute to students' content competence. When instructors implement practical approaches, students become more actively involved, thereby



facilitating their acquisition of content knowledge.

These results align with previous research, including studies by Anoh (2021), Arlianty et al. (2017), Chapoo et al. (2018), which have also identified a strong connection between authentic assessment methods and competency development. For instance, Arlianty et al. (2017) noted the positive impact of authentic assessment on Chemistry competence among students in Indonesia. Likewise, Meier (2021) and Njiku et al. (2021) emphasized the role of authentic assessment in enhancing both teacher and student competencies. Constantinou and Abrahams (2019) further underscored the importance of practical work in supporting learning and fostering content competence.

Secondly, the study found a significant relationship between pedagogical competence and teaching practice scores. This suggests that engaging in teaching activities correlates positively with the development of pedagogical skills among students. The utilization of portfolios also demonstrated a positive association with pedagogical competence, indicating that portfolio-based assessments contribute to skill enhancement. These findings resonate with research by Faizah and Sutopo (2021), Hagos et al. (2020), and others, who have highlighted the positive impact of authentic assessment on pedagogical competencies. Additionally, studies by Lin and Tsai (2021) and Kramer et al. (2021) emphasized the importance of student engagement in learning processes for the acquisition of pedagogical skills.

Moreover, the results reveal a relationship between authentic assessment tools, teaching practice, and generic competence among students. Engaging with authentic assessment methods was found to enhance students' generic competencies, including critical thinking, collaboration, communication, decision-making, and creativity. While some previous studies have also reported similar findings, it is important to note the nuanced relationship between practical work and generic competencies. While practical work inherently offers opportunities for developing these skills, the manner in which it is implemented by instructors can impact its effectiveness. Studies by Banu (2011) and Erduran et al. (2020) highlight the need for a formative approach to practical work to facilitate generic competence acquisition among students. Indeed, research by Constantinou and Fotou (2020) and others emphasizes the importance of utilizing practical work formatively to maximize its benefits.

The results underscore the significance of employing practical approaches and authentic assessment methods in education. By actively engaging students in practical tasks and adopting formative assessment practices, educators can effectively enhance both content and generic competencies among learners. These insights highlight the importance of creating engaging learning environments that prioritize active participation and skill development, ultimately fostering holistic student growth and success.

Conclusion

In this study we investigated the relationship between authentic assessment and the development of teaching professional competencies among undergraduate science student teachers in HEIs. The results underscore a significant association between authentic assessment tools and the enhancement of teaching professional competencies. Notably, the utilization of authentic assessment methods such as portfolios, practical work,



teaching practice, and projects demonstrated a positive impact on the improvement of teaching professional competencies encompassing content knowledge, pedagogical skills, generic knowledge and skills, and specific professional competencies among students.

This implies that there is a need to equip students in HEIs with the requisite knowledge and skills for them to survive in the competitive and dynamically evolving landscape of science and technology in the 21st century. It also implies that educators must integrate authentic assessment in the teaching and learning practices so that to have this kind of graduates. Moreover, active engagement of students in diverse activities conducive to the acquisition of desired competencies in the teaching profession is essential. To realize this vision, it necessitates concerted efforts such as a proportional increase in the government's budget allocation for education. For HEIs to establish and maintain laboratories and procure necessary apparatus to facilitate effective practical work among students they need an adequate funding system. The practice may not only help the nurturing and preparation of a generation of proficient and competent educators, but also meet the demands of the contemporary educational landscape of the 21st century.

Author(s)' Statements on Ethics and Conflict of Interest

Ethics Statement: We hereby declare that research/publication ethics and citing principles have been considered in all the stages of the study. We take full responsibility for the content of the paper in case of dispute.

Statement of Interest: We have no conflict of interest to declare.

Funding: None

Acknowledgements: None

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