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Rethinking Educational Pedagogy to Bridge the Skills Gap: The Impact of Competency-Based Learning at Kepler College

George Mulingi Mugabe *
Ashesi University
Accra, Ghana

Irene Uwamariya, Abel Barakamfitiye
Kepler College
Kigali, Rwanda

Abstract. The persistent misalignment between higher education curricula and labor market demands has intensified the skills gap among graduates, particularly in developing economies. In Rwanda, where youth unemployment exceeds 21% (Rwandan National Institute of Statistics, 2022), there is an urgent need for pedagogical approaches that align academic training with workforce competencies. This paper seeks to explain how competency-based learning (CBL) is applied at Kepler College in Rwanda and how such an approach helps to meet the ever-changing skill requirements of the labor market. The study establishes the efficacy of conducting learner-centered teaching through a competency-based methodology incorporating outcome-based assessments, office hours intervention, and remediation assessments on learners' performance and employability. Employing a quantitative quasi-experimental pre-test/post-test design, the study analyzed archival competency assessment records from 282 students drawn from the 2022 and 2023 cohorts at Kepler College, using descriptive statistics and paired-samples t-tests. Data were extracted from students' institutional competency assessment records, scored on a validated 1–6 performance rubric (1 = Beginner through 6 = Advanced), with Level 4 (Proficient) as the minimum mastery threshold. The objectives were achieved as the data reflected that all targeted competencies achieved improvement, with all posttests mean scores ranging from 4.32 to 5.07 as opposed to the pretest mean scores, which were between 3.25 and 5.02. For example, the mean score for measuring the ability to distinguish cash and accrual basis accounting improved from a pretest mean of 4.05 to a posttest mean of 4.74. Students who received outcome-based guidance and attended office hours showed notably greater improvement in their competencies. Standard deviations for pre-test scores ranged between 0.707 and 1.609, with reduced post-test variance indicating greater consistency in competency mastery following intervention. The eight competencies assessed spanned financial and professional domains: communicating financial information, distinguishing cash and accrual accounting, comparing business

* Corresponding author: *George Mulingi Mugabe, gmugabe@ashesi.edu.gh*

entity types, presenting and analyzing data, differentiating depreciation methods, identifying and prioritizing tasks, demonstrating professional time management, and demonstrating resourcefulness. These results demonstrate the value of CBL in developing the relevant skills required by industry. The findings are particularly relevant for higher education institutions (HEIs) seeking to adopt educational models that align with labor market expectations, offering actionable pathways for enhancing graduate employability through focused, competency-driven growth.

Keywords: competency-based learning; higher education; skills gap; job market preparedness; outcome-based assessments

1. Introduction

Globalization, technological advances, and evolving labor market demands have revolutionized education in the 21st century. Continuous lack of alignment between traditional teaching approaches and the needs of contemporary work situations has resulted in new teaching models, e.g., competency-based education (CBE). This paradigm shift follows increases in the requirement that educational providers gain the ability to learn the appropriate knowledge and have the capability to apply it to achieve a change in dynamic, unpredictable environments (Palloff & Pratt, 2013; Siemens & Matheos, 2010). Learning goes beyond the superficial knowledge handoff, which means developing critical thinking, values, and attitudes for individuals to contribute to society responsibly. With emphasis on practical abilities and virtues-based instruction, these have a holistic impact on students, enabling them to be flexible, and ready for future challenges, contributing as much as possible to their communities (Gulati & Pant, 2017). Developing CBL into curricula seeks to close knowledge and skill gaps between academic instruction and the labor market requirements by promoting practical learning experiences and the ability to demonstrate expertise relevant to the real world (Mulder, 2012).

The education system in Rwanda faces serious challenges. The long-term high level of economic growth in Rwanda, as attested by the average real GDP growth rate of 7.6% between 2024 and 2026 (World Bank, 2024), implies the need for a larger, more highly educated labor force capable of meeting the demands of a globalized, competitive world, especially in light of the country's Vision 2050. This emphasizes a shift to a knowledge-based economy that requires a redesigned, better-skilled workforce (Republic of Rwanda, 2020). However, there remains a significant gap between what students learn at university and what employers expect when hiring them. Rwandan employers have consistently cited the poor preparation of university graduates as a major barrier to business growth, pointing specifically to deficiencies in technical, communicative, problem-solving, and digital skills (World Bank, 2024). This concern was equally echoed at the 13th Academia Public-Private Partnership Forum, organized by the Inter-University Council for East Africa (IUCEA), where academics and employers jointly acknowledged a chronic misalignment between university training and labor market demands (IUCEA, 2025).

The Rwandan National Institute of Statistics (2022) reported that the youth unemployment rate exceeds 21%, which further underscores the deep disconnect between educational outcomes and employment realities. Such a pronounced gap calls for an urgent reconsideration of teaching and learning approaches, so that students not only meet academic standards but also graduate with the competencies required to participate effectively in the labor market. Kepler College of Higher Education, based in Rwanda, has introduced a competency-based education model aimed at bridging the gap between university outputs and labor market demands. Its graduates have demonstrated stronger employer-valued competencies and are twice as likely to secure employment compared to their counterparts at conventional universities (IDinsight, 2021). Central to this model are periodic evaluation and the systematic incorporation of personalized feedback. These are mechanisms that empirical research identifies as key contributors to students' progressive mastery of the competencies and soft skills demanded by employers (Hooda et al., 2022; Zhu et al., 2023). Building on this foundation, the present study examines the role of outcome-based feedback and personalized learning support within Kepler's model, with the aim of informing HEIs on how embedding such competency-driven approaches in their curricula can improve student achievement and better meet the needs of the contemporary workforce.

This paper investigates the effect of CBL practice at Kepler College by analyzing its impact on student achievement and its relevance for setting graduates up for the labor market. This study aims to assess the efficacy of one of the critical interventions, namely outcome-based feedback and personalized learning support. These interventions are aimed at providing valuable information for educational institutes to include such competencies in their curricula to achieve better student outcomes and meet the needs of the contemporary workforce. Outcome-based feedback and personalized learning support are foregrounded in this study because these mechanisms directly address the motivational and cognitive factors most critical to competency acquisition. Grounded in self-determination theory (SDT) (Ryan & Deci, 2017), they promote students' sense of autonomy and competence, two of the three core psychological needs that drive intrinsic motivation and sustained academic engagement. Simultaneously, Vygotsky's (1978) scaffolding principle within constructivist learning theory (CLT) establishes that individualized support delivered at the point of difficulty accelerates mastery by helping learners bridge the zone of proximal development (ZPD). These interventions are therefore not peripheral supplements; they are structurally integral to the CBE model under investigation at Kepler College. The research gap addressed in this study is empirical and contextual in nature. Despite a growing body of theoretical literature on CBE, rigorous quantitative evidence of its effectiveness, particularly in African higher education settings, remains sparse (Johnstone & Soares, 2014; Mulder, 2012). No prior peer-reviewed study has quantitatively evaluated the combined effect of CBE's outcome-based assessments, office hours, and remediation interventions on clearly operationalized competencies within Rwanda's higher education sector. This study fills that gap by providing institution-level evidence from Kepler College, Kigali, Rwanda.

Research Objectives

Guided by the above, this study is governed by the following three research objectives:

1. RO1: To assess the overall impact of CBL interventions on student performance at Kepler College;
2. RO2: To evaluate the effect of CBL interventions, specifically outcome-based assessments, office hours, and remediation, on the mastery of eight operationally defined competencies; and
3. RO3: To examine the construct validity and internal reliability of the assessment instruments used to measure competency mastery.

2. Literature Review

The theoretical framework for this study integrates contemporary educational theories to evaluate the impact of competence-based teaching methodologies on student performance (Johnstone & Soares, 2014; Le et al., 2014). This framework incorporates CBE, CLT (Barrouillet, 2015; Vygotsky & Cole, 1978), Bloom's taxonomy (Anderson & Krathwohl, 2001; Krathwohl, 2002), and self-determination theory (SDT) (Ryan & Deci, 2017; Vasalampi et al., 2021). Each theory provides valuable insights into how competence-based approaches can enhance content mastery, application, and student performance, aligning with the research objectives.

2.1 Competency-Based Curriculum and Student Performance

Competency-based education (CBE) is an innovative approach that addresses the gap between traditional education and workforce demands by prioritizing the mastery of skills over time-based learning. Students advance by demonstrating specific competencies, leading to a more personalized learning experience and enhancing engagement and performance (Colson & Hirumi, 2018; Guskey & Bailey, 2024). CBE aligns educational outcomes with industry standards, ensuring graduates are equipped with practical skills needed for real-world applications. Research by McKeown et al. (2021) highlights CBE's effectiveness, showing that CBE students often outperform peers in traditional models, particularly in terms of content mastery and practical knowledge application.

However, CBE's implementation faces challenges, such as the need for clear competency standards and robust assessments, as emphasized by Brower et al. (2017). Its success relies on well-defined expectations and rigorous evaluation methods to measure students' progress accurately. CBE's roots in the work of educational reformers such as Mager and Bloom who stressed measurable outcomes and mastery learning have evolved into modern practices incorporating technology and data-driven approaches to track student progress (Ormell, 1974; Ragland, 2018; Vasquez et al., 2021).

CBE theory is vital for HEIs as it provides a framework for evaluating the effectiveness of teaching practices in fostering content mastery and real-world skill application. This approach emphasizes personalized learning and continuous assessment, offering insights into the factors that significantly improve student performance. Understanding these factors can guide curriculum

development and instructional strategies across institutions, ensuring graduates are not only knowledgeable but also capable of effectively applying their skills in various professional contexts (Johnstone & Soares, 2020). Ultimately, CBE offers a promising solution for enhancing educational outcomes and aligning academic training with workforce needs, contributing to broader discussions on improving teaching practices in higher education.

2.2 Outcome-Based Assessments and Competence Mastery

Outcome-based assessments (OBAs) are essential in CBE because they evaluate students' ability to apply knowledge and skills in practical scenarios, rather than merely testing recall. Nehru et al. (2023) found OBAs effective in measuring competence mastery, providing a clearer assessment of students' abilities to perform relevant tasks. OBAs are closely aligned with learning objectives, offering objective evaluation criteria and continuous feedback (Qadir, 2020). This alignment ensures that assessments measure competencies crucial to professional success, contributing to improved student performance. However, OBAs face challenges related to the need for clear competency standards and reliable tools. Sun and Lee (2020) highlight that inconsistencies in defining competencies and assessment methods can reduce the accuracy of these evaluations. Overcoming such challenges requires careful planning to ensure alignment with educational and industry goals, making continuous refinement crucial to optimizing the effectiveness of OBA in improving student outcomes.

Bloom's taxonomy, introduced in 1956, provides a framework for structuring educational objectives into a hierarchy, from basic knowledge to higher-order thinking. The revised taxonomy by Anderson and Krathwohl (2020) emphasizes creating and evaluating critical higher-order processes. Bloom's framework is integral to CBE by guiding the design of assessments that foster higher-level cognitive skills. It aligns with CBE's goals of content mastery and practical application, helping students progress from foundational understanding to advanced cognitive abilities (Krathwohl, 2002). Bloom's taxonomy is crucial to evaluating cognitive skills developed through CBE (Krathwohl, 2002). By classifying skills into hierarchical levels, it provides a systematic way to assess content mastery and application (Anderson & Krathwohl, 2001). This framework supports the study's goals of analyzing how CBE impacts student development, offering insights into curriculum design that can enhance critical thinking and real-world application of knowledge (Nehru et al., 2023), ultimately improving educational practices across higher learning institutions (Ormell, 1974).

2.3 Office Hours Intervention and Student Engagement

Office hours interventions play a crucial role in enhancing students' educational experiences by offering personalized support outside of regular class time. Research by Hsu et al. (2022) underscores the importance of these interventions in improving student engagement and performance. Their findings reveal that students who actively use office hours tend to achieve better academic outcomes. These sessions provide students with personalized feedback and guidance, addressing individual learning needs and helping them overcome challenges in understanding course material. Such personalized support has been shown to boost student motivation and engagement significantly, contributing to academic

success. The benefits of office hours are further validated by Cardullo et al. (2018), who found that timely, constructive feedback and support during office hours lead to higher student motivation and engagement. This aligns with the principles of SDT (Ryan & Deci, 2017), which emphasizes that autonomy and relatedness are critical to motivation. When students feel supported and have autonomy in their learning process, their performance improves significantly. Office hours thus provide an effective mechanism for fostering this type of engagement and growth, ensuring that students are equipped to meet academic challenges.

Constructivist learning theory (CLT), based on the ideas of Piaget and Vygotsky, offers a valuable framework for understanding how students learn. Piaget's stages of cognitive development emphasize that knowledge is built through interaction with the environment, while Vygotsky's concept of the ZPD stresses the role of social interaction in advancing learning (Barrouillet, 2015; Vygotsky, 1979). Vygotsky's scaffolding approach, whereby a more knowledgeable person supports the learner, is crucial in helping students progress through difficult tasks. This theory supports the research objective of assessing how students construct knowledge and master content, especially in a CBE framework where practical application of knowledge is key. The modern applications of constructivist theory, such as project-based and problem-based learning, emphasize active, experiential learning and align with the goals of CBE (Barrouillet, 2015; Vygotsky & Cole, 1978). These methods encourage students to engage deeply with content and develop skills that are transferable to real-world scenarios. By focusing on how students build and apply knowledge, this approach supports the study's goal of understanding the impact of constructivist teaching on student success. Integrating constructivist principles with CBE can provide a comprehensive framework for improving teaching practices and ensuring that students not only learn the material but also develop the critical skills needed to apply it effectively in professional contexts (Johnstone & Soares, 2014; McKeown et al., 2021). This integration is vital for enhancing the educational outcomes in HEIs, ensuring that students graduate with both the knowledge and the practical competencies required for success in their fields.

2.4 Remediation Assessments and Content Application

Remediation assessments are critical for addressing learning gaps and ensuring students reach the necessary level of competency through targeted support and feedback (Guskey & Bailey, 2024). These assessments are especially valuable in CBE, where mastering key concepts and skills is essential for academic success. Research by Ran and Lin (2022) underscores the effectiveness of remediation strategies in improving students' ability to reinforce their understanding and apply content in practical contexts. This focus on addressing specific areas of difficulty enhances students' overall competence development, which is vital for long-term success. Moreover, Marinelli et al. (2024) found that personalized remediation strategies significantly impact students' ability to bridge learning gaps. By offering tailored feedback, remediation assessments not only improve content mastery but also equip students with the skills to apply their knowledge in diverse scenarios. However, as Hooda et al. (2022) note, the success of these interventions depends on the accurate identification of learning challenges and

the provision of timely, constructive feedback. By closely monitoring student progress and adapting remediation strategies, educators can help students overcome obstacles and improve both their academic performance and competence.

Self-determination theory (SDT), introduced by Edward Deci and Richard Ryan, offers a theoretical framework that explains the motivational drivers behind effective learning. SDT posits that individuals are most motivated when their needs for autonomy, competence, and relatedness are met (Ryan & Deci, 2017). Autonomy refers to the ability of students to take charge of their learning, fostering intrinsic motivation (Ryan & Deci, 2017). Competence involves developing and demonstrating mastery of specific tasks, which enhances engagement and persistence (Ryan & Deci, 2017; Vasalampi et al., 2021). Relatedness emphasizes the importance of social connections and supportive relationships in promoting motivation and learning (Vasalampi et al., 2021). In the context of CBE, SDT is highly relevant, as these programs often emphasize student autonomy by allowing learners to progress at their own pace and focus on mastery of skills rather than time spent in class (Le et al., 2014; Ryan & Deci, 2017). This aligns with the SDT principle of fostering intrinsic motivation by giving students control over their learning process (Ryan & Deci, 2017; Vasalampi et al., 2021). Additionally, CBE promotes competence by ensuring that students can apply their knowledge in real-world situations, reinforcing their sense of capability and achievement (Johnstone & Soares, 2014; Vasalampi et al., 2021). Relatedness is also supported in CBE through collaborative learning opportunities and constructive interactions with instructors, creating a supportive learning environment that further enhances motivation (Vasalampi et al., 2021).

The integration of SDT into this study on CBE provides a comprehensive framework for analyzing how motivational factors influence student engagement and performance (Ryan & Deci, 2017). By focusing on the psychological needs of autonomy, competence, and relatedness, the study evaluated how these factors contribute to students' mastery of content and their ability to apply knowledge effectively (Vasalampi et al., 2021). This understanding of motivational drivers in CBE settings offers valuable insights into how educational practices can be refined to improve student outcomes, ultimately leading to more effective teaching and curriculum design that supports long-term academic success (McKeown et al., 2021).

2. Methodology

This study adopts a quantitative research design to evaluate the impact of CBL at Kepler College on student performance and market readiness. CBE emphasizes the mastery of clearly defined competencies over time-bound learning, allowing students to progress at their own pace upon demonstrating proficiency (Lester, 2014; Mulder, 2012). This study builds upon existing literature on CBE and its role in closing the skills gap between education and industry requirements (Johnstone & Soares, 2020; Schwab, 2016).

3.1 Research Design and Approach

The 2022 and 2023 cohorts were specifically selected because they represent the first two complete cohorts to have undergone the fully implemented CBE curriculum at Kepler College, thus providing the most comprehensive and comparable institutional dataset available. Combining both cohorts (N=300 target; N=282 final) increases statistical power and enables assessment of consistency across intake years, thereby strengthening the study's internal validity. The target population includes 300 students from the 2022 and 2023 cohorts at Kepler College, comprising 150 students in each cohort. These students are enrolled in three core modules of the CBE curriculum. Given the manageable size of the population, a census sampling approach was used and all students' scores in both cohorts were included, ensuring comprehensive coverage and detailed analysis of CBL's impact (Nehru et al., 2023). It is acknowledged that students in the 2022 cohort were at a more advanced stage of the program when post-tests were administered compared to the 2023 cohort. Differences in academic maturity and prior exposure to the curriculum may therefore influence baseline performance levels. This interpretive limitation is borne in mind throughout the analysis, and cohort is treated as a contextual variable when discussing variability in results. A detailed limitation statement is provided in the Conclusion section.

3.2 Data Collection and Analysis Techniques Methods

Archival data collection was employed to ensure a thorough understanding of the impact of CBL. Through the approach, existing student records, including assessment scores, and module completion rates, were analyzed to quantify the success of CBL interventions (Kepler, 2021). Descriptive statistics techniques were also used to summarize student performance data. Moreover, diagnostic tests including validity and reliability were also performed.

3.3 Data Collection and Intervention Procedures

This study employed a one-group quasi-experimental pre-test/post-test design. All 282 students in the study participated in the same CBL program; there was no withheld control group, as the intervention was delivered to all enrolled students as part of the standard curriculum. Data were collected through systematic archival analysis of Kepler College's student performance records, extracted from the institutional student information system at the end of the respective academic years. Student records were anonymized prior to extraction in compliance with institutional data governance protocols. Pretest scores represent initial competency assessments administered at the commencement of each module, before any intervention was delivered. Posttest scores represent end-of-module competency assessments administered after all three intervention components had been fully delivered. The three components of the CBL intervention are described as follows:

- Outcome-Based Assessments (OBAs): Structured performance assessments explicitly aligned to industry-relevant competency standards, administered at the start (pretest) and end (posttest) of each module. Each OBA requires students to demonstrate a practical task (e.g., preparing a financial statement, differentiating depreciation methods in applied problems) rather than test rote recall.

- Office Hours Intervention: Weekly structured sessions offered to all students, with mandatory attendance for any student scoring below the proficiency threshold (Level 4) on any OBA. Sessions provided personalized academic coaching, concept clarification, and targeted feedback on areas of identified weakness.
- Remediation Assessments: Students who remained below the proficiency threshold following office hours were required to complete targeted remediation tasks, additional applied problem sets and exercises, before re-assessment. Remediation content was tailored to the specific competency gap identified per student, consistent with the principles of personalized mastery-based instruction (Marinelli et al., 2024).

At Kepler College, assessments are not traditional knowledge-recall tests. Each competency assessment is a performance-based evaluation explicitly designed to require students to demonstrate application of a specific skill in a realistic, scenario-based context aligned with the competency's operational definition. The 1–6 grading rubric rates students on demonstrated performance quality, not on familiarity with content. Level 4 (Proficient) requires students to perform competency independently with acceptable accuracy and consistency. Accordingly, scores on these assessments constitute a valid and context-appropriate proxy for competency attainment within Kepler College's framework, consistent with the principles of CBE performance assessment design (Guskey & Bailey, 2024; Ragland & Gyll, 2018).

3.4 Analytical Techniques and Instrument Validation

Descriptive statistics, including means, standard deviations, and minimum and maximum scores, were computed for all 16 variables (8 pretest and 8 posttest competency scores) across the 282-student sample. These provide a summary of the distribution and variability of competency scores before and after the intervention. Construct validity was assessed using Pearson's correlation coefficient (r), comparing item-level scores against composite competency totals, with a critical threshold of $r = 0.1168$ ($N = 280$ degrees of freedom, $p = 0.05$). All items exceeded this threshold, confirming construct validity. Face validity was established through alignment with Kepler College's industry-validated competency framework, which was developed in consultation with employer partners. Criterion validity is inherently supported using institutionally approved performance rubrics benchmarked against professional standards. Instrument stability (reliability) was assessed using Cronbach's alpha coefficient, yielding $\alpha = 0.841$, indicating very good internal consistency (George & Mallery, 2003). Additionally, a paired-samples t-test was employed to evaluate mean differences between pre-test and post-test scores, consistent with standard practice for within-group repeated-measures designs (Ross & Willson, 2017; Vetter & Mascha, 2018).

The data collection method employed is a systematic archival analysis of institutional competency assessment records. The specific instrument is the Kepler College Competency Assessment Rubric, a structured performance evaluation tool that produces numerical scores (1–6) for each of the eight operationally defined competencies. While the source of data is documentary

(institutional records), the data themselves are unambiguously quantitative (interval-level numerical scores). This approach is consistent with quantitative secondary data analysis, a well-established and widely accepted methodology in educational research (Creswell & Plano Clark, 2018). The classification of this study as quantitative therefore remains valid; the use of archival records as the data source does not render the design qualitative, provided the extracted data are numerical in nature and analyzed using quantitative statistical methods, which is the case here.

3.3 Operational Definitions of Variables (Competencies)

For this study, operational definitions of competencies that form constructs of variables include Communicate Financial Information (4.25) which refers to the student's ability to communicate financial data and insights effectively using tools and methods tailored to audiences with diverse levels of financial expertise; Distinguish Cash Basis and Accrual Basis Accounting (1.10) which refers to the student's skill to differentiate between cash basis accounting, which records transactions upon cash movement, and accrual basis accounting, which recognizes transactions when they are incurred; Compare and Contrast Major Types of Business Entities (1.8) which refers to a student's competency to evaluate and distinguish the characteristics, benefits, and limitations of various business structures, such as sole proprietorships, partnerships, and corporations; Present and Analyze Data (3.4) which refers to a student's capacity to present data visually and perform analytical assessments to derive meaningful conclusions; Differentiate Depreciation Methods (2.58) which refers to a student's ability to identify and distinguish between four common depreciation methods used for tangible assets—straight-line, declining balance, units of production, and sum-of-years-digits; Identify and Prioritize Tasks (5.1) which refers to a student's competency to establish priorities and set realistic deadlines to ensure project objectives are met efficiently; Respect for Time in Professional Settings (5.24) which refers to a student's ability to demonstrate consistent punctuality and effective time management in professional contexts; and Demonstrate Resourcefulness (5.7) which refers to a student's ability to seek and apply new knowledge and skills proactively to solve problems or improve outcomes. In line with the Kepler College grading system, all competencies in this study are assessed using a grading scale of 1 to 6, with 1 = Beginner, 2 = Emerging, 3 = Developing, 4 = Proficient, 5 = Strong, and 6 = Advanced. Consistent with the Kepler College grading framework, Level 4 Proficient is the minimum threshold to pass the competency.

4. Results and Discussion

This section presents the results and discussion which entail descriptive statistics, diagnostic test results, and pre- and post-test results conducted to assess and demonstrate the impact of CBL at Kepler College. The results are organized to address the three research objectives directly as stated in the Introduction.

4.1 Descriptive statistics

To assess the behavior of the variables for empirical estimation, descriptive statistics were measured for all 16 variables (8 pretest and 8 posttest competency scores). Out of the 300 students in the target population, 18 were excluded from

the final analysis owing to incomplete assessment records (missing either pre-test or post-test data for at least one competency), yielding a final analytical sample of N = 282. Exclusion was based solely on data completeness criteria. Results presented in Table 1 describe the mean, standard deviation, minimum, and maximum values of the eight variables under consideration. Results in Table 1 also show that for pretest scores, the mean ranges from 3.25 to 5.02. The lowest mean is also observed in Pre_Comp_3.4 (3.25), suggesting that the competency was particularly challenging for students before interventions. The highest pretest mean observed for Pre_Comp_5.24 (5.02), indicates relatively stronger initial performance in this competency. Furthermore, standard deviations for the pretest scores range from 0.707 to 1.609, reflecting moderate to high variability in performance. These variations suggest that students observed in the sample (2022 and 2023 cohorts) began the program with differing levels of prior knowledge and skill in each competency.

Table 1: Descriptive Summary Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Pre_Comp_1.8	282	1	5	4.21	.707
Pre_Comp_3.4	282	0	5	3.25	1.508
Pre_Comp_1.10	282	0	6	4.05	1.465
Pre_Comp_5.1	282	0	6	4.05	1.465
Pre_Comp_2.58	282	0	6	4.84	1.259
Pre_Comp_4.35	282	0	6	4.32	1.609
Pre_Comp_5.7	282	0	6	4.18	1.157
Pre_Comp_5.24	282	0	6	5.02	.780
Post_Comp_1.8	282	1	5	4.32	.550
Post_Comp_3.4	282	0	6	4.61	.688
Post_Comp_1.10	282	0	6	4.74	.676
Post_Comp_5.1	282	0	6	4.74	.595
Post_Comp_2.58	282	0	6	5.07	.972
Post_Comp_4.35	282	0	6	5.00	1.028
Post_Comp_5.7	282	0	6	4.49	.894
Post_Comp_5.24	282	0	6	5.02	.780

Note: 18 students were excluded owing to incomplete records, yielding N = 282.

On the other hand, the posttest results shown in Table 1 reveal an increase in mean scores across all competencies, ranging from 4.32 to 5.07. This steady improvement demonstrates the effectiveness of the CBL approach in enhancing student performance. The lowest posttest mean, found in Post_Comp_1.8 (4.32), is still higher than the lowest pretest means, indicating progress even in areas that remained relatively challenging. The highest mean, observed in Post_Comp_2.58 (5.07), underscores significant learning gains in differentiating depreciation methods. These findings align with research highlighting the benefits of CBL in fostering mastery and reducing performance disparities (Le et al., 2014). The method's focus on individual learning outcomes allows students to progress at their own pace while ensuring that they achieve the desired competencies. In this study, the increase in mean scores across all components and the reduction in variability post-intervention point to the program's success in addressing diverse learning needs, directly addressing RO1.

4.2 Diagnostic tests

4.2.1 Validity Test

A construct validity test was conducted to ensure that the data collected from pre- and posttests accurately reflected the impact of CBL (Fraenkel, Wallen, & Hyun, 2015; Creswell, 2020). Pearson's correlation coefficient (R_{xy}) was applied, comparing the relationship between test items and their respective constructs. The critical value, set at 0.1168 for the sample size of N=28 (N−2=280) at P=0.05, served as the benchmark for determining validity. Any correlation exceeding this threshold was deemed statistically significant and valid.

Table 2: Construct Validity

	Pearson's Correlation (R_{xy})	**Critical Value [N – 2] = 280, P = 0.05**	**Valid**
Pre_Comp_1.8	.549**	.1168	Valid
Pre_Comp_3.4	.535**	.1168	Valid
Pre_Comp_1.10	.743**	.1168	Valid
Pre_Comp_5.1	.743**	.1168	Valid
Pre_Comp_2.58	.571**	.1168	Valid
Pre_Comp_4.35	.568**	.1168	Valid
Pre_Comp_5.7	.600**	.1168	Valid
Pre_Comp_5.24	.482**	.1168	Valid
Post_Comp_1.8	.487**	.1168	Valid
Post_Comp_3.4	.224**	.1168	Valid
Post_Comp_1.10	.428**	.1168	Valid
Post_Comp_5.1	.488**	.1168	Valid
Post_Comp_2.58	.371**	.1168	Valid
Post_Comp_4.35	.267**	.1168	Valid
Post_Comp_5.7	.528**	.1168	Valid
Post_Comp_5.24	.482**	.1168	Valid

Note: ** Correlation is significant at the 0.05 level (2 – tailed)

Results in Table 2 show strong correlations across all items, affirming their validity. Pre-test components consistently demonstrate significant correlations, with coefficients ranging from R_{xy}=0.482 to 0.743. The highest correlation observed for Pre_Comp_1.10 and Pre_Comp_5.1 (R_{xy}=0.743), indicates a strong alignment with the constructs. On the other hand, the results of the post-test components also exceeded the critical threshold, with correlations ranging from R_{xy}=0.267 to 0.528. These results confirm the credibility of the assessment tool and support RO3. Notably, Post_Comp_5.7 had the highest correlation among post-test items (R_{xy}=0.528), while the lowest was for Post_Comp_4.35 (Rxy=0.267). Moreover, high correlations in the pre-test indicate that participants entered the program with varying but measurable levels of competency. The post-test results also suggest substantial improvement and alignment with the program's intended outcomes and highlight the efficacy of the CBL approach implemented at Kepler College, including the credibility of the tools to provide a solid foundation for iterative improvements for continuous alignment with learners' needs and industry demands (Hooda et al., 2022; Zhu et al., 2023).

4.2.2 Reliability test

For dependability, consistency, and replicability of findings, Cronbach's alpha coefficient was measured. In Table 3, the results show that the Cronbach alpha coefficient is 0.841, inferring a very good internal consistency among the items in the scale (George & Mallery, 2003). The results further enhance the credibility of the findings, confirming that the scale consistently measures the intended construct across the dataset, therefore further supporting RO3.

Table 3: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.841	.876	16

4.2.3 Impact of Competency-Based Learning on Student Performance at Kepler College

A paired samples T-test was conducted to evaluate the impact of CBL on students' performance at Kepler College. This method was chosen because it is widely recognized in academic literature for its effectiveness in comparing means from related groups, such as pretest and posttest scores (Ross & Willson, 2017; Vetter & Mascha, 2018). By focusing on paired data, the analysis eliminates individual differences, offering a precise measurement of the intervention's effect. The test provides valuable insights into whether the CBL approach significantly influenced students' knowledge and skills.

Table 4: Overall Impact – Competence-Based Learning on Performance

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Compst_Pretest Compst_Post-test	-.50754	.63009	.03752	-.58139	-.43368	-13.527	281	.000

Note: .000 is significance at the 0.05 level (2 – tailed)

The results in Table 4 show that there is a mean difference of -0.50754 between the pretest and posttest scores in the sample surveyed. This indicates that posttest scores of the sample surveyed in Kigali, Rwanda, were higher than pretest scores, suggesting that students performed better after interventions, including office hours and personal counseling, before remediation. Furthermore, although the standard deviation of the difference was 0.63009 for the sample, showing some variability in the score improvements across students, the standard error of the mean difference was much smaller, at 0.03752, indicating the precision of the estimated mean difference. Moreover, the results also show statistical significance at a 95% confidence interval for the mean difference ranging from -0.58139 to -0.43368. These results align with existing studies on CBL, which highlight its role in improving student performance through personalized, mastery-focused instruction (Le et al., 2014). The approach emphasizes practical application and ensures that students achieve specific learning outcomes before progressing. Results also demonstrate that implementing CBL has had a measurable and meaningful impact on student performance, directly addressing RO1.

4.2.4 Impact of Interventions on Mastery of Competencies at Kepler College

Competency-based learning emphasizes mastery of skills and knowledge, allowing students to progress as they demonstrate proficiency. At Kepler College, this approach was applied to improve students' capabilities across various competencies. A paired samples t-test was conducted to evaluate the effectiveness of these interventions, aligning with accepted approaches to assess changes within the same group before and after an intervention (Cohen, 1988; Hattie, 2008).

Table 5: Impact of Interventions on Mastery of Competencies in Fundamentals of Accounting Course (Cohorts 2022 &2023)

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pre_Comp_1.8 Post_Comp_1.8	-.106	.457	.027	-.160	-.053	-3.905	281	.000
Pre_Comp_3.4 Post_Comp_3.4	-1.362	1.676	.100	-1.558	-1.165	-13.646	281	.000
Pre_Comp_1.10 Post_Comp_1.10	-.688	1.412	.084	-.854	-.522	-8.180	281	.000
Pre_Comp_5.1 Post_Comp_5.1	-.695	1.381	.082	-.857	-.533	-8.453	281	.000
Pre_Comp_2.58 Post_Comp_2.58	-.230	.947	.056	-.342	-.119	-4.087	281	.000
Pre_Comp_4.35 Post_Comp_4.35	-.674	1.407	.084	-.839	-.509	-8.044	281	.000
Pre_Comp_5.7 Post_Comp_5.7	-.305	.795	.047	-.398	-.212	-6.439	281	.000

Note: .000 is significance at the 0.05 level (2 – tailed)

Results in Table 5 show statistically significant improvements in all eight competencies assessed. For Competency 1.8, the mean difference between the pretest and posttest scores of the sample was −0.106, with a standard deviation of 0.457. This small but significant change ($p<0.005$) indicates that even minimal interventions can yield measurable benefits in student mastery. Similarly, Competency 3.4 shows the largest improvement, with a mean difference of −1.362 and a confidence interval of −1.558 to −1.165, suggesting that the interventions (Office hours before remediations for students with special needs) had a pronounced impact on areas where students initially struggled the most. The substantial improvement highlights the effectiveness of targeted, CBL strategies including weekly office hours in addressing skill gaps. Other competencies, such as Competency 1.10 (−0.688), Competency 5.1 (−0.695), and Competency 4.35 (−0.674), demonstrate moderate yet significant improvements, reinforcing the consistency of the learning approach.

Smaller gains, such as those seen in Competency 2.58 (−0.230) and Competency 5.7 (−0.305), indicate that while improvements occurred across all areas, some competencies may require additional reinforcement to achieve larger impacts.

Results in Table 5 conform with findings in the literature where CBL has been shown to provide learners with clear goals, tailored pacing, and frequent feedback, all of which enhance learning outcomes (Anderson et al., 2001).

Considered against the study's theoretical frameworks, the findings are interpreted as follows. First, with respect to CBE theory, the universal improvement in post-test means across all eight competencies aligns directly with CBE's core premise that mastery-focused, paced instruction yields measurable competency gains (Colson & Hirumi, 2018; Guskey & Bailey, 2024). Second, viewed through Bloom's taxonomy, the progression from below-proficiency to proficient and advanced scores reflects upward movement along the cognitive hierarchy, from the recall and comprehension levels characteristic of pretest performance toward the application and analysis levels evident in posttest performance (Krathwohl, 2002). Third, from the perspective of SDT, the office hours intervention addressed students' needs for competence and relatedness (Ryan & Deci, 2017): students received personalized feedback that reinforced their sense of capability, while the structured instructor-student interaction fulfilled the need for a supportive relational context. Fourth, the scaffolded structure of office hours followed by targeted remediation mirrors Vygotsky's (1978) ZPD principle, whereby the instructor functions as the more knowledgeable other, guiding learners through the precise points of difficulty until independent mastery is achieved. Collectively, these theoretical alignments confirm that the results are not isolated empirical findings but are coherent with established educational science.

In summary, the results presented in this section directly and comprehensively address all three research objectives. RO1: the overall impact of CBL on student performance, is addressed by the paired t-test results in Table 4, which demonstrate a statistically significant mean improvement of 0.51 score points across all competencies ($p < 0.001$). RO2: the effect of specific CBL interventions on the mastery of eight competencies, is addressed by the competency-level analyses in Table 5, which confirm statistically significant improvements in all eight competencies, with effect sizes ranging from small (Competency 1.8) to large (Competency 3.4). RO3: the validity and reliability of the assessment instruments is addressed by the diagnostic test results in Tables 2 and 3, which confirm construct validity (all $Rxy > 0.1168$) and excellent internal consistency ($\alpha = 0.841$). These results underscore the significance of CBL at Kepler College and ineffective skills-building across the education sector. Similarly, results in Table 5 also conform with findings in the literature where CBL has been shown to provide learners with clear goals, tailored pacing, and frequent feedback, all of which enhance learning outcomes (Anderson et al., 2001). The findings also present practical implications. For competencies with smaller gains, it may be beneficial to analyze the instructional methods further and identify specific challenges faced by students. For example, incorporating additional practice opportunities or varied teaching methods could lead to greater mastery in these areas.

5. Conclusion and Policy Suggestions

This study reveals a more effective model of CBL focused on student performance and meeting the competency demands of the labor market at Kepler College. By combining the acquisition of practical skills with continuous assessments and focused interventions, specifically outcome-based assessments, weekly office hours, and targeted remediation, CBL successfully reconciles the preparation of students for academic progress with the expectations and needs of employers. The data obtained revealed statistically significant improvement across all eight assessed competencies, with posttest means ranging from 4.32 to 5.07 compared to pretest means of 3.25 to 5.02, confirming that CBL's individualized, outcomes-based approach positively impacts both retention and application of content. The investigation demonstrates that the persistent challenge of ensuring students are ready for professional practice can be meaningfully addressed through competency-based interventions grounded in OBA and personalized support. These findings call on policymakers and educators to promote greater adoption of competency-based practices to produce knowledgeable and adaptable graduates ready to contribute to the contemporary workforce.

5.1 Limitations and Recommendations for Future Research

This study has several limitations that should be acknowledged. First, regarding representativeness and generalizability: the study was conducted at a single institution, namely Kepler College in Kigali, Rwanda, and the findings may not directly generalize to other HEIs with different institutional structures, resource levels, or cultural contexts. Second, regarding the research design: the one-group quasi-experimental pre-test/post-test design, while appropriate for this institutional context, does not include a parallel control group receiving a non-CBE curriculum. This precludes definitive causal claims and leaves open the possibility that observed improvements are partly attributable to alternative explanations such as student maturation, test-retest familiarity, or time-on-task effects. Third, regarding data collection: the study relies exclusively on archival numerical performance records. While these are valid quantitative indicators of competency attainment within Kepler College's framework, they do not capture students' subjective learning experiences, motivational states, or the perceived quality of instruction. Fourth, regarding the sample: the 2022 and 2023 cohorts were at different stages of the program at the time of assessment, which may introduce cohort-level differences in academic maturity and baseline competency levels. Fifth, the sample (N = 282) is drawn from a limited subject area (Fundamentals of Accounting), which may limit the breadth of competency domains represented.

5.2 Recommendations for Future Research

Based on the above, the following directions for future research are recommended: (a) Replication studies with randomized control group designs across multiple higher education institutions in Rwanda and sub-Saharan Africa to strengthen causal inference; (b) Longitudinal follow-up research to assess whether competency gains demonstrated at graduation translate into improved employment outcomes and employer satisfaction; (c) Mixed-methods studies that integrate student and instructor perceptions of CBL interventions alongside quantitative performance data, to provide a more complete picture of the learning

process; (d) Extension of the CBL evaluation framework to additional competency domains and subject areas beyond accounting; and (e) Comparative cross-national studies exploring how institutional, cultural, and economic context moderates the effectiveness of CBL interventions.

5.3 Availability of Data

Data employed for this study were generated from original data from Kepler College students' results for cohorts 2022 and 2023 who took the Fundamentals of Accounting Course.

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