Outcome-based assessment vocational education: Conceptual model and an application example

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Abstract

This paper presented a comprehensive and adaptive outcome-based assessment model for vocational education, addressing the need for industry-aligned, flexible, and integrative assessment practices. The model's components ensure a holistic approach to evaluating both technical and soft skills in technical vocational education and training programs. It is outlined in detail the conceptual author's model with its five interconnected elements as well as the whole implementation process. Follows the discussion of the challenges in implementing the model, its strength and implications for vacational education practices. The model is shown in an exemplary application in student profile "computer science and technology" demonstrating the potential for enhancing the relevance and effectiveness of vocational education. It offers a framework for aligning educational outcomes with industry needs, potentially improving graduate employability and workforce readiness.

Keywords: outcome-based assessment, VET, employability, industry need.

Introduction

Outcome-based assessment has become a critical methodology in the evaluation of education, moving the focus from inputs to outputs in learning. This model, with origins in Spady's (1994) work, stresses the necessity of establishing clear, observable, and quantifiable learning outcomes. In recent times, outcome-based assessment has gained momentum across educational areas as institutions and policy creators acknowledge its capacity to connect educational aims with societal and industrial requirements (Biggs & Tang, 2011). This approach denotes a considerable shift from conventional assessment techniques, prioritizing the demonstration of abilities and competencies over pure knowledge gain.

The value of outcome-based assessment in vocational learning cannot be praised unconditionally. As highlighted by Winther and Klotz (2013), vocational education and training (VET) frameworks globally are progressing toward this method to enhance student preparedness for the needs of the contemporary job market. Outcome-focused assessment in vocational schooling ensures learners cultivate practical, industry-applicable competencies directly relevant to their selected domains. Additionally, it enables a more transparent and accountable educational procedure, granting stakeholders like employers and policy creators the capacity to plainly comprehend and appraise graduates' capabilities (Mulder, 2017). This synchronizing of learning outcomes and industry demands is integral in tackling the skills deficit frequently seen in rapidly developing technical arenas.

This paper puts forth a conceptual framework for executing outcome-based evaluation in vocational learning, with particular attention to technical and vocational education and training (TVET). Further, it offers a practical example in computer science and technology, exhibiting the model's applicability in a modern vocational setting. The structure of this paper incorporates an exhaustive literature review, succeeded by a thorough delineation of the suggested conceptual model, encompassing a visual depiction. Next, an implementation instance in TVET computer science and technology is presented, followed by a discourse on the model's advantages, plausible limitations, and inferences for vocational education practice. Finally, the paper summarizes critical results and recommendations for future research pathways.

Literature Review

Outcome-Based Education: Definition and Principles

Outcome-based education (OBE) is an instructional methodology centered on clearly delineated, quantifiable learning objectives. Spady (1994), a pioneer in this domain, characterized OBE as an integrated approach to structuring and managing an educational framework aimed at the effective realization of end goals by all learners at the conclusion of their academic journey. Salient attributes of OBE encompass precisely expressed learning outcomes, an adaptable curriculum, and continuous assessment and feedback. Historically, OBE is rooted in the 1950s with the advent of pedagogical goals, but truly assumed form in the 1980s and 1990s. Its advancement was driven by the need for enhanced accountability in schooling and superior synchronization between academia and job market requirements. Killen (2000) underlines that OBE is evolving from an emphasis on instructional content to what students can practically apply with their knowledge and abilities post-graduation. Recent scientific articles proposing various models for OBE are: for higher education (Nguyen et al, 2020; Xu, 2020); model with the integration of artificial intelligence for application in higher education (Prihantoro, 2023); model for English teaching classes (Rahayu et al, 2021); model of development of a OBL-assessment application for vocational high school (Universitas et al, 2023); curriculum formation and evaluation in OBE (Japee & Oza, 2021);

Assessment in Vocational Education

Traditional evaluation techniques in vocational schooling are often based on gauging theoretical understanding through written examinations and standardized testing. However, these methods were limited in appraising practical abilities and competencies integral to vocational settings (Mulder et al., 2007). Assessment in OBE must be in confruence with competency-based approaches as frequently used to evaluate learning outcomes in technical and vocational education (Yusop et al, 2022). Lavanya et al. (2020) proposed model for assessment tool to measure student skill, and knowledge in OBL. The shift toward competency-based assessment denotes a major transformation in vocational education. As elucidated by Wesselink et al. (2010), this approach focuses on analyzing students' capacity to integrate knowledge, skills, and mindsets in the execution of professional tasks. Competency-based assessment incorporates methods such as practice simulations, portfolios, and workplace evaluations. These techniques enable assessors to obtain a more comprehensive perspective of a learner's competence in realistic occupational situations. Moreover, this approach facilitates enhanced cohesion between education, assessment, and labor market demands, culminating in better-equipped graduates (Biemans et al., 2009). Finally, the shift to competency-based assessment in vocational education allows for more holistic and authentic evaluation of students' occupational abilities, better alignment with workplace demands, and increased accountability in preparing *work-ready* graduates.

Current Practices in TVET

Global tendencies in TVET exhibit an expanding emphasis on outcome-oriented approaches. UNESCO-UNEVOC (2014) documents a developing consensus on the significance of harmonizing TVET curricula with industry requirements and cultivating transferrable abilities. There is also a drift toward more flexible learning avenues and acknowledgment of previously attained competencies. Concrete instances from various nations highlight these inclinations. In Germany, the dual framework, combining classroom education with on-the-job training, has integrated outcome-focused principles to reinforce industry pertinence (Deissinger, 2015). Australia has actualized a comprehensive competency-based training (CBT) model in its TVET domain, linking industry benchmarks to learning objectives and assessment criteria (Wheelahan, 2016). In Singapore, the SkillsFuture effort has stressed lifelong learning and evolution of future-proof capabilities, with a robust emphasis on quantifiable outcomes and industry relevance (Tan, 2017). Overall, TVET systems worldwide are increasingly

adopting outcome-based approaches to strengthen industry alignment, develop transferable skills, allow for flexible pathways, and ensure programs are equipping students with the relevant competencies demanded by the modern workplace.

Challenges in Implementing Outcome-Based Assessment

The implementation of outcome-based assessment in TVET has multiple challenges. Institutional barriers often include rigid organizational structures and resistance to change, which limits the flexibility needed for effective outcome-based practices (Klein & Wikan, 2019). Teacher preparation poses another challenge, as many may not be adequately trained in outcome-based assessment methods or have difficulty with the paradigm shift (Barman & Konwar, 2011). Moreover, implementing outcome-based assessment often requires significant resources for curriculum development, teacher training and the creation of authentic assessment environments. Limited financial resources and infrastructure can hinder full implementation, especially in developing countries or underfunded institutions (Cheng, 2015). While outcome-based assessment can improve the relevance and quality of TVET, systemic barriers related to inflexible institutions, teacher readiness, and resource constraints are the limitations of the effective implementation and sustainability of this approach.

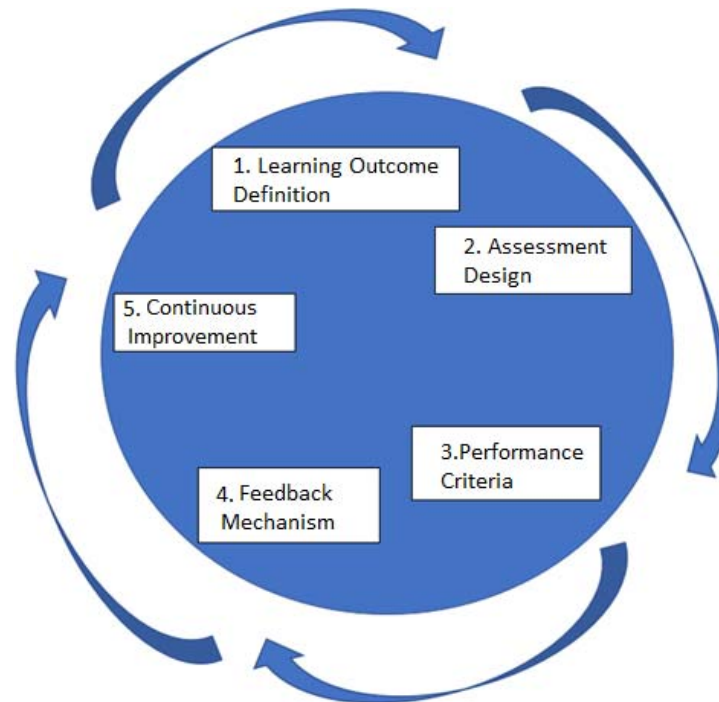### Conceptual Model for Outcome-Based Assessment in Vocational Education

Description of the Model Components

The suggested conceptual framework for outcome-based assessment in vocational education encompasses **five interconnected elements**:

1. Definition of Learning Outcomes: This element entails precisely articulating the knowledge, abilities, and competencies students need to exhibit upon finishing a program or course. As stated by Biggs and Tang (2011), these outcomes should be specific, quantifiable, achievable, applicable, and time constrained.

2. Assessment Design: This element focuses on constructing evaluation approaches directly aligned with the defined learning objectives. It involves selecting suitable assessment tools such as practical projects, simulations, and workplace-based tests (Gulikers et al., 2004).

3. Performance Criteria: These are precise, observable benchmarks that delineate levels of achievement per learning outcome. Performance criteria enable objective grading and consistency in evaluation (Sadler, 2005).

4. Feedback Systems: This element includes developing mechanisms to provide students with prompt, contextualized, and constructive feedback. Effective feedback is imperative for student learning and progress (Hattie and Timperley, 2007).

5. Continuous Improvement: This element ascertains the framework stays adaptive. It requires routinely garnering and examining assessment data to enhance curriculum, pedagogy, and evaluation approaches (Education Development Center, 2019).

Visual Representation (Diagram/Drawing)

The diagram shows a circular cycle connecting the five components: Learning outcome definition, Assessment design, Performance criteria, Feedback mechanisms, and Continuous improvement loop. Arrows indicate the flow and interconnection between components.

Figure 1: Conceptual Model for Outcome-Based Assessment in Vocational Education
Author' s source

Explanation of How the Model Addresses Vocational Education Needs

Alignment With Industry Requirements

The suggested model directly confronts the imperative necessity of harmonizing vocational education with industry requirements. By first clearly delineating learning outcomes, the framework guarantees these are directly associated with professional competencies. As Wesselink et al. (2010) highlight, this synchronization is integral to bridging the divide between academia and actual practice. Additionally, the assessment design element enables creating authentic evaluative activities emulating real-life situations, while performance benchmarks can be cultivated in partnership with industry specialists to ensure applicability and currency.

Flexibility for Different Vocational Fields

The model's versatility makes it pertinent across an extensive scope of vocational areas. All constituents can be re-organized to the distinct requirements of various industry sectors and occupations. For example, learning goals and performance benchmarks can be modified to represent the specialized competencies needed in diverse realms like engineering, healthcare, or culinary arts. Such adaptability is vital in the continuously changing vocational education landscape, as stressed by Mulder (2017) in his analysis of competence-based vocational preparation. The framework allows for calibration to prepare students for evolving skill demands within their respective fields.

Integration of Practical and Theoretical Assessment

The model facilitates a balanced integration of practical and theoretical assessment, a crucial aspect of vocational education. The assessment design component allows for the incorporation of methods that evaluate both theoretical knowledge and practical skills. This could include written exams to assess conceptual understanding, alongside practical projects, or work-based assessments to measure skill application. As Baartman et al. (2006) argue, this integrated approach is essential for developing competent professionals who can apply theoretical knowledge in practical contexts. Moreover, the model's feedback mechanisms

allow students to receive guidance on both aspects of their learning, fostering a comprehensive development of their vocational competencies.

Application Example: Outcome-Based Assessment in TVET Computer Science and Technology

Context: Specific TVET Program or Course

This example applies the model to a two-year technical and vocational education program in Computer Science and Technology. The program is intended to equip learners for entry-level software development and IT support roles. It integrates theoretical classroom teaching with practical lab work and industry internships. The target cohort comprises high school graduates between 18-25 years old, possessing fundamental computer skills and aspiring towards a career in the IT sector. The curriculum is designed to accommodate academically oriented and practical, skills-focused students. Overall, the program aims to fulfill the rising need for qualified IT experts across various industries like finance, healthcare, and e-commerce.

Learning Outcomes for the Selected Program/Course

Technical skills outcomes: Upon completion of the program, students will be able to:

1. Design and develop software applications using current programming languages (e.g., Java, Python, C++).
2. Implement and manage database systems using SQL and NoSQL technologies.
3. Configure and maintain computer networks and security systems.
4. Develop responsive web applications using HTML5, CSS3, and JavaScript frameworks.
5. Apply version control and collaborative development practices using tools like Git.

Soft skills outcomes: Graduates of the program will demonstrate the ability to:

1. Communicate technical concepts effectively to both technical and non-technical audiences.
2. Work collaboratively in diverse teams to complete complex projects.
3. Apply critical thinking and problem-solving skills to troubleshoot software and hardware issues.
4. Manage time and resources efficiently to meet project deadlines.
5. Adapt to innovative technologies and methodologies through self-directed learning.
6. Adhere to ethical standards and professional practices in the IT industry.

Assessment Methods Aligned with Outcomes

Practical Projects: Students will complete a series of hands-on projects that mirror real-world scenarios. These include:

1. Developing a full-stack web application for a simulated client.
2. Creating a mobile app with cross-platform functionality.
3. Implementing a secure network infrastructure for a small business.

Projects would be assessed using rubrics that evaluate both technical proficiency and project management skills. Peer reviews will be integrated to enhance collaborative learning.

Theoretical examinations: Written and online exams will assess students' understanding of core concepts and theories. These will include:

1. Multiple-choice questions to evaluate breadth of knowledge.
2. Short-answer questions to evaluate depth of understanding.
3. Case studies to assess analytical and problem-solving skills.

Exams will be designed to test not only recall but also application of knowledge to realistic scenarios.

Industry-based assessments: To ensure alignment with industry standards, the program will incorporate:

1. Internship evaluations by industry supervisors.
2. Industry certification exams (e.g., CompTIA, Cisco, Microsoft).
3. Capstone projects evaluated by a panel of industry experts.

These assessments will provide external validation of students' skills and enhance their employability.

Implementation Process

Curriculum Mapping

Implementation starts with thorough curriculum mapping, aligning learning outcomes to specific courses and assessments. This approach guarantees all outcomes are appropriately embedded and evaluated within the program. Mapping involves cooperation between faculty, industry advisors, and curriculum experts to ensure harmony with both academic principles and workplace needs.

Assessor Training

Faculty and industry partners partaking in evaluation undergo rigorous training. This approach encompasses workshops on outcome-based assessment concepts, rubric building, and constructive feedback. Regular calibration meetings held to ensure reliable grading between assessors.

Student Orientation

At program onset, students become familiar with the outcome-based methodology. They receive comprehensive details on learning objectives, assessment formats, and expectations. Regular feedback sessions are organized to help students track their progress in achieving the defined outcomes.

Evaluation of the Application

Success indicators (of career readiness):

1. High percentage of students achieving targeted outcomes.
2. Positive feedback from industry partners on graduate competencies.
3. Increased employability rates of graduates.
4. Entrepreneurship rates measure (the number of graduates who start their own businesses); needs a system for after-graduation student's career track.
5. Progression Rates: The percentage of students who advance to university needs a system for after-graduation student's career track.
6. Level of mastery of *Technical Skills* (assessment of students' proficiency in specific technical skills required for their field); of *Soft Skills* (evaluation of students' communication, problem-solving, teamwork); of *Transferable Skills* (assessment of students' ability to apply learned skills to new situations and contexts).

Areas for improvement:

1. Continuous updating of outcomes to match rapidly evolving industry needs
2. Enhanced integration of soft skills assessment across all courses

Discussion

Strengths of the Proposed Model

The suggested outcome-oriented assessment framework shows considerable strength in meeting the intricate requirements of vocational education programs. Its extensive scope guarantees that all facets of vocational learning, from hard skills to soft competencies, are appropriately covered and gauged. The model provides a comprehensive approach to nurturing and evaluating abilities via its structure of well-defined learning goals, aligned

evaluations, and continuous betterment mechanisms. Additionally, its adaptability across technical areas is an invaluable asset, enabling customization for diverse vocational sectors. Such versatility ensures the model remains applicable and potent across various industries, from conventional trades to emerging technological realms (Billett, 2011; Wesselink et al., 2017). The framework is organized to address the multifaceted and evolving needs of the 21st century employment landscape.

Potential Challenges in Implementation

Despite its merits, applying this model may encounter notable obstacles. Resource needs are a major issue, as creating authentic, industry-aligned evaluations and preparing assessors can require substantial investments. Many institutions may find difficulty meeting the financial and time commitments for comprehensive implementation (Cheng, 2015). Furthermore, obtaining stakeholder support poses another roadblock. Opposition to change from educators habituated to conventional assessments, alongside skepticism from industry partners unaccustomed to outcome-centric approaches, may hinder adoption. Surmounting these challenges necessitates clearly conveying the model's advantages and a graduated implementation plan to regulate resource distribution and manage stakeholder outlooks (Mulder, 2017). A thoughtful management strategy can help address reservations and highlight the framework's far-reaching benefits.

Implications for Vocational Education Practice

Implementing this model bears broad ramifications for vocational education practices. It compels a fundamental shift towards learner-centric, competency-driven teaching and evaluation. Such realignment can strengthen the concordance between academic preparations and industry requirements, potentially elevating graduate employability and overall technical education efficacy (Billet, 2011). The framework prompts a re-envisioning of conventional TVET approaches to address the contemporary abilities sought by employers. Its widespread adoption promises to bolster both individual and systemic career readiness in an evolving economy. Innovations in the field of education have been born out of the development of modern society and the technological revolution. Revolution 4.0 has brought more products and services based on robotics, artificial intelligence, the Internet of Things (IoT) and big databases into everyday life. It is assumed broadly that today's students will work in occupations that do not yet exist. Future professions require new knowledge and competences, which should be provided to learners through an innovative approach in education, to promote the acquisition of different competences and creative thinking. In recent years, educational institutions have gradually begun to implement various activities to respond to these changes. For example, new pedagogical models are introduced (in the form of an individual approach to learning, flexibility of learning content, online and blended learning, use of information and communication technologies in the learning process, project-based learning, i.e. learning by doing, formative assessment and etc.), change in the educational environment (use of different spaces of the building as an environment for conducting an educational process), active involvement of parents in the educational process; leadership of the director, aimed at the development of the educational institution and pedagogical specialists; introduction of the teacher as a mentor in the learning process, etc. It is necessary to continue the activities to achieve intelligent education, in view of the interests of modern students and technological progress. Intelligent learning environments could provide just-in-time learning that is based on the broad capabilities and levels of adaptation and greater specification of student learning conditions (Tham&Verhulsdonck, 2023). In a narrower sense, smart learning can be comprehended as the personalization of learning, not only anytime, but everywhere, by applying the tools of artificial intelligence and considering the individual learning style of students. The role of smart education nowadays is to support learners in the 21st century to meet and successfully cope with the challenges of a digitalized

society, including developing the ability to solve problems. The innovation of the modern education system is also related to the processes of globalization, which have an impact on the need to acquire a set of competencies for quick adaptation to the labor market, in which creative and flexible thinking is a prerequisite for successful implementation. *The main goal* of modern education is to prepare specialists who are competent in various fields and can skillfully use different professional tools and constructively interact with each other. Using innovation, modern schools can promote not only student satisfaction with the learning process, but also support their social and mental development.

Therefore, the search for suitable adaptive and innovative means (models, systems) of assessing learning outcomes should also be prioritized. Especially regarding vocational training and education and the assessment of competences and skills practical manual creativity creative attitudes. This perspective is encouraging and desirable the development and improvement of methodologies for truthful assessment of the above mentioned.

This paper presented a comprehensive outcome-based assessment model for vocational education, addressing the need for industry-aligned, flexible, and integrative assessment practices. The model's components ensure an integrated approach to evaluating both technical and soft skills in TVET programs. The proposed model and its application in computer science and technology demonstrate the potential for enhancing the relevance and effectiveness of vocational education. It offers a framework for aligning educational outcomes with industry needs, potentially improving graduate employability and workforce readiness. Further research should focus on longitudinal studies of model implementation, cross-sector adaptability, and the impact on long-term career outcomes for graduates.

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