Designing an Educational Monitoring System (EMS) Framework for Evaluating Effectiveness in VET

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ABSTRACT: The article is an answer of the imperative need to align vocational education and training (VET) with the dynamic demands of the modern economy. The objective of the article is to develop feasible and practical guidelines for the implementation of pedagogical monitoring within VET institutions. It is proposed and an Educational Monitoring System framework for dynamic and online assessment criteria, which conceptualizes monitoring as a systematically organized, continuous process of inquiry and multidimensional analysis of dynamic indicators. The study states the key objects and principal directions of pedagogical monitoring in the VET contexts. It is also given a proposed implementation exemplary stage with their particular features and timings as well as nine fundamental author-developed guidelines for establishing such a system. The current article presents a continuation and conceptual generalization of the author's empirical study entitled "*Developing Models for Measuring and Evaluating Success in Vocational and Professional Education and Training. An Empirical Study*" as well as design of a framework for assessment effectiveness in VET.

KEYWORDS: Educational Monitoring System (EMS), design principles, framework of monitoring VET, effectiveness in VET

INTRODUCTION

The relevance of this study is based on the immense need to modernize VET systems to the demands of the knowledge-based economy. A distinguishing feature of contemporary global development is the transition toward economies increasingly lead by the creation, dissemination, and application of knowledge. The human capital—particularly its creative and research competencies—emerges as a critical determinant of societal economic performance (*Jacobs & Hawley, 2009*). The emphasis of nowadays VET would be shifted toward the educating creative professionals. Achieving this goal requires substantial reforms in the structure and content of professional education to align it with labour market dynamics and economic transformation. Current developments in VET include the diversification of social partnership models, the growing integration among educational institutions, and the introduction of public accountability mechanisms. Within this environment, the quality of institutional and pedagogical management assumes a crucial role; without its enhancement, neither theoretical nor practical challenges in professional education can be effectively addressed.

One of the most effective tools for achieving these objectives is pedagogical monitoring. Monitoring enables the systematic analysis, diagnosis, correction, and forecasting of trends within the professional education system at national, regional, and local levels. According to *Beberina and Savenko* (2019), the evaluation of VET institutions should encompass five key components: intellectual, activity-based, communicative, reflexive, and professionally significant qualities. Authors like *Voronina-Prygodii* (2024) examine and dentine the main indicators for assessing the impact on the quality of professional education in the EU as well as developing a system of indicators for assessing the quality of VET. *Barishev* (2024) proposes a model and key indicators for evaluating the effectiveness of educational organizations in the system of secondary VET. Numerous studies are with locally based focus, proposing context-specific models that are not intended for gross generalization beyond the particular country or educational system they examined (*Ratnaya et al., 2022; Haddi et al. 2019; Siddiqui et al., 2019*).

Although monitoring is recognized of high importance, there still remains a lack of general framework of operationalization of monitoring in the context of VET. The concept of "monitoring" has evolved from its earlier, more limited interpretations—such as the simplistic tracking of student achievements or assessments of knowledge and skills—toward more complex understandings as control, diagnostics, and systemic evaluation aligned with educational and other quality standards. An analysis of prevailing

definitions shows shared conceptual elements, including process orientation, systemic structure, analysis, forecasting, and the diagnostic examination of educational phenomena.

The subject of pedagogical monitoring is the educational system itself, including students, educators, learning goals, content, pedagogical methods, and instructional resources. As illustrated in *Figure 1.*, the proposed *Educational Monitoring System* (**EMS**) model integrates both conventional and expanded criteria for monitoring effectiveness. This includes not only educational and professional parameters but also often-overlooked aspects such as student health and individual needs especially concerned for Gifted and Talented students. The given data inputs should be systematically collected via digital platforms as and processed by weighting the indicators value by the precise period, reported periodically and analysed. In the context of VET, monitoring is conceptualized as a systematically organized and continuous process of team-based inquiry and multidimensional analysis of key indicators. Its function is to facilitate the timely diagnosis and forecasting of the state of the educational system in accordance with pre-defined objectives and expected outcomes.
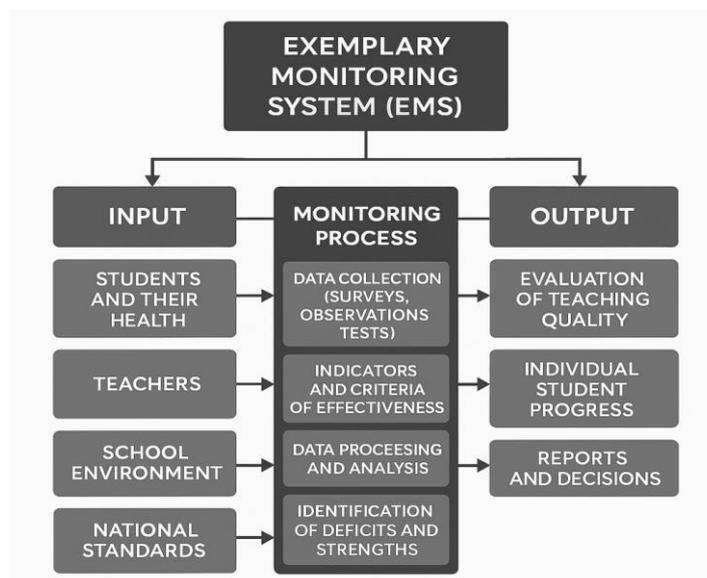

Figure 1. General diagram of EMS: an exemplary outlay

Table 1. Framework for Educational Monitoring System(EMS) in VET with examples of students' activities.

Monitoring Focus	Scientific Description	Representative Monitoring Activities
Educational Monitoring	Evaluates the overall efficacy of the educational program and its alignment with desired learning outcomes and environmental conditions.	• Analyze student achievement metrics (e.g., standardized test scores, course grades). • Assess curriculum alignment with industry standards and competencies. • Evaluate instructional methodologies and the utilization of learning resources. • Conduct surveys to gather stakeholder (students, instructors) feedback on the educational environment.
Monitoring of Students' Educational Needs	Assesses the extent to which instructional practices and curriculum design address the diverse cognitive, emotional, and learning profiles of the student population.	• Conduct diagnostic assessments through surveys, interviews, or performance-based tools. • Identify learning gaps and implement differentiated instructional interventions. • Monitor progress toward individualized learning outcomes. • Utilize performance analytics to inform curriculum refinement.

Professional Monitoring	Investigates the effectiveness and professional competence of educators, particularly in vocational and technical training contexts.	• Observe instructional delivery and provide formative feedback to educators. • Evaluate pedagogical proficiency and subject-matter expertise. • Ensure instructor practices align with current professional and industrial standards. • Review teaching materials and lesson plans for quality and relevance.
Monitoring of Socialization Processes	Assesses the development of interpersonal, communication, and teamwork competencies essential for professional integration and civic participation.	• Evaluate student social interactions during collaborative tasks and group projects. • Facilitate structured opportunities for cooperative learning. • Monitor involvement in extracurricular activities and student governance. • Assess conflict management and teamwork capabilities.
Health Monitoring	Ensures the physical and mental well-being of students by identifying health-related factors that may influence academic engagement and performance.	• Implement routine health screenings and preventive care programs. • Collaborate with healthcare professionals (e.g., school nurses, counselors). • Monitor attendance trends for potential health-related disruptions. • Promote health literacy and lifestyle habits conducive to academic success.
Pedagogical Monitoring	Evaluates the quality and effectiveness of instructional strategies, with an emphasis on curriculum alignment, technological integration, and active learning.	• Systematically observe teaching practices and provide evidence-based feedback. • Compare instructional approaches in relation to learning outcomes. • Analyze coherence between intended learning objectives and implemented curricula. • Assess integration and efficacy of digital and material learning tools.

METHODOLOGY

Methodological Framework

A central methodological position in the present study is occupied by the **process-informational approach**, which conceptualizes pedagogical monitoring as a systematically organized and continuous process of data collection, indicator analysis, and diagnostic-prognostic evaluation of the educational system. This approach ensures alignment between monitoring activities and the strategic goals of VET institutions, allowing for timely identification of deviations, formulation of corrective measures, and optimization of training processes.

Monitoring in VET institutions is inherently **multifunctional**, fulfilling managerial, evaluative (*qualimetric*), supervisory-control, and informational roles. It encompasses all institutional structures, including **individual-level monitoring of students**, and serves as a tool for aligning educational outcomes with policy and labor market demands. Thus, monitoring is a **complex and interdisciplinary phenomenon**, integrating elements from education science, management, statistics, sociology, and public health. According to the *GIZ Dictionary* (2013), monitoring is defined as a long-term observation process of training and education, aimed at the **early identification of adverse, critical, or harmful developments**, thereby supporting the timely intervention and informed decision-making by stakeholders.

Based on the process-informational approach, the following **research principles** are employed:

- **Principle of Consistency**: Monitoring should align with the objectives and nature of the observed processes, incorporating one-time, periodic, regular, or random observations of educational actors and their interactions (*OECD, 2015*).

- **Scientific Principle**: The process should be grounded in scientifically validated data, subject to empirical verification and reproducibility (*Kluve, 2010*).
- **Principle of Objectivity**: Only data that objectively exist and can be independently confirmed (e.g., consistent expert assessments of graduate readiness) are used (*UNDP, 2014*).
- **Principle of Integrity**: Indicators must provide a comprehensive representation of the monitored object as a whole, not only its isolated aspects (*OECD, 2015*).
- **Principle of Effectiveness**: Data collection should serve timely managerial decision-making, allowing for intervention before undesirable developments become irreversible (*UNDP, 2014*).
- **Principle of Adequacy**: The selected measurement tools must correspond to the goals and tasks of monitoring, as well as to practical, ethical, and contextual constraints (*Beleva, 2019*).

RESULTS
The main results of the study can be summarized as follows:
- Identification of **key objects** of pedagogical monitoring.
- Determination of **main trends** in pedagogical monitoring in VET institutions.
- Definition of **monitoring practices for the regional component** of professional education.

Objects of Pedagogical Monitoring

The research established the following **key monitoring objects** in the VET context is presented in ***Table 2.***

Table 2. Key monitoring objects (indicators): summary

Monitoring Object	Indicators
1. Institutional Characteristics	- Ranking in regional and national systems of professional education - Enrollment by field and form of education- - Student retention, migration, and dropout rates
2. Quality of Student Cohort	- Entrance exam performance and training backgrounds - Motivation for vocational education (via sociological surveys) - Social-demographic indicators (e.g., low-income, orphaned, or disabled applicants)
3. Quality of Training	- Academic progress, certification results, state exam scores - Final project defence outcomes - Surveys of graduates, educators, and employers regarding training quality
4. Graduate Labor Market Integration	- Employment rates 3–12 months after graduation - Graduate interaction with employment services - Employer feedback on graduate competencies
5. Teacher Qualifications	- Percentage with academic degrees - Length and type of teaching experience - Age structure of teaching staff
6. Curriculum and Content	- Alignment with qualifications and labour market needs - Compliance with national education standards
7. Health and Well-being of Students	- Medical examination results - Absenteeism due to illness - Participation in individualized education and physical activity
8. Information and Methodological Resources	- Availability of textbooks and library use - Access to encyclopaedic, methodological, and digital resources - Level of computer access and institutional publishing activity

9. Material and Technical Resources	• Equipment of educational and sports facilities- • Provision of dormitories, nutrition, healthcare, and student welfare services

To effectively implement and operationalize a **framework for monitoring the quality** of vocational education and training (VET), a **clearly defined stage-based outline** is essential. Below is a scientifically structured model comprising key stages:

Stages of Monitoring. *General design*

Pedagogical monitoring in VET is structured into **three interrelated stages**:

- **Planning Stage**: Analysis of curricula, program design, and methodological materials to ensure alignment with learning goals.
- **Implementation Stage**: Evaluation of student readiness and progress using qualimetric tools and educator feedback.
- **Achievement Stage**: Comparison of planned versus actual results to inform adjustments in training practices and institutional policy.

This **stepwise monitoring system** enables the tracking of key educational outcomes, thus supporting evidence-based decision-making and continuous improvement in vocational training.

The detailed stage *phases design* is given in **Table 3.**

Table 3. Staged Framework for Monitoring Quality in VET

STAGE	DESCRIPTION
1. PLANNING AND PREPARATION	• Define objectives of monitoring • Determine scope and focus areas • Establish indicators aligned with standards • Develop data collection tools • Assign monitoring roles and responsibilities
2. DATA COLLECTION	• Select appropriate data collection methods • Ensure ethical compliance and data privacy • Use digital systems for real-time input
3. DATA PROCESSING AND ANALYSIS	• Validate collected data for accuracy • Analyze trends and performance indicators • Benchmark results against standards
4. INTERPRETATION AND REPORTING	• Synthesize and integrate findings • Prepare stakeholder-specific reports • Use data visualization for accessibility
5. FEEDBACK AND DECISION-MAKING	• Disseminate results to all stakeholders • Use findings for curriculum and policy improvements • Plan corrective actions based on evidence
6. FOLLOW-UP AND EVALUATION	• Monitor implementation of interventions • Evaluate framework effectiveness • Institutionalize the monitoring cycle

Main directions of pedagogical monitoring in VET institutions. The "tenth Guidelines".

Pedagogical monitoring will be an effective tool for managing the quality of professional training in the case of focusing on the analysis of the organization of the educational process, the conditions for the development of students, the continuous professional training of the teaching staff for timely management of decision development. The author's summarized main guidelines in pedagogical monitoring in VET institutions are defined as follows:

- *Guideline 1*. socio-economic planning of personnel training in regional conditions
  - *Tasks:* to identify the regions' future needs for specialists; to predict the introduction of new promising specialties; to predict the role and functions of the educational institution in the provision of educational services

to the population; to identify future needs for retraining and continuous professional development of staff in the regions

Results: creating tools to survey the region's future needs for personnel and educational services

➢ *Guideline 2:* **person-oriented learning model**

Tasks: to identify and characterize students' individual learning trajectories; to determine their goals, tasks, functions; to create variable curricula and programs in relation to different learning trajectories of students; to develop a system for monitoring the quality of education

Results: practical recommendations regarding the organization of individual student learning trajectories

➢ *Guideline 3:* **the content of professional education**

Tasks: to study the content of professional education; to determine the principles of selection and structuring of the content of study plans, programs and their compliance with the requirements of the state standard

Results: practical recommendations for improving curricula and programs

➢ *Guideline 4:* **forms and methods of professional education**

Tasks: to identify traditional and innovative forms and methods of professional education, to discover their similarities and differences.

Results: practical recommendations for applying traditional and innovative forms and methods of professional education

➢ *Guideline 5:* **the content and organization of students' independent work**

Tasks: to summarize the experience of the organization of students' independent work; to determine the ratio of classroom and independent work of students; to develop mechanisms for organizing students' independent work

Results: practical recommendations for teachers regarding the organization of students' independent work. Practical advice for students on independent work

➢ *Guideline 6:* **organization and content of production training (professional practice)**

Tasks: to establish an effective balance between the theoretical and practical training of students in the various stages of professional education; to determine the goals, content of industrial (professional practice) training; to identify the effectiveness of different types of industrial (vocational training) training

Results: practical recommendations for organizing production (professional practices) training

➢ *Guideline 7:* **monitoring the quality of students' professional education at the various stages**

Tasks: to substantiate the indicators of the quality of the professional education of students at different stages; to determine the types and forms of monitoring the quality of professional education in the various stages; to develop a system of tasks for diagnosis and correction of the quality of professional education of students

Results: practical recommendations for organizing monitoring of the quality of professional education at different stages.

➢ *Guideline 8:* **the learning process management system**

Tasks: to justify the principles, functions, criteria and types of management of the educational process, the program for continuous professional training of teachers

Results: the educational process management program. The Continuing Professional Education Program for Teachers

➢ *Guideline 9:* **development of information and technological base**

Tasks: to identify the state of the information and technological base

Results: development of the information and technology base plan

➢ *Guideline 10:* **improvement of the system for planning, organization and management of the learning and educational process in the professional institution**

Tasks: to develop a system for the selection and support of talented students; to justify and build a hierarchy of development directions of the institution.

Results: practical recommendations for the development of the institution.

The summary of the *main 10 directions* above shows that the implementation of the main directions of pedagogical monitoring in the vocational training institution will strongly allow the realization of systemic structural and holistic integrity and content-methodical continuity at all stages of professional education; will contribute to the preservation, promotion and continuous professional development of the teaching staff, the stability of the teaching staff; increasing the effectiveness of student socialization.

Monitoring the implementation of the regional component of professional education

The regional component of VET represents the pedagogical interpretation of the socio-economic and cultural characteristics of the regional community (*Heckman, LaLonde, and Smith, 1999*). This component consists of two primary aspects: methodological and reflexive. The methodological aspect involves reflecting the regional component within the educational curriculum and documentation, while the reflexive aspect entails adjusting the regional component based on the analysis and evaluation of the results from its experimental application.

The content of the regional component of professional education (***Table 4.***) is designed to address the interests of various sectors within the economic and socio-cultural structure, focusing on the demand for highly qualified specialists in fields that are needed not only in the present but will also be sought after in the future (*Barney, 1991*). This component reflects the natural competition among workers to demonstrate relevant skills, which are manifested in their professional knowledge, abilities, and competencies. It also highlights the competition among VET institutions (*Strategy for the Development of VET and Training in the Republic of Bulgaria for 2015-2020*) and the creation of new specialties that enable young people to secure strong and dignified futures (*Weber, 2003*). Moreover, effective youth policies that integrate young professionals into market relations based on their educational background and professional training methods are emphasized.

The study identified several criteria for assessing the effectiveness of the regional component's implementation. These include student satisfaction with the educational process, ensuring the continuity and unity of professional training and retraining, as well as continuous professional development. Additionally, reducing the migration of specialists through retraining and ongoing professional development in the workplace, taking into account regional specifics, is a key criterion.

Monitoring the implementation of the regional component, based on these identified criteria, plays a crucial role in ensuring the sustainable functioning and development of VET institutions. It helps reduce pressure on the labor market, enables more efficient use of human resources, and ensures that the training of specialists aligns with uniform regional standards. Furthermore, it allows for the updating of professional education content, contributing to the employment of graduates and enhancing the responsiveness of VET institutions to evolving regional needs.

Table 4. Key Criteria for Monitoring Regional Component Effectiveness: a summary

Criteria	Description
Student Satisfaction	Measure student feedback on the relevance and quality of the regional component of the education process.
Unity and Continuity in Professional Training	Ensure a seamless progression from initial education to retraining, and continuous professional development.
Reducing Specialist Migration	Track migration trends by providing opportunities for retraining and continuous professional development.
Adaptation to Regional Socio-cultural Needs	Ensure that training is responsive to local social and cultural specifics, enhancing regional integration.
Collaboration with Local Employers	Measure cooperation with local businesses, including feedback on graduate employability and workplace needs.
Sustainability of VET Institutions	Monitor the effectiveness of VET institutions in adapting to regional labor market changes and demands.
Labor Market Integration	Evaluate the success of graduates in securing employment in the regional labor market post-graduation.

DISCUSSION

The issues surrounding pedagogical monitoring have been extensively studied, particularly in relation to its regional implementation. In the works of researchers such as *Beleva* (2019) and *Hristova* (2018), the regional aspect of pedagogical monitoring is comprehensively explored. These studies focus on analyzing the quality of education in regional VET institutions within a market economy context, with the goal of providing an objective assessment of the regional vocational training system and forecasting its development prospects.

Numerous studies highlight the role of monitoring as an essential tool for improving the management of VET systems at various levels—international, national, regional, and institutional. Key works in this area include those by *Jacobs&Hawley* (2009), *Becker* (1964), *Aleksiev* (2021), and *Heckman et al.* (1999). These researchers emphasize the importance of monitoring for controlling the quality of vocational training, as it enables the identification of corrective and preventive measures that can be taken by administrators based on the results obtained.

However, there is a lack of consensus among experts regarding the essence of pedagogical monitoring. Differences exist in the interpretation of its goals, tasks, objects, and types. The purposes of pedagogical observation vary widely. Some see it as the collection, summarization, and preliminary analysis of information related to the state of education and its key indicators, to assess and predict development trends and make informed management decisions. The objectives of monitoring include organizing observations and measurements, gathering reliable and objective data on the conditions, content, and outcomes of the educational process, developing standardized rules and diagnostic methods, and conducting monitoring studies at all levels, including the development of appropriate software and hardware.

The objects of monitoring are also diverse, encompassing educational institutions, educational bodies, structural elements, components of educational systems, and various processes of formation and development. These include educational content, goals, curricula, plans, methods, and tools. The subject of monitoring concerns the specific changes in the state of the education system over certain periods.

A crucial aspect of pedagogical monitoring is not only the analysis of individual quantitative and qualitative indicators but also the examination of changes resulting from comparative analysis. Monitoring tools typically include statistical report forms, questionnaires, checklists, and various diagnostic tasks. Strict monitoring involves a systematic approach to collecting, processing, presenting, and disseminating information while ensuring the appropriate organization of monitoring procedures.

The classification of monitoring types is broad, including both regulated statistical monitoring based on official reporting data and non-statistical monitoring, which is based on researcher-developed indicators and diagnostic methods. The choice between statistical or non-statistical monitoring depends on management objectives. It is essential to identify the features of statistical observation for training purposes. A key issue in this context is the justification and selection of specific indicators for diagnosis and monitoring, ensuring that the requirements are clear, simple, and that the results are objective, reliable, and understandable.

Monitoring can be conducted at different levels, including federal, regional, municipal, and institutional systems. The methods used depend on the nature of the objects studied and whether they are measured directly or indirectly. Depending on the target audience—such as students, parents, employers, or the public—monitoring can be aimed at shaping public opinion, characterizing the education system at the regional level, or providing results primarily for managers.

The variety of perspectives on the nature of pedagogical monitoring complicates its practical application in education. This underscores the need for further research in this area, which is the focus of the current study.

CONCLUSION AND RECOMMENDATIONS

The management of vocational education and training (VET) and the enhancement of its efficiency and quality necessitate the implementation of a deliberate and systematic approach to monitoring the operations of VET institutions. In this context, pedagogical monitoring is integral as it facilitates the acquisition of multifaceted analytical data. This process involves the continuous observation and assessment of administrative activities, systematically analysing the condition of the system by comparing actual outcomes against predefined goals and forecasting potential changes. The ultimate objective is to inform management decisions that drive improvements in the quality of the system.

The research findings suggest several key recommendations regarding the organization of pedagogical monitoring within VET institutions.

As first, the fundamental distinction between pedagogical monitoring and traditional methods of assessing the educational process lies in the active role that monitoring plays. Unlike conventional methods that simply document the current state, pedagogical monitoring is inherently dynamic, as it influences the ongoing development of educational institutions, fosters the creative potential of teaching staff, and promotes the enhancement of their professional competence. This dynamic approach ensures that monitoring is not a passive observation but an active agent for improvement.

As second, the objects of pedagogical monitoring are derived from a wide array of sources, including statistical data, sociological research, evaluation and accreditation reports from VET institutions, reports from the chairpersons of state attestation commissions for professional specialties, the results of final state certifications for graduates, outcomes from student competitions and Olympiads, as well as examination and test results of candidates and students. These diverse sources form the empirical foundation for the monitoring process.

Thirdly, the methodologies employed in pedagogical monitoring encompass a range of approaches, such as comparative assessment, which involves comparing the quality of education with established professional standards, both internal and external expert evaluations, and surveys targeting students, parents, and stakeholders from relevant industries. Additionally, monitoring employs assessment tools designed to evaluate student knowledge, as well as instruments that simulate the professional activities of graduates. Sociological instruments also play a critical role in capturing the broader social context of educational outcomes.

Fourthly, monitoring the regional component of professional education is essential for ensuring the structural coherence of the educational process. It contributes significantly to the preservation and ongoing development of teaching staff, facilitating continuous professional development. Furthermore, it stimulates innovative practices among educators in vocational training, ensuring that teaching practices remain responsive to the evolving needs of the labour market and the specific socio-economic conditions of the region.

The outcomes of this research provide a strong foundation for further scholarly inquiry into the diagnostics of educational environments across different types of VET institutions. These findings are particularly valuable for institutional managers, educators, and professionals in centres for continuing professional education and staff retraining. The research provides actionable insights for the selection, structuring, and continuous refinement of content in professional development programs, with a focus on ensuring the long-term sustainability and relevance of VET curricula in response to both regional and global labour market trends.

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