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SYNERGIZING ERGONOMIC WORK SYSTEMS WITH ISO 9001:2015 QUALITY MANAGEMENT IN INDUSTRIAL TECHNOLOGY EDUCATION: A PARADIGM OF INNOVATIVE EDUCATIONAL PRACTICES

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Abstract
This study examines the integration of ergonomic work systems and the ISO 9001:2015 standard in the context of industrial technology education at FTI-UMI. The main focus is to understand the impact of ergonomic work systems on student satisfaction, highlighting aspects such as organizational conditions, learning processes, physical environment, academic services, student research activities, and facilities. Through a qualitative and case study approach, the research shows the significant contribution of ergonomic aspects to student satisfaction, with proposed improvements including enhancing classroom facilities, hotspot services, and academic services. Findings also emphasize the importance of intensive communication, improving learning processes, and enhancing service quality. In conclusion, the integration of ergonomic work systems and ISO 9001:2015 can enhance operational efficiency, service quality, and responsiveness to environmental changes in educational institutions, providing valuable insights for institutions and students to enhance learning experiences and performance in the academic environment.

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Ergonomic Work Systems, ISO 9001:2015, Student Satisfaction, Industrial Technology Education FTI-UMI, Operational Efficiency.

1. Introduction

Education plays a crucial role in the development of a country, asserting its position as the main foundation for creating quality and competitive human resources (Denkowska et al., 2020). In the era of globalization and the fourth industrial revolution, educational institutions are faced with increasingly complex challenges, requiring innovative approaches to enhance the effectiveness and efficiency of the learning process (Chigbu et al., 2023; Oke & Fernandes, 2020) . The focus on improving the quality of education is essential, where synergizing ergonomic work systems with the ISO 9001:2015 quality management system becomes one of the important aspects to consider, especially in the context of education (Hallioui et al., 2023; Spychalski, 2023).

The integration of ergonomic work systems with the ISO 9001:2015 quality management system in education aims not only to improve operational efficiency but also to optimize the learning experience for students (Nurcahyo et al., 2020). By creating an efficient and functional learning environment, educational institutions can facilitate a more effective and enjoyable learning process, impacting the overall quality of education and students' readiness in a complex work world (Haleem et al., 2022). This integration is key in creating an adaptive and relevant education system to the needs of the times, with a significant impact on work systems in the educational environment. Emphasis on comfort, efficiency, and excellence in educational management within a structured and adaptive environment can enhance the quality of

educational services, provide optimal learning experiences for students, increase student satisfaction, and improve the effectiveness of the learning process (Pandita & Kiran, 2023).

A work system based on the integration of ergonomic principles and ISO 9001:2015 also directly impacts student satisfaction (Spychalski, 2023). With a learning environment designed to support effective interaction among students, teachers, and the curriculum, students can directly benefit from an organized and responsive work system (Anis & Anwar, 2020). A pleasant and efficient learning experience not only increases student motivation in pursuing academic achievements but also shapes a positive attitude toward the learning process (Seemiller et al., 2021). Thus, integrating ergonomic principles and quality management can create a learning environment that stimulates creativity, collaboration, and optimal academic performance (Fuente et al., 2020), providing a satisfying educational experience for students in the Faculty of Industrial Technology.

By utilizing an ergonomic work system approach, the Faculty of Industrial Technology at the Muslim University of Indonesia (FTI-UMI) strives to create harmony between institutional work systems and the external factors that influence them. Ergonomic work systems highlight the social, economic, political, and technological aspects that affect the well-being and performance of individuals in the workplace. By understanding and designing work systems according to existing external conditions, the faculty can create a healthy, safe, comfortable, and efficient work environment (Peters & D'Penna, 2020).

Using an ergonomic work system approach, FTI-UMI can evaluate their work systems to identify and make changes that align with the external factors influencing them. The main goal is to increase productivity by optimizing work systems and creating a conducive work environment (Basalamah & As'ad, 2021). By considering the social, economic, political, and technological aspects that affect the well-being and performance of individuals, the faculty can ensure that work systems are designed to meet the needs of employees and the organization and adapt to changes in external conditions.

The ergonomic work system approach also enables FTI-UMI to pay attention to factors such as job rotation, task allocation, workload management, and work scheduling to improve overall work system efficiency and effectiveness (Hammoudi Halat et al., 2023). Through continuous improvement initiatives and regular evaluations, the faculty can create an adaptive work system, promote employee well-being, and enhance organizational performance by considering external influences holistically (Shanafelt et al., 2023).

To increase student satisfaction levels, it is necessary to identify and assess the influence of ergonomic work system aspects on various work system components, such as organizational conditions, learning processes, physical environment, academic services, research activities, and facilities (Gumasing & Castro, 2023). After determining the most significant aspects of ergonomic work systems, an in-depth analysis is conducted on these work system components, followed by proposed improvements to enhance student satisfaction (Safutra, Fole, Dahlan, et al., 2024). Through a qualitative research approach involving a case study at FTI-UMI, this study explores the impact of integrating ergonomic work systems and ISO 9001:2015 on work systems in educational institutions, focusing on operational efficiency, quality of educational services, and responsiveness to environmental changes (Van Wart et al., 2020). It is hoped that this

research will provide comprehensive insights into the benefits of this integration for educational institutions and students.

This research aims to investigate the influence of ergonomic work system aspects on student satisfaction levels in a work institution, focusing on components such as organizational conditions, applied learning processes, the physical environment within the institution, academic services provided to students, research activities carried out by students, and the availability of facilities for student activities. The main goal is to identify the most influential aspects of ergonomic work systems and lead to in-depth analysis and proposed improvements to enhance student interest and satisfaction with the services experienced. Through a qualitative approach and a case study at FTI-UMI, this research also aims to evaluate how the integration of ergonomic work systems and ISO 9001:2015 affects work systems in educational institutions, focusing on operational efficiency, quality of educational services, and responsiveness to environmental changes, with the hope of providing comprehensive insights into the benefits of this integration for academic institutions and students.

2. Research Methods

This research method will combine a qualitative descriptive approach and a case study to investigate the integration of ergonomic work systems with the ISO 9001:2015 quality management system in the context of FTI-UMI. First, identification and assessment of the influence of ergonomic work system aspects on work system components will be conducted through document analysis, field observations, and interviews with various stakeholders in the selected educational institution. Subsequently, the most significant aspects of ergonomic work systems will be identified for further analysis.

A case study will be conducted at FTI-UMI to explore how the integration of ergonomic work systems and ISO 9001:2015 affects the implemented work systems. Data will be collected through participatory observation, in-depth interviews, and analysis of policy and procedure-related documents. Data analysis will be carried out using statistical approaches by conducting data adequacy testing, validity testing, reliability testing, correlation analysis, and regression analysis on all research variables and indicators.

The research results will provide a comprehensive overview of the impact of integrating ergonomic work systems and ISO 9001:2015 on work systems in the context of industrial technology education. Concrete improvement proposals will be formulated based on research findings to enhance student satisfaction through an optimal learning environment. The conclusions of this research are expected to provide valuable insights into the benefits of this integration for educational institutions and students, as well as provide guidance for other educational institutions in improving the quality of their educational services.

3. Results and Discussion

3.1. Determination of Research Instruments Results

In determining the research instruments, an open questionnaire was conducted with respondents to identify ergonomic work system aspects that are suitable for the conditions of FTI-UMI, resulting in the determination of appropriate research instruments as follows.

Table 1. The results of the determination of Research Instruments

Variable	Indicator	Statement Item Number
The conditions experienced by the organization (x1)	Availability of training in determining the types of good and proper leaders.	1,2
	Necessary communication.	3,4
	Rules and regulations applicable for the advancement of the institution.	5,6
Applied learning processes (x2)	Teaching methods to be provided to students.	7,8
	Activities provided are extracurricular in nature.	9,10
	Delivery of course material tailored to field conditions.	11,12
Academic services provided to students (x3)	Availability of friendly and easily accessible services for students and employees in the institution.	13,14
Physical environment within the institution (x4)	Environmental conditions that require environmental factors to be adjusted to student conditions.	15,16
	Availability of classrooms provided to students that are safe and comfortable for the learning process.	17,18
Research activities involving students (x5)	Providing easy access to external collaborations and receiving support from local institutions.	19,20
Availability of facilities and infrastructure for student activities (x6)	Availability of equipment in good and usable conditions.	21,22
	Conducting training on the operation of facilities and infrastructure so they can be used to their maximum potential.	23,24
Interest and satisfaction with the services experienced by students (y)	Creating an atmosphere that enhances interest and desire, thereby achieving satisfaction for students effectively.	25,26,27,28

In Table 1 above, it can be seen that there are 6 variables X, and 1 variable Y consisting of 13 indicators and 28 statements that can be used in this research.

3.2. Results of Statistical Testing

In determining the statistical test, adequacy of data testing, validity testing, and reliability testing are conducted on each research instrument. The results of the determination can be seen as follows.

- Data Adequacy Testing

In determining data adequacy testing, 50 questionnaires were distributed to respondents with an error rate of 6% and a significance level of 5% with a Z_(∝⁄2) value of 2.05 and an assumed proportion value of 0.98. Using the equation below:

$$N' = \left[\frac{Z_{\alpha/2}}{e}\right]^2 p.(1-p) \quad (1)$$

$$= \left[\frac{2,05}{0,06}\right]^2 0,98.(1-0,98)$$

$$= 1167,36 \text{ x } 0,0196$$

$$= 22,88$$

From the above calculation, the data adequacy result is obtained by observing N>N', which is 50>22.88. This indicates that the research data is sufficient.

- Validity Testing

In determining the validity testing for all research instruments deemed sufficient, it was conducted with the assistance of IBM SPSS software to facilitate the calculation process. The results of the validity testing determination can be seen below.

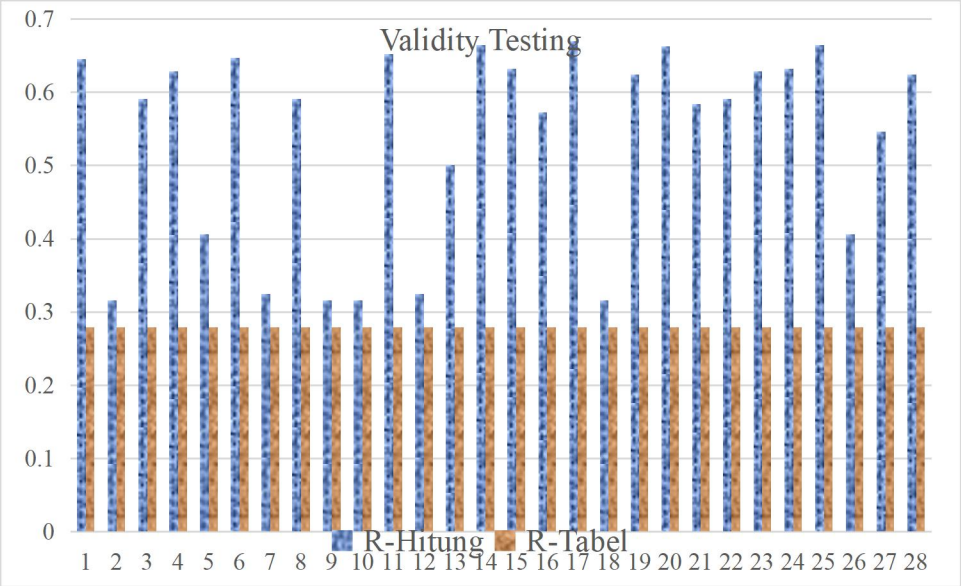

Figure 1. Results of Validity Testing

In Figure 1 above, it can be seen that the validity testing results were conducted by comparing the calculated r-value ≥ the table r-value. From the above determination, with a table t-value of 0.279 and all calculated R-values exceeding the table t-value, all research instruments are deemed valid.

- Reliability Testing

In determining the reliability testing for all research instruments deemed valid, it was conducted with the assistance of IBM SPSS software to facilitate the calculation process. The results of the reliability testing determination can be seen below.

Table 2. Results of Reliability Testing

Testing Scale Score	Cronbach's Alpha	N of Items
0,700	0,925	28

From the above Table 2, it can be observed that the reliability testing results show that the testing scale score is greater than the Cronbach's Alpha value, i.e., 0.700 > 0.925. This indicates that the testing results for all instruments are deemed reliable, allowing for further calculations. Determination of Scores for Each Variable

3.3. Results of Correlation and Regression Determination

In determining the variable scores with the assistance of IBM SPSS software, correlation results between variables, regression coefficients, and path analysis testing outcomes were obtained. The results can be seen below.

Table 3. Results of Correlation Between Variables

	X1	X2	X3	X4	X5	X6	Y
X1	1	.830**	.728**	.705**	.604**	.753**	.665**
X2	.830**	1	.590**	.608**	,266	.834**	.903**
X3	.728**	.590**	1	.871**	.763**	.745**	.551**
X4	.705**	.608**	.871**	1	.918**	.544**	.469**
X5	.604**	,266	.763**	.918**	1	,196	,407
X6	.753**	.834**	.745**	.544**	,196	1	.875**
Y	.665**	.903**	.551**	.469**	,407	.875**	1

Based on above Table 3, it can be seen that the correlation determination results for each variable lead to the following model summary.

Table 4. Results of Model Summary

Model	R	R-Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.968[a]	.937	.928	.49335	1.377

In Table 4 above, it can be observed that the model summary results for each correlation between variables, with an R-Square value of 0.937, indicate that the relationship between each variable is very strong.

Table 5. Regression Determination Results

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	,208	,765	-	,272	,787
X1	,228	,089	,207	2,553	,014
X2	,166	,066	,167	2,519	,016
X3	-,379	,126	-,273	-2,997	,005
X4	-,537	,240	-,342	-2,238	,030
X5	,566	,253	,312	2,239	,030
X6	,680	,069	,944	9,865	,000

In Table 5 above, it can be seen that the regression determination results for all variables show significance for both independent and dependent variables with an impact value of 0.787 or 78.7% of the relationship between independent and dependent variables, leaving 21.3% unaccounted for in this study.

3.4. *Discussion*

Based on the results of determining the research instrument obtained from the collection of open questionnaires from respondents, 7 variables, 13 indicators, and 28 statements were identified to analyze the influence of macro ergonomics on student satisfaction. The testing of the research instrument involving 3 stages of data testing resulted in 28 instruments with 50 respondents being considered sufficient, valid, and reliable for this study.

In the testing results, correlation coefficient values were obtained for all variables with a significance level of R-Square at 0.937, indicating a very significant relationship for each variable. In this study, several correlations can be elucidated. Ranging from a very strong relationship between Organizational Conditions experienced (x1) and Learning Processes implemented (x2) with a value of 0.630, to a very strong connection between Physical Environment in the institution's area (x4) and Research Activities involving students (x5) reaching 0.912. However, there is a very weak relationship between Research Activities involving students (x5) and the Availability of facilities and infrastructure for student activities (x6) with a value of 0.166. Additionally, a strong relationship is also observed between Organizational Conditions experienced (x1) and Academic Services provided to students (x3) at 0.745, as well as between the learning process (X2) and Availability of facilities and infrastructure for student activities (x6) reaching 0.804. All of these indicate the complexity of the relationships between these variables in the context of this study.

Recommendations regarding the availability of facilities and infrastructure for student activities can enhance interest and desire for the services experienced by students by providing adequate air conditioning and ventilation, upgrading damaged seats, and optimizing the use of teaching aids such as viewers and PowerPoint slides. Hotspot facilities need to be maximized, and orderly parking arrangements are also essential. Quality management principles emphasize efficiency through managing activities and resources (Fole et al., 2024), process simplification,

and bureaucracy elimination. This is in line with clause 6.1 of ISO 9001:2008, which requires resource provision for enhancing Quality Management Systems and consumer satisfaction.

To enhance interest and desire for the services experienced by students towards the Physical Environment in the institution's area, several improvements can be suggested. Creating more comfortable classrooms with better seating arrangements and improved air circulation is crucial to optimize teaching and learning activities. According to clause 6.3 of ISO 9001:2008, organizations must identify, provide, and maintain infrastructure covering buildings, workplaces, process equipment, and support services such as transportation and communication (Safutra, Fole, Gunawan, et al., 2024). Furthermore, clause 6.4 of ISO 9001:2008 mandates organizations to establish and manage the necessary work environment to achieve compliance with product requirements. This work environment includes various physical and environmental conditions such as noise, temperature, humidity, lighting, and weather. Therefore, improvements in infrastructure and a good work environment will support student satisfaction and compliance with quality standards.

To boost interest and desire for the services experienced by students in research activities involving students, it is recommended to facilitate student exchanges to share experiences and expand cooperation with private and government entities. The eighth quality management principle, mutually beneficial supplier relationships, emphasizes the importance of synergy between companies and suppliers to create successful outcomes. Implementing this principle involves establishing balanced short-term and long-term relationships, leveraging expertise and resources, identifying key suppliers, joint development, and providing incentives and rewards for supplier performance.

To enhance interest and desire for the services experienced by students in the academic services provided to students, it is advised that staff be friendlier and more responsive in meeting student needs. The first quality management principle, customer focus, underscores the importance of understanding and meeting customer needs and expectations. Implementing this principle includes a deep understanding of customer needs, ensuring organizational objectives align with customer expectations, effective communication, measuring and taking actions based on customer satisfaction, and systematic customer relationship management. This aligns with clauses 5.2 and 8.2.1 of ISO 9001:2008, emphasizing the importance of customer focus and monitoring customer satisfaction as a performance measure.

To enhance interest and desire for the services experienced by students, faculty leaders need to clarify the roles and responsibilities of each individual and engage in intensive two-way communication with students. The leadership principle in quality management emphasizes the importance of building unity of direction and goals for the organization, creating a supportive environment, and considering the needs of all stakeholders. Implementing this principle includes establishing a vision, objectives, and ethical values, as well as providing necessary resources. According to clause 5.1 of ISO 9001:2008, management must demonstrate commitment to the development and implementation of a Quality Management System (QMS) and ensure the availability of necessary resources.

To enhance interest and desire for the services experienced by students in the applied learning process, teachers should be more accessible for guidance on final assignments. The

fourth quality management principle, process approach, emphasizes that efficient outcomes are achieved by managing activities and resources as a process. This involves identifying customer needs, streamlining processes, and eliminating bureaucracy. Evaluating risks and the impact of activities on customers is also crucial (Fole, 2023; Fole & Mujaddid, 2023). In accordance with clause 6.1 of ISO 9001:2008, organizations must provide the necessary resources for the implementation and improvement of the Quality Management System (QMS) and meet customer satisfaction.

The five proposed improvements related to the impact of the work system on student satisfaction reflect the application of the sixth quality management principle, continuous improvement. This principle underscores that overall organizational performance improvement should be a constant goal. Continuous improvement involves sustained efforts to enhance organizational effectiveness and efficiency to meet policies and objectives. Necessary steps include consistency in improvement approaches, employee training, product and process improvements, setting goals and objectives, and acknowledging improvements. This ensures a dynamic evolution of a quality management system that is responsive to customer needs and expectations.

4. Conclusion

Based on the results and discussions earlier, several conclusions can be drawn regarding students' interests and desires in the services they experience. The aspects of ergonomic work systems influencing satisfaction include the Conditions experienced by the organization, the Learning processes applied, the Academic services provided to students, the Physical environment within the institution, Research activities involving students, and the availability of facilities for student activities. Significant contributions to student satisfaction come from the Conditions experienced by the organization (25.91%), Academic services provided to students (22.37%), the Physical environment within the institution (8.29%), and the availability of facilities for student activities (25.30%). Proposed improvements include adding AC and ventilation in classrooms, updating chairs, optimizing teaching aids, enhancing hotspot facilities, organizing parking spaces, addressing seating arrangements, and improving air circulation. Research activities can be enhanced through student exchanges and cooperation with external parties. Academic services provided to students need to be improved with friendlier and more responsive staff. Organizational conditions can be enhanced by clarifying roles and responsibilities and intensifying two-way communication. The Learning processes applied can be enhanced by making instructors more accessible. Suggestions for the faculty include improving communication with students, optimizing facilities, conducting further research, and enhancing questionnaire quality. For further advancement in knowledge and research, conducting advanced studies involving various educational institutions is necessary. Specific ergonomic strategies per aspect (organizational conditions, learning processes, academic services, physical environment, research activities, facilities) and objective evaluation criteria are crucial. Employee training, cross-institutional collaboration, follow-up research, and technology are required. Detailed conceptual models, along with ongoing monitoring and evaluation, are expected to positively contribute to student satisfaction and the development of ergonomic knowledge in education.

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