International Journal of Academic Management Science Research (IJAMSR)
ISSN: 2643-900X
Vol. 8 Issue 11 November - 2024, Pages: 58-64

What Educational Leaders Need to Know About Science Education Management as the Key Components and Strategic Framework

Irfan Ananda Ismail[1]*, Mawardi Mawardi[2], Lufri Lufri[3], Usmeldi[4], Festiyed[5]

[1,2,3,4,5] Postgraduate Department, Universitas Negeri Padang, Padang, Indonesia

*Corresponding Author: halo@irfanananda28.com

Abstract: *Science education management is a crucial component in the education system that requires comprehensive understanding from educational leaders. This article aims to analyze the key components and strategic framework in science education management that educational leaders need to understand. The method used is a literature study with a content analysis approach to various reference sources related to science education management. The analysis results show that there are four key components that educational leaders need to understand: (1) basic principles of science education management which include planning, organizing, implementing, and evaluating; (2) educational management functions in the context of science learning; (3) important aspects in implementing science education management including curriculum, human resources, infrastructure, and financing; and (4) educational management models that can be adapted in science learning. The resulting strategic framework provides practical guidance for educational leaders in implementing science education management effectively. This article contributes to providing a systematic understanding of science education management for educational leaders.*

Keywords—component; Educational management, Science education, Educational Leadership, Management components, Strategic framework

1. INTRODUCTION

Science education plays a vital role in building a generation that is able to think critically, analytically, and innovatively to face the challenges of the 21st century. Through science learning, students are equipped with the ability to analyze natural phenomena systematically, understand scientific principles, and develop problem-solving skills (Windschitl & Stroupe, 2017). However, the success of science education does not only depend on the learning process alone, but also on an effective and structured education management system.

The reality shows that there is still a significant gap between the expectations and achievements of science learning at various levels of education. Data from the Programme for International Student Assessment (PISA) in 2018 shows that Indonesia's science literacy score is ranked 70th out of 78 participating countries, with an average score of 396, far below the OECD average of 489 (OECD, 2019). These results indicate that there is a fundamental problem in the science education management system that requires serious attention from education leaders.

Science education management is a series of educational resource management activities to achieve science learning goals effectively and efficiently. Terry (2015) defines management as a process that consists of planning, organizing, implementing, and supervising to achieve predetermined goals by utilizing human resources and other resources. When applied to science education, this concept includes curriculum management, learning, laboratory infrastructure, development of science teacher professionalism, and learning evaluation. Education leaders, as key decision-makers, have a strategic role to ensure the optimal implementation of science education management. Siagian (2018) emphasizes that the success of an educational organization is highly dependent on the capacity of its leaders to manage and organize various components of education. Education leaders need to understand not only the technical aspects of science learning, but also the managerial aspects that include strategic planning, human resource development, infrastructure management, and program evaluation.

The complexity of science learning involving practicum activities, experiments, and field observations demands a comprehensive management system. According to Hasibuan (2016), science education management must be able to integrate various learning components ranging from curriculum planning to evaluation of learning outcomes. This includes setting laboratory schedules, managing practicum tools and materials, coordinating teaching teams, and an assessment system that measures not only cognitive aspects but also science process skills. Several previous studies have identified various challenges in science education management. A study conducted by Mulyasa (2019) revealed that the main obstacles include limited laboratory infrastructure, lack of competence of science teachers, and an evaluation system that is not yet comprehensive. Meanwhile, Darmawan's research (2018) found that many schools do not have an integrated management system for science learning, which results in suboptimal achievement of learning goals.

The strategic framework of science education management needs to be developed by considering various aspects. Fayol (2017) identifies four main management functions that can be

adapted for science education: planning, organizing, actuating, and controlling. Each of these functions must be carried out systematically and continuously to achieve optimal results. The planning aspect includes the preparation of a science curriculum that is in line with the needs of students and the demands of the times. Robbins and Coulter (2018) emphasized the importance of strategic planning that takes into account the latest developments in science and technology. This includes determining learning objectives, selecting teaching materials, designing practicum activities, and developing a comprehensive evaluation system. Resource organization is the next crucial aspect. According to Koontz (2016), organizing includes structuring, assigning tasks, and coordinating various science learning activities. Education leaders must be able to allocate human and material resources efficiently, including teacher assignments, laboratory scheduling, and management of learning infrastructure.

The implementation of science learning programs requires effective leadership. Stoner (2017) emphasizes that educational leaders must be able to motivate and direct teaching teams to achieve the learning goals that have been set. This includes learning supervision, teacher professional development facilitation, and monitoring student progress. A comprehensive monitoring and evaluation system is an important component to ensure the quality of science learning. Griffin (2018) underlines the importance of a monitoring system that can measure the effectiveness of learning programs on an ongoing basis. Evaluation not only includes student learning outcomes, but also teacher performance, the effectiveness of the use of infrastructure, and the impact of the program on the achievement of overall educational goals.

Science education management innovation also needs to consider technological developments and the demands of the digital era. Davies (2019) highlighted the importance of information technology integration in the science education management system, including the use of digital learning platforms, laboratory information systems, and integrated learning outcome databases.

Based on the above presentation, this article aims to analyze the key components and strategic framework of science education management that need to be understood by education leaders. Specifically, this article will review: (1) the basic principles of science education management; (2) educational management functions in science learning; (3) important aspects of the implementation of science education management; and (4) educational management models that can be adapted for science learning. This study is expected to make a significant contribution to the development of an effective science education management system. A comprehensive understanding of the key components and strategic framework of science education management will help education leaders optimize the management of science learning, ultimately contributing to the improvement of the overall quality of science education.

2. RESEARCH METHODS

This study uses a qualitative approach with a systematic literature study method. Data collection was carried out through document analysis and literature review of primary and secondary sources relevant to science education management. Sources of literature include scientific journal articles, textbooks, educational policy documents, and research reports.

The data analysis process is carried out through three stages. The first stage is the identification and selection of relevant literature sources using keywords: education management, science education, educational leadership, and science learning management. The second stage includes categorization and codification of information based on four main aspects: basic principles, management functions, implementation aspects, and science education management models. The third stage is the synthesis and interpretation of data to produce a strategic framework for science education management.

The validity of the data is guaranteed through source triangulation by comparing different perspectives from different sources of literature. Data analysis uses content analysis techniques with a thematic approach to identify the main patterns and themes related to science education management. The results of the analysis are then systematically compiled to provide a comprehensive understanding of the key components and strategic framework of science education management.

3. RESULTS AND DISCUSSION

3.1. Definition of management

Management comes from the Latin language, namely from the origin of the word manus which means hand and agete which means to do. These words are combined into the verb manager which means to handle. Managere is translated into English in the form of work to manage, with the nouns management and manager for people who carry out management activities. Finally, management is translated into Indonesian into management or management.

In addition, in terms of language, management comes from the word manage (to manage) which means "o conduct or to carry on, to direct" (Webster Super Ne School and Office Dictionary). As for the terminology, many experts have given a sense of management, with different formulations. The following will be presented some definitions of management in order to obtain a clearer understanding.

Table 1.1 Expert Opinion on Management/ Administration

No	Definition	Source
1.	The most comporhensive definitios vies management as an integrating process by which authorized individual create, maintain and operate an organization in the selection an accomplishment of its aims	(Lester Robert Bittel (Ed), 1978:640)
2.	Management is the control and utilization of all factors and resources that, according to a plan, are injured to achieve or complete a certain task or task.	(Prajudi Atmosudirdjo, 1982:124)
3.	Management is the use of the people and other resources to accomplish objective	(Boone &Kurtz, 1984)
4.	.. managmenet the function of getting things done trough people	(Harold Koontz, Cyril O'Doonels:3)
5.	Management is a typical process, which consists of actions: planning, organizing, moving, and supervising, which are carried out to determine and achieve the goals that have been set through the use of human resources and other resources.	(George R. Terry,1986:4)

Based on the definition that has been explained by several experts, it can be concluded that management is a process or activity that is planned and involves a number of people to achieve certain goals that have been set. By paying attention to some of these definitions, it is clear that the difference in formulation is only due to different pressure points but the basic principle is the same, namely that all activities carried out are in order to achieve the goal by utilizing all existing resources, while definition number four put forward by G.R.Terry added with the process of activities while definition number five from Sondang P Siagian adds an affirmation of the management position its relationship with the administration. Apart from these differences, there are several principles that seem to be the common thread about the meaning of management, namely: 1) Management is an activity 2) Management uses or utilizes other parties 3) Management activities are directed to achieve a certain goal.

After looking at the meaning of management, it is clear that every organization, including educational organizations, such as schools, will really need management to manage the cooperation that occurs in order to run well in achieving goals, for that its management must run systematically through stages starting with a plan to the next stage by showing an integration in the process, With that in mind, the meaning of the importance of management is increasingly clear for human life, including in the field of education.

3.2. Management functions

According to Marno (2007), in the language there are functions that apply universally. Thus, even though the management concept is built on the basis of different values and cultures, it has the same managerial functions. Its existence lies in its application in the management of an organization because of the difference in managers, types, nature of the organization, types of members and so on.

The management functions as stated by experts are as follows (H.Siagian, 1977) 1) According to G.R.Terry a. Planning b. Organizing c. Actuating d. Controlling 2) According to Henry Fayol a. Planning b. Organizing c. Commanding d. Coordinating e. Controlling 3) According to Harold Koontz and Cyril O'Doonel a. Planning b. Organizing c. Staffing d. Directing e. Controlling 4) According to L.Gullick a. Planning b. Organizing c. Staffing d. Coordinating e. Reporting f. Budgeting

In addition, according to Malayu P. Hasibuan (in Kompri, 2015), management activities: 1) Planning function a. Setting business goals and targets b. Formulate strategies to achieve these business goals and targets c. Determine the resources needed d. Setting standards/indicators of success in achieving business goals and targets 2) Organizing function a. Allocating resources, formulating and assigning tasks, and establishing necessary procedures b. Establish an organizational structure that shows the existence of a line of authority and responsibility c. Recruitment, selection, training and development of human resources/workforce d. Activities to place human resources in the most appropriate position. 3) Implementing function (Directing) a. Implementing the process of leadership, guidance and motivation to the workforce so that they can work effectively and efficiently in achieving goals. b. Provide routine tasks and explanations about work c. Explain the policies set. 4) Supervisory function a. Evaluate success in achieving business goals and targets with predetermined indicators b. Take steps to clarify and correct any irregularities that may be found c. Conducting various alternative solutions to various problems related to the achievement of business goals and targets.

3.3 Management principles

According to Henry Fayol (in Purwanto, 2001), a principle can be defined as a fundamental statement or general truth that is a guideline for thinking or acting. In relation to management, the principles are flexible in the sense that they need to be considered according to special conditions and changing situations. These management principles were compiled by Henry Fayol.

The general principles of management according to Henry Fayol (in Kompri, 2015) consist of: 1) Division of Work: The division of labor must be adjusted to the ability and expertise for work effectiveness, using the principle of the right man in the right place. A good division of labor is the key to successful work implementation. 2) Authority and Responsibility: Every authority is attached to accountability. The two must be balanced. The biggest responsibility lies with the top manager. 3) Discipline: A feeling of obedience and obedience to work responsibilities. Discipline is closely related to authority. 4) Unity of Command: Employees must know who is responsible according to the authority obtained. 5) Unity of Direction: Employees need to be directed towards their goals with a clear flow of authority. 6) Prioritizing Organizational Interests: Organizational interests must take precedence over personal interests. 7) Employee Payroll: The payroll system must be fair and satisfactory to encourage productivity and work discipline. 8) Centralization: Centralization of authority to avoid confusion of responsibilities. 9) Hierarchy: Organizational structure from top managers to subordinates for clarity of command and responsibility flow. 10) Order: Order at work requires high discipline from all employees. 11) Fairness and Honesty: The main condition for achieving the goal, must be upheld starting from the superior. 12) Stability of Employee Conditions: The stability of employees must be maintained for the smooth running of work. 13) Initiative: Employee initiative should be rewarded for showing thinking and creativity. 14) Spirit of Unity: A sense of solidarity to create a spirit of good cooperation (esprit de corps).

3.4. Definition of education

Education semantically comes from the Greek word paidagogia, which means association with children. Pedagogus was a fisherman or bachelor in ancient Greece whose job was to pick up and drop off children to and from school. In addition, in his house the child was always under the supervision and guard of the paedagogos. The term comes from the word paedos which means child, and agogos which means I guide or lead.

Education in a narrow sense is the influence that schools seek and engineer on children and adolescents that are entrusted to them so that they have perfect abilities and full awareness of their relationships and social duties. Meanwhile, in a broad sense, education is a basic effort carried out by families, communities and governments, through guidance and teaching activities that take place in schools and outside schools throughout life to prepare students to be able to play a role in life now and in the future.

According to Mudyaharjo (2002), education is a programmed learning experience in formal and non-formal forms as well as information at school and outside of school that lasts a lifetime and aims to optimize individual abilities so that in the future they can play an appropriate role in life. The true essence of education includes physical education and spiritual education. All efforts aimed at helping children in their development, both physically and spiritually, so that they become moral human beings are called education.

Education is also an absolute requirement to move towards a just, prosperous and prosperous society in accordance with the goals of national education as stated in Law of the Republic of Indonesia No. 20 of 2003 concerning the national education system which explains that the purpose of national education is to develop the potential of students to become human beings who believe and devote themselves to God Almighty, have noble character, are healthy and knowledgeable, capable, creative, independent and become democratic and responsible citizens.

Education is an integral process that involves several factors, including educational goals, educators, students, educational tools and the environment. These five factors are a unit that cannot be separated but must run in a determined, complementary and sustainable manner and have a role that greatly determines the success of the educational process. Education directs human beings to a good life and concerns the degree of humanity so that they achieve their life goals in accordance with the origin of their events.

True education is to provide opportunities for openness to external influences and self-development in students. Thus, only then will the fitrah be given the right to shape the child's personality at the same time as external factors will educate and direct operationally containing aspects of maintaining or improving and growing or fostering the child's personality that is ongoing so that with good education from educators, good success will be achieved in accordance with educational goals.

3.5. Definition of education management according to experts

The understanding of education management is probably easier to understand because it has previously been explained or described about management in general, because in terms of principles and functions it does not seem to be much different. The difference will be seen in the substance that is used as the object of study, namely everything related to education. The following are some definitions of education management from experts:

Table 2.1 Opinions of Experts on Education Management

Experts/Experts	Opinion
Tony Bush (1986-2003)	Educational management is a field of study and practice related to the operation of an educational organization.
Made Pidarta (1988:4)	Education management is the activity of integrating educational resources to be centralized in an effort to achieve predetermined educational goals.

H A R Tilar (2006)	Educational management is an activity that implies the existence of an educational plan or plan and its implementation activities.
Hasbullah (2006)	Education management is a cycle process of education implementation starting from planning, followed by organizing, directing, implementing, monitoring and assessing the school's efforts to achieve its goals. Therefore, education management is also an effort to manage the education system.
Veithzal Rivai dan Silviana Murni (2008)	Educational management is a process to coordinate various educational resources such as teachers, educational facilities and infrastructure such as libraries, laboratories, and others to achieve educational goals and objectives.
Engkoswara dan Ann Komariah (2010 : 89)	Education management is an arrangement of educational fields that are carried out through planning, organizing, staffing, coaching, coordinating, communicating, motivation, budgeting, controlling, supervising, assessing and reporting systematically to achieve quality educational goals.
Djam'an Satori (1980 : 4)	Educational administration/management is defined as the entire process of cooperation by utilizing all available and appropriate personnel and material resources to achieve the educational goals that have been set effectively and efficiently.
Castetter (1996 : 198)	Educational administration is a social process that take place within the context of social system.
Soebagio Atmodiwirio (2000 : 23)	Education management is defined as the process of planning, organizing, leading, and controlling educational personnel and educational resources to achieve educational goals.
Engkoswara (2001 : 2)	Educational management is a science that studies how to organize resources to achieve goals that have been set productively and how to create a good atmosphere for human beings who participate in achieving mutually agreed goals.

By paying attention to some of the opinions of the experts above, it appears that education management/administration is in principle a form of management or administration in managing, regulating and allocating resources in the world of education.

The function of education administration/management is a tool to integrate the role of all resources in order to achieve educational goals in a certain social context, this means that the fields managed have different specificities from management in other fields.

Meanwhile, in a more operational sense, education management is more emphasized on the efforts of a leader in mobilizing subordinates to manage resources that are always limited, to achieve educational goals efficiently and effectively.

3.6. Elements of educational management

Management functions according to Malayu P. Hasibuan (in Kompri, 2015): 1) Planning: Setting business goals and targets, formulating strategies, determining the necessary resources, setting success standards. 2) Organizing: Allocating resources and tasks, establishing organizational structures, recruiting and developing human resources, placing human resources in the right position. 3) Directing: Carrying out leadership and motivation, providing routine tasks and explanations, explaining the set policies. 4) Controlling: Evaluating the achievement of objectives based on indicators, taking corrective steps for deviations, providing solutions to problems related to the achievement of objectives.

Classical organizational theory according to Fayol (1949) discusses six aspects of management in the context of education: 1) Technical: Activities to produce educational graduates who are ready to work. 2) Commercial: Networking and management of students to produce benefits for students and the community. 3) Financial: Management of funds for facilities, infrastructure and the implementation of education. 4) Security: Securing the educational environment internally and externally, including moral protection through religious and moral education. 5) Accountancy: Systematic, accurate and efficient financial management. 6) Managerial: Implementation of management functions in the planning and management of educational activities.

3.7. Aspects of education management

According to Kompri (2013), aspects of the education management system include: 1) Goal-Based Management: Focus on organizational goals with benefits: increased work effectiveness, good cooperation between personnel, and mutual assessment between managers and subordinates. 2) Structure Aspect Management: Managers must be responsive to changes by adjusting the organizational structure according to the demands of the times. 3) Engineering Aspect Management: Optimizing decisions through educational media and a systematic learning system according to the objectives. 4) Personnel Aspect Management: Management of human resources (teachers, employees, students, alumni) who are competent and dedicated to achieving educational goals. 5) Information Aspect Management: An information system that is integrative, long-term, future-oriented, and efficient as a link between parts of the organization. 6) Environmental Aspect Management: Management of relationships with the community, including relationships with other schools, the government, related agencies, and the general public.

3.8. Scope of education management

Organizational management according to Kompri (2015) consists of 2 main activities: 1) Administrative Management: Directing organizational members to work according to their goals. 2) Operative Management: Fostering the accuracy of the implementation of individual tasks. The scope of education management includes: 1) Curriculum: Learning management and curriculum development. 2) Staffing: HR management from recruitment to development. 3) Students: Management of student activities for optimal development. 4) Infrastructure: Effective and efficient management of educational facilities. 5) Finance: Fund management and funding sources. 6) Office: Administrative management for optimal services. 7) Supporting Units: Management of BK, UKS, library, extracurricular. 8) Special Service: Consumption management, shuttle, special guidance. 9) Environment: Spatial management, cleanliness, safety. 10) Public Relations: Management of relationships with the community and stakeholders.

3.9. Principles of science education management

Educational management as a science has its own characteristics that are different from other management sciences. The difference between education management and others lies in its operational principles, and not general principles (Pananrangi, 2017). Basically, the attention of education management is goals, people, resources, and also time. When combined and seen from form and behavior, these four elements reveal themselves as a certain social unit, which is often called an organization. The function of education management includes science education in the implementation process referring to the school's vision and mission, so it is necessary to pay attention to the principles of education management.

Principles of education management according to Dauglas (in Kristiawan, Safitri, and Lestari, 2017): 1) Priority Goals: Prioritizing organizational goals over personal interests. 2) Coordination of Authority: Balance between authority and responsibility. 3) Task Suitability: Placement of personnel according to ability and experience. 4) Psychological Understanding: Understanding the psychological aspects of an individual. 5) Value Relativity: Considering value relationships in the work environment. Five essences of education management: 1) The existence of human beings as an object of management. 2) Managerial dynamics of the institution. 3) Position hierarchy. 4) Internal-external development. 5) Norms and rules of the institution.

3.10. Functions of science education management

The implementation of education that can improve the quality of education must be carried out effectively and efficiently by implementing management functions in a basic manner, namely planning, organizing, actuating, and controlling (Ali, 2017). The implementation of an action or program is influenced by the quality of the initial steps taken (Musfah, 2015). It must be understood where and for what and what functions must be carried out in education management.

The implementation/implementation of education policy as a determinant of the success of education policy must apply the principles of good governance, namely transparency, accountability,airness, and responsiveness. So that education policies can really guarantee an improvement in the quality of education. Korten stated that a program will be successfully implemented if there is a conformity of the three elements of program implementation. First, the suitability between the program and the benefits, namely the suitability between what the program offers (and what is needed by the target group (students). Second, the suitability between the program and the implementing organization, namely the compatibility between the tasks required by the program and the capabilities of the implementing organization. Accordingly, the agreement between the beneficiary group and the implementing organization, namely the conformity between the conditions decided by the organization to be able to obtain program output and what can be done by the program target group.

Eight main functions of education management according to Prihatin (2014): 1) Planning: Goal determination, problem analysis, data collection, and activity stages. 2) Organization: The division of tasks according to personnel's talents, interests, and experience. 3) Coordination: Alignment of tasks between groups to prevent unfair competition. 4) Communication: Building communication and motivation between personnel by paying attention to the clarity of goals and common opportunities. 5) Supervision: Supervision by the principal to ensure the effectiveness of learning. 6) Staffing: HR management from planning to organizing. 7) Financing: Budget management from planning to accountability. 8) Supervision: Monitoring the implementation of educational programs.

3.11. Evaluation

The assessment or evaluation of the science learning program must be able to be carried out by a teacher authentically. Assessments are not only carried out with tests in the middle of the semester or semester exams, but teachers also need to plan assessments in other forms such as daily tests and other structured assignments. The assessment aims to find out to what extent the process of implementing science learning that has been carried out with what has been planned in achieving educational goals in general and to reveal the shortcomings that have been done to improve the next activities.

3.12. Science education management model

Educational management model according to Suharsaputra (2013): 1) Formal Model: Organization as a hierarchical system with managers using rational instruments and legal authority. 2) Collective Model: Decision-making through discussion to reach consensus with common understanding. 3) Political Model: Policy through negotiation and bargaining between interest groups. 4) Subjective Model: An organization as an individual creation with different interpretations and perceptions based on the background. 5) Ambiguity Model: Focuses on the uncertainty of organizations with goals and processes that are not always clear. 6) Cultural Model: Organizations based on beliefs, values, and ideologies that influence behavior and perspective.

4. CONCLUSION

The basic concept of management which is science as a field of knowledge that governs an organization to achieve goals based on special expertise. Educational management can be defined as the process of planning, organizing, mobilizing, and controlling educational resources to achieve educational goals effectively. The National Education System is a whole of educational components that are interconnected in an integrated manner to achieve the goals of National Education, in this case the goal of science learning in various levels of education

5. REFERENCES

[1] Ali, Muhammad. 2017. Secondary Education Policy in Governance Perspective in Indonesia. Malang: UB Press.

[2] Asmendri.2012. Theory and Application of Management for Improving the Quality of School/Madrasah Education. Batusangkar: STAIN Batusangkar Press.

[3] Kompri.2015. Education Management-Volume I. Bandung: Alfabeta.

[4] Kristiawan, M. Safitri, D. Lestari, R. 2017. Education Management Edition 1. Yogyakarta: Deepublish.

[5] Marno.2007. Islam dan By Management and Leadership. Jakarta: Lintas Pustaka.

[6] Musfah, Jejen.2017. management of Education Theory, Policy, and Practice. Jakarta: Kencana.

[7] Pananrangi, Andi Rasyid. 2017. Education Management. Makassar: Celebes Media Perkasa.

[8] Prihatin, Eka.2014. Theory of Educational Administration. Bandung: Alfabeta.

[9] Purwanto, Yadi. 2001. Paper: Management of Exercise Modules. Jakarta: Informatics Scholars.

[10] Suharsaputra, Uhar. 2013. Education Administration. Bandung: PT Refika Aditama.

[11] FIP-UPI Education Science Development Team. 2007. Science and Application of Education. Bandung: PT Imperial Bhakti Utama.