

Administrative Strategies for the Science Centers for Education in the Digital Age

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Abstract - The purposes of this study were to investigate administrative components and indicators, to study the current and the desirable condition and to develop administrative strategies for the science centers for education in the digital age. The sample groups were 245 staffs in 20 science centers for education obtained by purposive random sampling technique.

The findings were as follows: 1) Seven administrative component factors and 32 indicators for science centers for education in the digital age are found. Those factors comprise: (1) creativity and innovative thinking; (2) computer skills and technological media; (3) analytical thinking and problem solving; (4) cooperation and teamwork; (5) cross-cultural understanding; (6) learning and professional skills; and (7) communication and information technology, 2) On the whole, current and desirable condition of the organization to support the administrative strategies of the science centers for education in the digital age was at high level. The highest-rated aspect is that of teacher, trainer and staff development, the aspect of instruction and learning support respectively. This might be because attention to education in digital age requires development of teachers, trainers, and staffs, along with technological development. In all, current and desirable condition of external organization supporting administrative strategies of the science centers for education in the digital age is at high level. The highest-rated aspect is technological advancement. This might be because of environmental changes, especially

total disruptive changes of technology, and 3) Recommended administrative strategies for the science centers for education in the digital age comprise: (1) increasing effectiveness of cooperative network; (2) accelerating research and development on variety of activities; (3) developing administrative system and learning services to reach full capacity; (4) on-going development of teachers, trainers, and staffs; and (5) developing more effective publications and service activities in the science centers.

Keywords - Administrative Strategies; Science Centers for Education; Digital Age

I. INTRODUCTION

Currently technology changes disruptively. People receive information, news, and updates through different channel in a very fast fashion. Digital technology ignites changes in education such as different instructional methods. Digital technology has been utilized in knowledge inquiry, which leads to creation of publications or research projects. In addition, digital technology speeds up the collection of information for generating new information. These examples show the capacity of digital technology as a source or accelerators in creation of the new knowledge.

In addition, changes in the digital age make communication through various channels more convenient.

The science centers for education is one of the learning resources that require development in

all aspects in order to catch up with current advancement. This is due to the fact that science and culture were coined together with beliefs and life style of people in different generations. Trend, technology, and innovation are considered as needs among the people. The science centers for education is an informal learning resource for science. Its designated role is to provide knowledge in science and technology for general public. General concept in providing services in the science centers is to provide experiential learning, because science is not only the study about theories or principles, but also the practices. Therefore, scientific activities must emphasize on applications of theories to practices through observations and experiments.

However, instruction in the digital age envisages the whole world as its classroom. Learners in the digital age is capable for self-guidance, while the curriculum is flexible to support individual differences. Teaching and instruction must not be only what presented in the textbooks and memorization, but to intrigue the learners with problem-solving skill. Teaching and learning in this digital age must prepare students to get ready for their life in the real world. Based on this concept, the researchers want to adopt some research-based principles of administrative strategies of the science centers for learning in the digital age. Moreover, the science centers for education provide a variety of exhibitions and media, as well as learning activities to enhance potential of the learners. Moreover, the centers also adopt educational factors in the digital age such as analytical problem solving skills, creativity and innovation, cultural formation to abide in the services. In addition, we analyze administrative strategies, including SWOT analysis, Tows Matrix analysis, and analysis of stakeholders' needs so that there would be assessment and assurance for administrative development and to enhance learners' potential. Specifically, the development will modernize the science centers for education in terms of technological and innovative advancement, as well as security and sustainability as the preferred learning resource of science for the future.

II. OBJECTIVES OF THE STUDY

- 1) To investigate administrative factors and indicators of science centers for education in the digital age.
- 2) To investigate current and desired statuses of administration of the science centers for education in the digital age.
- 3) To develop administrative strategies for science centers for education in the digital age.

The researchers divided the current study in to three phases as follow:

Phase 1: The researchers studied administrative factors and indicators of the science centers for education in the digital age as follows: 1) concepts, theories and relevant research on administrative factors and indicators of the science centers for education, 2) analyzed and synthesized the information, then conceptualized to determine framework of the study, 3) conducted an interview related to administrative factors and indicators of the science centers for education in the digital age. There were two groups of informants, including the policy maker (the director of the science centers for education who materialized the policy into practice), and five experts, who obtained a doctoral degree in educational administration and had excellent practice. The research instrument was a semi-structure interview. Qualitative data were analyzed to identify recommendation for improvement of the science centers for education in the digital age, and 4) assessment of the administrative factors and indicators of the science centers for education was run by the experts by an assessment of the administrative factors and indicators of the science centers for education. Quantitative data were analyzed in the forms of appropriate, uncertain, or inappropriate.

Phase 2: Study current and desired statuses of administrative factors of the science centers for education in the digital age. The study was a mixed method to investigate current and desired statuses of administrative strategies of the science centers for education as follows: 1) studied current and desired statuses of administrative strategies for science centers for

education in the digital age, with a sample group of 245 staffs from the population size of 629. A total number of 12 key informants included director of the science centers for education, deputy director, head of department, and staff from the science centers for education. The research instrument was validated by 5 experts for the IOC. Then it was tested with 30 staffs in the 20 science centers to calculate the Cronbach's alpha coefficients. Data collected were analyzed by descriptive statistics, including frequency, percentage, mean, and standard deviation. Moreover, SWOT analysis revealed strengths, weaknesses, opportunities, threats, and PNI_{modified}.

Phase 3: Related to the study of administrative strategies for the science centers for education. The researcher: 1) conducted Tow Matrix Analysis, and identify appropriateness of the stakeholders in administrative strategies for science centers for education in the digital age, 2) crafted the administrative strategies for science centers for education in the digital age, 3) verified and confirmed administrative strategies for the science centers for education by running a focus group discussion, and 4) the administrative strategies of the science centers for education in the digital age were assessed, confirmed, and approved from the stakeholders. The researchers prepared the forms for assessment, confirmation, and approval, with the permission of 30 directors of the science centers for education. Upon approval, the researchers will implement the administrative strategies of the science centers for education in the digital age.

III. SUMMARY OF THE FINDINGS

1) Administrative information factors and indicators of the science centers for education in the digital age.

1.1 Overall administrative factors and indicators of the science centers for education at a high level. When inspecting at individual aspects, the highest rated aspect was of creativity and innovation thinking, followed by computer skills and technological media, analytical thinking and problem solving,

cooperation and teamwork, cross-cultural understanding, learning and professional skills, and communication and information technology, respectively.

2) Current and desired internal statuses to support administration of the science centers for education in the digital age, as per the analysis from internal and external environmental factors.

2.1 Overall current and desired internal statuses to support administration of the science centers for education was at a high level. When inspecting at individual aspects, it was found that the highest rated the teacher, trainer, and staff development aspect, followed by the aspect of instruction and educational services, the aspect of education, study, research, and development of activities, the aspect of publication and activity services, and the aspect of networking promotion and support, respectively.

2.2 Overall current and desired external statuses to support administration of the science centers for education was at a high level. When inspecting at individual aspects, it was found that the aspect of technological advancement was rated the highest, followed by the aspect of politics and law, the aspect of economics, and social aspect, respectively.

3) Administrative strategies for science centers for education in the digital age can be summarized into 5 strategies, 21 objectives, 32 measures, and 32 indicators, according to the PNI_{modified} as follows:

Strategy 1: Increasing effectiveness of cooperative network

Objectives: (1) Improving plans to promote and support missions of the network; (2) Promoting and support cooperation among the networking members; (3) Improving effectiveness of the operations among the networking members; and (4) Evaluating and monitoring the operations.

Measures: (1) Improving projects / activities that promote and support operations of the networking members; (2) Promoting and empowering to enhance cooperation among the networking members for effective operations; (3) Improving for effective communication and information sharing among the networking members; (4) Forming system and mechanism on effective analytical thinking and problem solving among the networking members; (5) Developing learning skill that could inspire to future career among networking members; (6) Assessing achievements that are in compliance with the promotion and support plans for the networking members; and (7) Using data as input for the next plan on networking members.

Indicators: (1) The improvement of the projects and activities to promote and support missions of the networking members; (2) The support and inspiration to enhance cooperation among networking members; (3) The improvement of effective communication and ICT among the networking members; (4) The system and mechanism to analyze and solve problems of operations effectively for the networking members; (5) The frequency of staff training sessions for development of learning skills and inspiration to career among the networking members; (6) Evaluation of the achievement in compliance to the objectives of the promotion and support plans for the networking members; and (7) The use of the results for the next mission development of the of networking members.

Strategy 2: Accelerating research and development on variegation of activities.

Objectives: (1) Developing research plans and patterns of activity; (2) Developing ICT system and research database, as well as effective patterns of activity; (3) Promoting staff to do research and effective patterns of activity; (4) Promoting cooperation among organizations, networking members, and local agencies for research and development on patterns of activities; and (5) Evaluating and monitoring.

Measures: (1) Preparing plans for research and development of activity patterns; (2) Supporting the organization to bring ICT system and research database to administer the science centers for education in the digital age; (3) Determining standard on research and development of the activity patterns for the most effective products; (4) Organizing activities on recognitions and awards for outstanding developers of research and development; (5) Forming cooperation in research and development of the activity patterns among organizations, networking members, and local agencies by exchanging analytical and problem solving process, innovative production, study for career preparation, and cultural differences; (6) Organizing assessment schemes on achievement of the research and development plans; and (7) Implementing the results to improve plans for research and development of the activities in the next stage.

Indicators: (1) There are plans for research and development on activity patterns; (2) There is an ICT system and a database for research and development; (3) Percentage of research and development of activity patterns that achieve the standard; (4) Level of score on quality of the activity patterns; (5) Mean score of satisfaction assessments for cooperation among organizations, networking members, and local agencies; (6) There are assessments on achievement of the research and development for activity patterns; and (7) Implications of the findings to adjust research and development plans for activity patterns.

Strategy 3: Developing administrative system and leaning services for the full potential.

Objectives: (1) Developing plans for community-based learning and educational services; (2) Promoting operations of community-based learning and educational services; (3) Promoting operations of learning and educational services for community by up-to-date technologies; and (4) Providing assessment and evaluation schemes.

Measures: (1) Making plans on the promotion of community-based learning and educational services; (2) Promoting community-based learning and educational services; (3) Adopting technology and software in educational services to community; (4) Evaluating achievements of promotion plans for community-based learning and educational services; and (5) Implementing the results to promote next community-based learning and educational services.

Indicators: (1) There are plans on the promotion of community-based learning and educational services; (2) There are projects or activities on community-based learning and educational services; (3) There are evidences of the adoption of technology and software in educational services to community; (4) Results from evaluation on achievements of promotion plans for community-based learning and education services are available; and (5) There are evidences of how the results will be implemented to promote next community-based learning and educational services.

Strategy 4: Continually developing teachers, trainers, and staffs.

Objectives: (1) Planning teacher, trainer, and staff development with a systematic career path analysis; (2) Providing mentoring system for career promotion; (3) Providing training sessions, both intra and extra organization, as well as sharing of working experience with different local organizations; (4) Providing learning sessions on exchanging of experience with teachers, trainers, and staffs from different organizations; (5) Providing adequate system and mechanism of staff recruitment and job assignment; (6) Providing fair performance assessment system; (7) Providing an evaluation of achievements in accordance with staff development plan; and (8) Implementing the results of the evaluation for the next operation.

Measures: (1) There is a development plan for the career path of teachers, trainers, and staffs; (2) There is a mentoring system for career promotion; (3) There are training sessions, both intra and extra organization, as well as

sharing of working experience with different local organizations; (4) There are learning sessions on exchanging of experience with teachers, trainers, and staff from different organizations; (5) There is a system and mechanism of staff recruitment and job assignment; (6) There is a fair system of performance assessment; (7) There is an evaluation of achievements in accordance with staff development plan; and (8) There is an implementation of the results for the next operation.

Indicators: (1) There is a development plan for the career path of teachers, trainers, and staffs; (2) There is a mentoring system for career promotion; (3) Numbers of training session, both intra and extra organization, as well as sharing of working experience with different local organizations; (4) Percentage of learning sessions on exchanging of experience with teachers, trainers, and staff from different organizations; (5) There is a system and mechanism of staff recruitment and job assignment; (6) There is a fair system of performance assessment; (7) There is an evaluation of achievements in accordance with staff development plan; and (8) There is an implementation of the results for the next operation.

Strategy 5: Developing more effective publications and activity services in the science centers.

Objectives: (1) Development plans for publication and activity services, which are in line with policy and promotion of the government; (2) Develop up-to-date technology, which fits for effective and productive publication and activity services; (3) Development of publication channel and activity services that are accessible by the target group; and (4) Assessment and Evaluation.

Measures: (1) Preparing plans for publication and activity services, which are in line with policy and promotion of the government; (2) Providing up-to-date technology that is effective and productive for publication and activity services; (3) Focusing on effectively

and productively accessible and diverse channel of publication and activity services; (4) Evaluating achievement of the objectives in the plans for publication and activity services; and (5) Implementing the results of evaluation on the plans for publication and activity services for the next operation.

Indicators: (1) There are plans for publication and activity services, which are in line with policy and promotion of the government; (2) There is an up-to-date technology that is effective and productive for publication and activity services; (3) There are effectively and productively accessible and diverse channels of publication and activity services; (4) There is an evaluation on achievements of the objectives in the plans for publication and activity services; and (5) There is an implementation of the results of evaluation on the plans for publication and activity services for the next operation.

IV. DISCUSSION

The following are points to discuss about the study of administrative strategies of the science centers for education in the digital age.

1) Administrative factors and indicators of the science centers for education in the digital age. Overall administrative factors and indicators of the science centers for education at a high level. The highest ranked factor was the aspect of creativity and innovation thinking, followed by computer skills and technological media, analytical thinking and problem solving, cooperation and teamwork, cross-cultural understanding, learning and professional skills, and communication and information technology, respectively. The order found in this study is in line with on the promotion of learning in the 21st century for digital age in Thailand. The findings suggested that instruction in the digital age must concern about self-adjustment to the changing world. Moreover, the education must emphasize on creativity and modify learning to critical thinking and solving skills for complicated problem. The education must emphasize on the use of an online platform for education, including provision of

simulations so that the learners will gain experiential learning experience. The content must be exchangeable on the online platform. The learners can share their experience and knowledge through the online channel, and promote the knowledge of work. This rational is due to the fact that we are living in the era of advanced technology, and it influences on our lifestyle. So the learners must adjust themselves to catch up with technological advancement.

2) Current and desired administrative statuses of the science centers for education in the digital age. It was found that the aspect of teacher, trainer, and staff development was rated as the highest aspect for current and desired administrative statuses of the science centers for education, followed by the aspect of learning and educational services. These may be due to the fact that education in the digital age pays attention on simultaneous development of teachers and staff, as well as technology. Teachers, trainers, and staff are still essential factors for knowledge delivery to the learners. The findings are with that educational administrators in the digital age must know how to make use of technology in a proper way. For example, in the classroom, only presenting content through PowerPoint is not preferred anymore, teacher must be able to connect sources of knowledge from different locations to the classroom via internet connection. This will make learning atmosphere more pleasurable among students. In addition, teachers need not be the only source of knowledge, they would better be learning facilitators. Students are encouraged to participate in inquiry-based learning or collaborative learning. Therefore, teachers, trainers, and staffs are really important for learners' achievements.

The overall current and desired status of external organizations to support administrative operations of the science centers for education was at a high level. The highest rated aspect was technological advancement. This might be because of, among environmental changes, what we can observe the most is technological changes. The changes are in line with the National Education Plan (B.E. 2017-2036), which summarizes impacts of changes of

digital technology on living that changes of innovation and technological advance are disruptive, and people need to adjust themselves to such changes. Quite a number of challenges that people need to experience such as in learning and education, natural resources management, traveling, information-based work management. ICT involves with all life aspects; therefore, young generation must be digital literate so that they would catch up with the updates and make use of the technology for benefits of themselves, society, and nation. This requires education to prepare our young generation to possess such skills.

3) Administrative strategies of science centers for education in the digital age. From previous studies suggest administrative strategies for science centers for education as follows:

Regarding strategy for teacher, trainer, and staff development, this strategy has quite a number of factors during the planning process. The strategy is aimed at: (1) promoting development plans for teachers, trainers, and staffs; (2) promoting staffs possess adequate knowledge and skills for the job; (3) promoting engagement of the staff; and (4) assessing and evaluating of the strategy. It can be seen that the strategy for teacher, trainer, and staff development emphasizes on organizational engagement. That is because of the important roles of those staff towards education in the digital age, which needs development along with the technological changes. This idea is with that educational administrators in the digital age must know how to make use of technology in a proper way. For example, in the classroom, only presenting content through PowerPoint is not preferred anymore, teacher must be able to connect sources of knowledge from different locations to the classroom via internet connection. This will make learning atmosphere more pleasurable among students. In addition, teachers need not be the only source of knowledge, they would better be learning facilitators. Students are encouraged to participate in inquiry-based learning or collaborative learning. Therefore, teachers, trainers, and staffs are really important for learners' achievements. In

addition, teachers must be able to turn the traditional classroom to the digital one. The researcher does not believe that technology will replace teachers, thus we need teachers who can make good use of technology. Administration in the digital age thus concerns about sufficient infrastructure such as hardware, software, network, and potential staffs, as well as the knowledge to assess effectiveness of the system, and to prevent inappropriate use of the ICT.

The findings of the administrative strategies for science centers for education are in line with the educational promotion policy of the government, as suggested in the National Education Plan (B.E. 2017-2036) that the conceptual design of national curriculum still emphasizes on the principles—led by the national strategy such as education for all, inclusive education, sufficiency economy, all for education, and sustainable development goals (SDGs). This is translated into the idea that “all Thai people must access to education and participate in a good quality lifelong education, and living their happy life with sufficiency economy principle, and changes in the 21st century”. Education in this era thus has 4 objectives: (1) to develop system and process of effective educational management; (2) to produce good citizen of Thailand. They must possess desired characteristics that in line with the national constitution, the national education act, and the national strategy; (3) to develop Thai society be learning society with moral, ethics, harmony, and sustainable development of the country; and (4) to push Thailand for the country which is in the “middle income trap”. Disparities must decrease. Regarding learner aspirations, education must prepare all learners to have critical thinking and problem solving skills, creativity and innovation, cross-cultural understanding, collaboration, teamwork and leadership, communications, information and media literacy, computing and ICT literacy, career and learning skills, and compassion.

In summary, the skills to control equipment and tools, as well as application of cognitive process abovementioned will lead to development of

education that is dynamics. This must be prepared to face all changes to come. This also helps educator aware of status of institution with technological advancement. It also must include philosophical concepts to improve the curriculum with this disruptive changes. Also, the country will be a full digital society. There must base the concept of digital age education for curriculum development. Therefore, administrative strategies of the science centers for education in the digital age is very significant to educational development in the new era.

V. RECOMMENDATIONS

A. *Implications from the Study*

1) The least rated administrative strategies of the science centers for education was the factors and indicators of the formation of communication and ICT, especially the aspect of publication and activity services by providing effective communication and ICT, and promoting and supporting networking members through communication and ICT for better learning resources. The administrators must pay more attention onto the aspect to attain more effective and productive application of communication and ICT.

2) The highest rated aspect of administrative factors and indicators for the science centers in the digital age was the formation of creativity and innovation, especially in the aspect of promoting and supporting operations of the networking members. The activity from this finding should be about how to materialize such creativity or innovative thoughts for better direction so that the network could produce materials to develop teachers, trainers, and staff. This will also provide up-to-date material for staff development. Therefore, administrators must focus on the way to materialize those concepts and ideas.

3) Weaknesses from ordering the importance based on necessities of the internal environment that support administration of the science centers for education revealed that the aspect of promoting, supporting, and coordinating the network was rated highest necessary. Therefore, it is

the most concern weakness of the organization. There should be an improvement plan for such weakness, especially for the aspect of promoting and supporting operations of the network. The administrators must support communication and the use of ICT to the development of learning resources. Cooperation among the network bodies must be emphasized by the use of effective communication and ICT for better cooperation among the network bodies.

4) The strength of the necessities for internal environment to support administration of the science centers for education was the aspect of publications and activity services. This factor was rated the lowest, especially for the aspect of publications and activity services by staffs who have been well trained on computer and ICT skills. The administrators should consider bringing more advanced technology to publicize and provide services to distinguish the science centers for education from other educational institutes.

5) The threats of the administration of the science centers for education in the digital age included the factors of economic, social, and political and law. Therefore, advantages such as the aspects of publications and activity services must be brought in to lessen obstacles. The publications and activity services must be in line with the promoting policy of the government, with current technology, accessible by the public and local members, as well as reaching the target group in a diverse channel.

6) Opportunities that still open for the administration of the science centers for education in the digital age included technological advancement. This will strengthen the centers in terms of effective publications and activity services for the target group. The administrators should consider this advantage and opportunity to distinguish the science centers for education in the digital age from other educational institutes.

7) Administrators of the science centers for education should integrate administration of the science centers for education and the administrative factors in the digital age to plan

administrative strategies of the science centers for education from the findings of the current research. The strategies are as follows: (1) promoting and supporting operations of the network; (2) developing research and development of activity services; (3) promoting learning management and services; (4) developing teachers, trainers, and staffs; and (5) promoting publications and activity services. The strategic plan must implement in different time frames such as short-term, medium-term, and long-term plans. During implementation of the plans, there should designate measures and guidelines in the organizational structure and the person in charge. There should be performance assessment, with both quantitative and qualitative indicators that will lead to adjustment of the plan for the next operation.

B. Suggestions for the Future Research

1) The future research should investigate learners in the science centers for education to attain their points of view. Different age group of learners will reflect different perspectives toward administration of the science centers for education. This will lead to more effective data.

2) There should be an investigation of the administrative problems of different centers and network, so the problems will be analyzed to achieve a guideline or a strategy to solve such problems for specific context.

3) There should be a study to investigate the foreign context of administration of the science centers for education. Then we will be able to compare administrative approaches and strategies they operationalized. The findings will be used to determine more effective strategies for administration of the science centers for education.

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