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Analyzing the Perceptions and Expectations of Students Towards Science Using Soft System Methodology

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Abstract: Analyzing the Perceptions and Expectations of Students Toward Science Using Soft System Methodology. Objectives: This research aims to analyze students' perceptions and expectations regarding science lessons so that the resulting data and information can be utilized by teachers as learning leaders to be applied in the learning process. **Methods:** A soft system methodology (SSM) approach was used to achieve this goal. With SSM, this problem can be overcome. SSM produces a conceptual model to formulate a strategy for Aceh junior high school science teachers. The observation locations were conducted at ten junior high schools (SMP) in two districts in Aceh. **Findings:** Several factors influence students' interest in learning science, namely learning facilities in representative classrooms and laboratories, availability of resources, media and learning facilities, and teaching materials with virtual support. Several other factors were also found in different schools, such as the low ability of teachers to manage classes, not yet optimal preparation for learning and practicums, not all science teachers utilizing laboratories, and the unavailability of virtual laboratories. **Conclusion:** The results of the SSM method analysis produced two suggested recommendations. The first is a technical recommendation, namely that teachers must make efforts to improve the quality and services of learning, such as trying to take advantage of the unique learning environment to support education and providing exciting learning materials, resources, and facilities as a result of continuously improving professional performance. Second, policy recommendations such as determining appropriate learning models and strategies and choosing practicum models and approaches that can equip students with knowledge, skills, and attitudes toward students.

Keywords: science lessons, science teachers, soft systems methodology, student interests.

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INTRODUCTION

Results from the Program for International Student Assessment (PISA) show that 70% of 15-year-old students are below the minimum level of ability to comprehend simple reading or apply basic mathematical concepts (Kusmaryono and Kusumaningsih 2023). The PISA score has remained relatively high over the last fifteen years. These findings also show significant gaps in the quality of learning between regions and socio-economic groups. The COVID-19 pandemic has made the situation worse. To overcome this problem, the Ministry of Education and Culture simplified the curriculum to reduce learning loss during the pandemic.

The new paradigm curriculum has been implemented in stages since the Academic Year 2021/2022 (Retnaningrum et al. 2023). Various breakthroughs in improving the quality of graduates, the quality of teachers, and the learning process, including the management of educational institutions, are organized to be more effective and flexible. In the new paradigm curriculum, teachers as learning leaders are given the freedom to develop various strategies, approaches, and learning models with methods adapted to the characteristics of the material topic and the state of students' initial understanding or knowledge (Charokar and Dulloo 2022; Parker, Thomsen, and Berry 2022; Pokhrel and Chhetri 2021). The teacher's ability and experience in leading learning is an important influencing factor on student interest (Fernández Espinosa and López González 2023). Few students tend to certain subjects because of the teacher's leadership in learning (Maqbool et al. 2022). Teacher innovation in the learning process will ultimately leave an impression on students (Slavit, Nelson, and Lesseig 2016).

General students have a happy and positive attitude towards a lesson (Wassalwa et al. 2022). However, science lessons in junior high school could be more exciting and disliked for specific reasons in the students' opinion (Kaleva et al. 2019). Students generally prefer science lessons if they feel satisfied with the learning services provided by the teacher (Pozas, Letzel-Alt, and Schwab 2023). Therefore, teachers should make various efforts to make students feel happy, have a positive attitude, and have a high interest in learning (Gopal, Singh, and Aggarwal 2021).

Soft Systems Methodology (SSM) is suitable for solving this problem through decision-making strategies (Fadhil et al. 2021). The SSM method is a method that can describe problems holistically to find honest and conceptual aspects in students (Nair 2015). SSM can tell everything that happens in a human activity system, where a series of interconnected human activities can be said to be a system that forms a series (Yadin 2013). The SSM approach produces a conceptual model with the formulation of problem-solving strategies in science lessons in junior high schools (Nikhlis, Iriani, and Hartomo 2020).

SSM has been widely used by academics, researchers, and experts to solve problems, especially in education (Yadin 2013). SSM has been used in teaching undergraduate, postgraduate and executive students, which can be done using an experience-based approach and participation in problem-solving (Sewandono et al. 2023), developing knowledge management (Maryam 2020; Nikhlis et al. 2020), developing human resources (Françozo, Paucar-Caceres, and Belderrain 2022), visual assessment of concrete damage and also in the military section (Hindle 2011), and there are still many applications of SSM in overcoming existing problems.

SSM has yet to be widely used to solve students' problems with classroom learning. In the results of a study using VOSViwer, which uses the keywords Soft Systems Methodology, Education, and learning, 500 Scopus data that have been confirmed in the last five years (2019-2023) show that research related to learning and education has no direct connection with SSM. Figure 1. shows that research associated with SSM is very close to solving problems through methodology, analysis, process, and development.

The topic of education in SSM research is a separate area of SSM-related research. Based on research trends in the last five years, SSM will still frequently be discussed in international research in 2020 and will continue to decrease until 2021. On the contrary, research trends related to education, practice, and project-based research perspectives have increased since 2021 (figure 2).

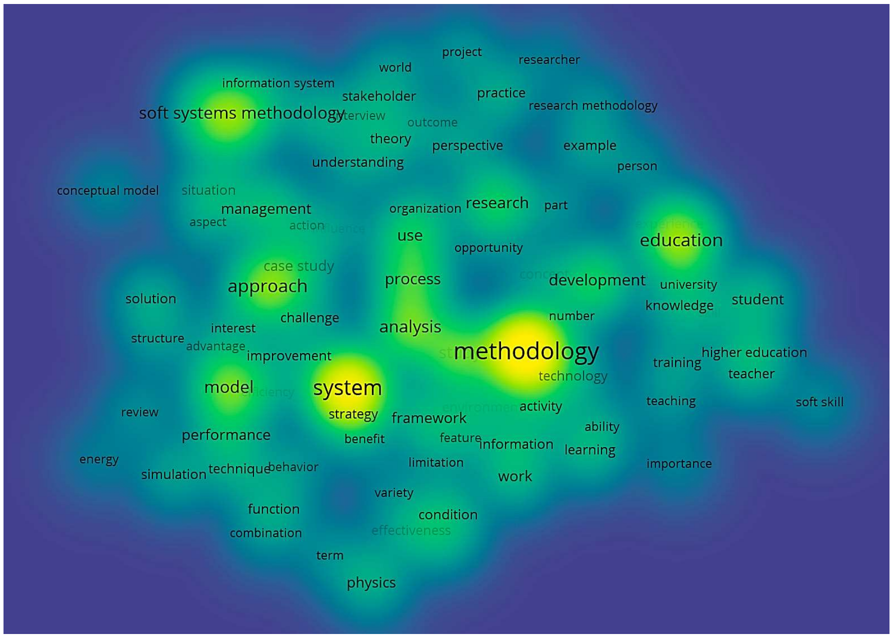

Figure 1. Results of SSM literature analysis

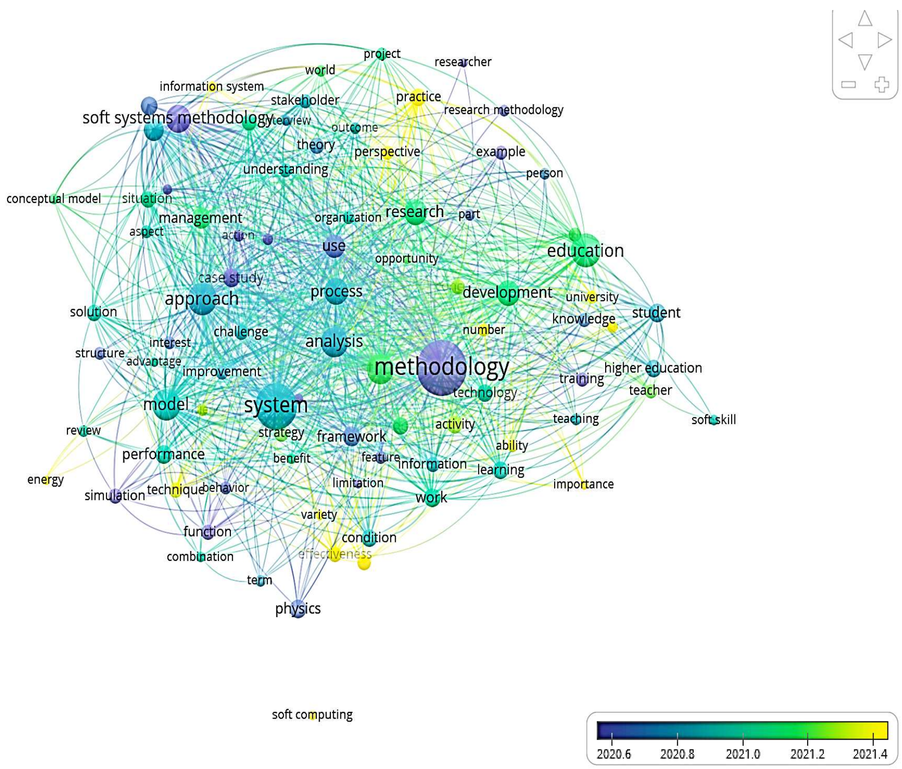

Figure 2. SSM research trends in the last five years

This research aims to analyze what factors students can consider when showing a scientific and positive attitude towards science lessons, as well as to find out what factors make students uninterested or hostile towards the process of learning science lessons. Through the SSM method approach, it is hoped that it will produce a conceptual model formulation that can be used as an example media for teachers to develop learning strategies to be applied in developing the learning process for science lessons. Increasing the quality of learning and creating good productivity in the learning process is expected to increase expectations, satisfaction, loyalty, and quality of learning in the classroom.

■ METHOD

Participants

This research uses a qualitative approach because SSM is naturally suited to a qualitative approach and focuses more on a deep understanding of complex situations. In qualitative research, the emphasis is on process, meaning, and human experience, which are highly relevant to the goals of SSM. This research was conducted in March – June 2023 with observation locations at 10 Junior High Schools in Aceh. This research involved 150 students, represented by 15 students from each school, based on the results of science lesson evaluations with ratings of one to five from each grade level. Determination of observation locations was carried out through purposive sampling, considering these ten schools because they are favored by the community in each district. These two districts represent the locations closest and furthest to the center. Thus having an impact on the availability of resources and tools that support science learning in schools. Due to ethical reasons, the respondents' data and school data were not included in the manuscript. However, the respondents certainly gave their consent for this research.

Research Design and Procedures

SSM uses several conceptual tools and processes to facilitate understanding and discussion of complex issues. Instruments like those used in quantitative data collection have yet to be used in SSM research. As explained in Figure 3, the research design of SSM consists of seven crucial stages that do not directly measure variables quantitatively but focus more on facilitating and mediating shared understanding and collaborative actions toward complex issues.

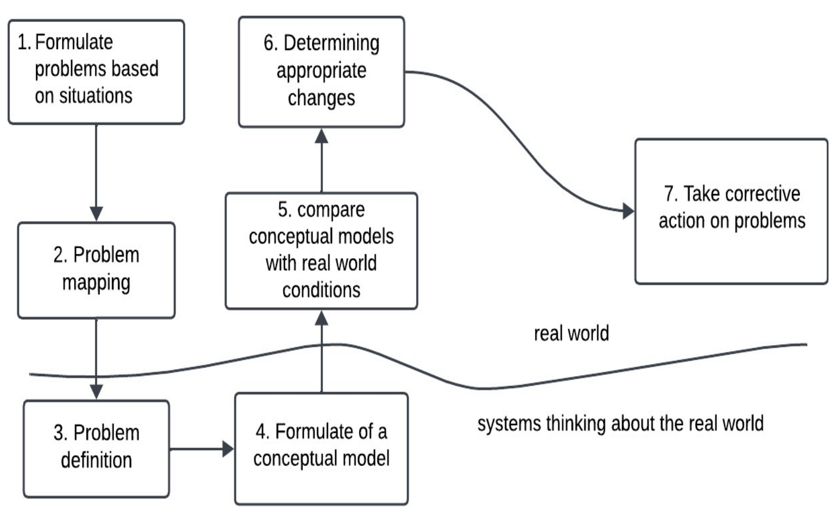

Figure 3. SSM stages in solving problems

Data Analysis

Researchers collected primary data through observation and open interviews with relevant experts with the capacity and experience in this issue. There are 12 experts selected from the Department of Education and Humanitarian Affairs, namely achievement teachers and certified educators, provide the latest information regarding developments and problems often faced in the learning process. Furthermore, there are three academic experts, namely lecturers from the Universitas Terbuka, Universitas Samudra, and Universitas Serambi Mekkah, who have research related to science learning and act as providers of knowledge and input on the concept of learning strategies that will be developed.

The following primary data source is 150 students who provide information regarding problems faced during the learning process. All students get questions from the prepared interview sheet. The interview sheet contains perceptions and expectations regarding science lessons and the learning process. This interview sheet was adapted from (Fadhil et al., 2021), which focuses on solving problems through decision-making using a holistic description approach to find honest and conceptual aspects in students. Students' perceptions and expectations regarding science lessons include Interest, benefits, anxiety, and further study or education careers.

In the perception interviews, the sheet has criteria of very unsuitable, unsuitable, quite suitable, appropriate, and very suitable. Meanwhile, the hope interviews have a criterion of very unimportant, not necessary, quite important, essential, and significant. Information was also obtained from secondary data from literature studies, including national and international articles related to research results in science education and learning, to support primary data. Data analysis from observations and interviews is explained in detail at each stage of SSM. Because SSM uses a qualitative approach, the interview results for each criterion are not quantified into a specific score. Data is processed and explained comprehensively according to SSM's problem-solving and decision-making stages.

Based on Figure 3. Data collection was carried out in seven stages. First, formulate problems based on situations. At this stage, efforts are made to collect the required amount of information related to problem indicators that are taken into consideration by students in determining interest and positive attitudes towards science lessons. Second, problem mapping from information data obtained in the first stage. This data is used to represent current conditions by designing a rich picture, namely a picture of problem situations in the real world, or it can also be interpreted as a representation of current problem situations. The third is problem definition, namely determining the root definition formula, a short sentence describing that a system can carry out plan A with method B to achieve goal C. The root definition is then entered into the CATWOE formula, namely C (Customer), A (Actor), T (Transformation), W (World-view), O (Owner), and E (Environment). The fourth stage is formulating a conceptual model for each part of CATWOE to achieve the appropriate objectives. This model examines the human activity system from the results of problem mapping in rich pictures and represents the relationships between activities. This conceptual model is a framework in the form of a diagram of the overall relationship between aspects. All elements compiled in CATWOE are then included in the formulation of this model.

Fifth, conceptual models should be compared with real-world conditions to facilitate monitoring of possible changes in problem expression. The formulation of this conceptual model was then consulted with experts so that it is hoped that it will later become a solution and recommendation for resolving the problems faced. The sixth stage is determining appropriate changes. The aim is to identify recommendations that may be feasible to implement, maintain, or need to be improved in the science learning process in schools. The final stage is to take corrective action on the problem. In the final stage, the aim is to provide recommendations for changes that can be implemented.

RESULT AND DISCUSSION

Based on the observations and interviews with experts and students, researchers found several factors that became references for students' considerations in responding to science learning at school. Indicators of student consideration: supportive study room, representative lab room, availability of relevant media, resources, and learning materials, availability of virtual learning media, availability of a fast-supporting network, availability of practical tools and materials/practicum kits, teacher's ability to operate the practical kit. The learning model in science lessons provides thinking skills, scientific readiness, and a complete science lesson assessment. To obtain optimal and valid analysis results, a unique approach is needed for students, such as in-depth interviews, so the information received is appropriate and on target. Each answer information is described again to make it easier to study or study in detail. These indicators are obtained from extracting in-depth information collected by prioritizing aspects, such as learning facilities in the form of representative classrooms and laboratories, availability of resources, media and learning facilities, and availability of teaching materials with virtual support of course with adequate internet. Several other factors were also found, such as the low ability of teachers to manage classes, not yet optimal preparation for learning and practicums, not all science teachers utilizing laboratories, and the unavailability of virtual laboratories.

This finding is relevant to the results of previous research. Several aspects that influence students' responses and attitudes toward science lessons at school are that using learning models can affect students' responses. Learning stages that equip students with scientific attitudes, skills, and knowledge (Firmansyah and Suhandi 2021). Support for interactive teaching materials through virtual class assistance also increases student interest (Firmansyah et al. 2022). Apart from that, the use of technology in the evaluation and assessment process also has a percentage influence on students' interest in learning science (Valverde-Berrocoso, Acevedo-Borrega, and Cerezo-Pizarro 2022).

The exciting thing about this research is that the gender aspect of students also turns out to be an exciting topic for discussion. Most research results show that male students are more interested in science lessons than female students (Putri, Pranata, and Sastria 2024). Apart from the characteristics of science learning, it includes practical and experimental activities that require specific process skills and dexterity (Hacýeminoðlu, Yýldýz, and ªeker 2022). The problem data obtained is then studied and processed using the seven work steps of the SSM method, and the results obtained can later be used by teachers in making decisions to improve services and the quality of science learning in the classroom.

Formulated Problems

Professional teachers must continue to strive to provide quality learning services that impact learning outcomes. Therefore, professional teachers need to determine a formulation that can maintain and improve their professional performance in delivering services and the quality of learning in the classroom so that it impacts students' knowledge and skills, including students' responses to the learning process provided.

Professional teachers present science learning with complex activities, scientific approaches, and stages that can equip thinking skills and scientific attitudes. However, in practice in schools, science learning still applies learning and practicum stages that do not allow students to be directly involved and train their thinking skills in solving problems to achieve learning goals (Maksum, Yuvenda, and Purwanto 2022a; Satria et al. 2024). This can be seen from the number of students considering science lessons unpopular for grades IX. Based on the results of observations and in-depth interviews with respondents, several confirmed factors that caused this include the fact that the study/practice class is not attractive. This finding follows the results of previous research, which stated that science learning, both as a lesson in the classroom and in experimental investigations, can be engaging but complex in the learning process because apart from being a science, science cannot be separated from the activities of reasoning, decision making, and thinking strategy (Hadzigeorgiou and Schulz 2019).

Another factor is that practical facilities are incomplete, learning media is virtual media do not yet support limited, monotonous learning and practicum media, the practical kit does not function according to its function, the learning and practice stages are tedious, practical activities do not challenge to be skilled in thinking and solving problems, there is no practical performance feedback (Kang 2023), internet network is slow, and the practicum assessment is only on the practicum report (Isti Muslikhah 2023). Based on the findings, they are following the data from research conducted by (Chhetri, 2021; Retnaningrum et al., 2023), who reported that class conditions, quality learning services, contextual selection of science learning facilities, use of technology as a learning resource, and medium, comprehensive assessment, and learning processes that provide direct experience have a significant impact on students' responses to science lessons, including offer a positive attitude towards science learning and practice (Lusiana and Maryanti 2020; Maksum, Yuvenda, and Purwanto2022; Yanti, Rahayu, & Rabbani 2024).

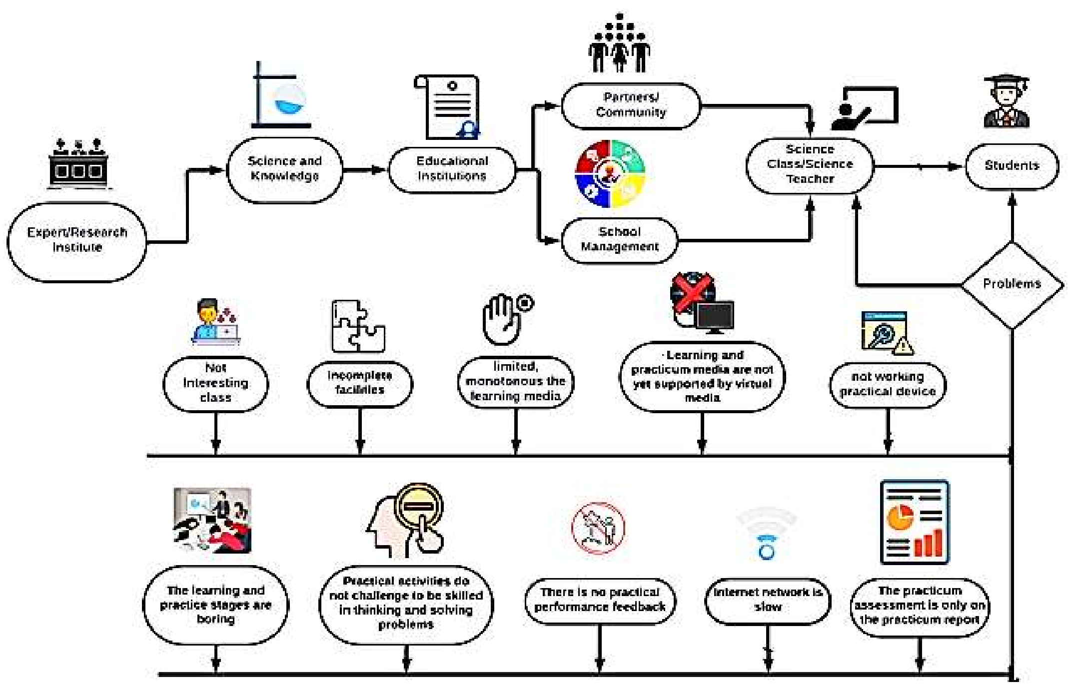

Figure 4. Rich picture problem mapping in science class

Problem Mapping

The information summarised from the results of the interviews is used as the basis for creating a rich picture or problem mapping to provide a point of view in the form of a visual depiction of what problems exist in the science learning process. Rich pictures are input from various points of view that can determine processes and relationships and reveal issues obtained and depicted through symbols (Figure 4).

According to Figure 4, the rich picture interprets problem mapping, including problems found in the science learning process. These problems can be grouped into supervision, responsibility, and the need for teachers to understand and maintain the quality of science learning services (Keiler 2018). The impact of the issues expressed by students can cause a decrease in students' interest in science learning at school (Reed et al. 2022).

The Rich Picture resulting from this root cause analysis can serve as a tool in systems thinking used to aid in comprehending complexity (Conte and Davidson 2020). In this context, the Rich Picture depicts various elements, relationships, and interactions within a complex system. In the early stages of system analysis, it is highly beneficial to capture and convey an understanding of the overall complexity of science learning situations, assisting stakeholders in viewing issues and relationships from multiple perspectives, thereby facilitating communication and discussion among various parties involved (Gisby et al. 2023; Maryam 2020; Yadin 2013).

Building a Problem Definition (Root Definition)

At this stage, each problem related to the condition of the problem is then outlined in a root definition, namely a system table for carrying out development activities on the quality of science learning. Table 1 memuat hasil analisis dan sintesis dari permasalahan yang telah dikumpulkan. In the context of scientific education, the issues are framed using formulations and CATWOE aspects, identifying them as fundamental problems. This approach aids in constructing a conceptual model that maps the interconnections between the scientific issues and the observed factual realities.

Table 1. CATWOE analysis of students' interest in science learning

CATWOE ASPECTS	CATWOE formulation
Learners: People who influence/are influenced by the quality of science learning services	Teachers, students, stake holders
Actor: a person who plays a role in an activity	Teacher: The person responsible for classroom learning services, starting from preparing learning tools, implementing learning and evaluating learning outcomes
	Learners: people who receive treatment and enjoy quality learning services in achieving learning goals
	Stakeholders: parties who enjoy the results of the learning process and provide input, improvements, and suggestions in efforts to achieve learning goals.
Transformation: Process and Change	There is an increase in the performance and professional quality of teachers in science learning, so that it has special characteristics in science learning so that it can inspire colleagues

World-View: Impact of System Implementation	Formation of interest and positive behavior from students so that they are motivated to review or study science learning material outside of class, and are enthusiastic about returning to science learning
Owner: The parties involved	School management (stakeholders) and teachers
Environment: Environmental constraints surrounding the system and their implications.	Science learning in Middle Schools in has not yet fully met students' expectations, which has an impact on positive attitudes, interests, and behavior so that they are increasingly motivated to repeat science learning outside the classroom.
Root Definition: The SSM approach plays a role in carrying out development activities on the quality of science learning in the classroom through the formulation of a conceptual model as a strategy for developing science learning in the classroom in the short, medium, and long term (X). The strategy that can be implemented by teachers is to increase productivity and quality of learning in accordance with recommendations (Y). It is hoped that the recommendations provided from the conceptual model can improve the quality of science learning services.	

The root definition is then entered into the CATWOE formula, namely C (Customer), A (Actor), T (Transformation), W (World-view), O (Owner), and E (Environment). The fourth stage is formulating a conceptual model for each part of CATWOE to achieve the appropriate objectives. This model examines the human activity system from the results of problem mapping in rich pictures and represents the relationships between activities (Gisby et al. 2023). This conceptual model is a framework in the form of a diagram of the overall relationship between aspects. All elements compiled in CATWOE are then included in the formulation of this model (Zarei et al. n.d.). CATWOE analysis facilitates the generation of a root definition of the problematic situation in science learning (Sulartopo, Manongga, and Nugraha 2021). It is embodied in a root definition statement that can be implemented as a solution in science education.

The results of CATWOE analysis are used to develop a conceptual model based on expert definitions to complement and extend the results of CATWOE analysis (Nair 2015). CATWOE serves as a mechanism or checklist for scrutinizing the principal definitions, ensuring that the selected terms are as precise as possible and accurately reflect the optimal choice for their intended meanings (Radfar et al. 2020). The CATWOE analysis is beneficial in solving learning problems because it helps identify various crucial aspects related to the issue at hand. By understanding customers, actors, transformation processes, worldviews, owners, and environments (CATWOE), one can better understand the problem at hand and develop more effective solutions.

Formulating a Conceptual Model

The next stage in the SSM method is building a conceptual model, namely describing a model for identifying activities needed to impact teachers and quality learning services positively. The formulation of the conceptual model results from the adaptation of norms and ethics and a response to the quality of science learning in Middle Schools in Aceh. Responses and feedback from students in this SSM system are presented in Figure 5. The conceptual model provides details of the issues that are the focus of problem-solving arising from the results of interviews and data exploration(Zarghani et al. 2024). The conceptual model is then considered an essential part of determining concrete steps toward students' responses to science lessons. All alternative solution recommendations given are organized, structured, and on target, including facilitating stakeholders in providing detailed task descriptions for problem-solving steps to avoid overlapping solutions (Stouten, Rousseau, and De Cremer 2018).

This has been elaborated from research on learning management development, explaining the need for a well-defined conceptual model that clearly articulates the essential components of the science approach implemented by teachers to conduct empirical research on the effectiveness of science lessons (Quigley, Herro, and Jamil 2017).

Compare the conceptual model.

The next stage is to pay attention to the results of comparing conceptual model formulations with factual science learning in class. The aim is to provide recommendations for improvement efforts teachers can carry out, maintain, or improve. Based on the conceptual model formulation that has been built, recommendations are classified into technical activities and policy activities. The recommendations given are presented in Table 4 and Table 5. Comparison of the Conceptual Model with the Real World (Perceived Reality). It includes recommendations for activities and measurable steps by stakeholders consisting of technical conceptual model activities, their presence in reality, and comments or recommendations.

Table 4. Comparison of conceptual models and real-world conditions in technical activities

Technical Activities	real-world conditions	Recommendation
Not interesting class	The classroom layout and classroom arrangement do not attract students' attention and interest in science, there are no pictures or eye-catching science props	Science teachers need to arrange the class in such a way as to have a dynamic seating arrangement, install pictures and props that attract students' attention to foster students' scientific attitudes such as curiosity, thoroughness, critical and responsible attitudes.
Incomplete facilities	Science classes and science laboratories do not have complete facilities, this often becomes an obstacle in achieving science learning objectives and does not at all help equip science as a product, process, and attitude.	Science teachers must be creative and innovative in looking for alternative media facilities, tools and learning resources in science classes and laboratories that can support the achievement of learning objectives and equip science, namely science in terms of products, processes, and attitudes.
Limited of materials and media learning	Science practicum learning stages, using learning materials and media that are limited to textbooks and are not updated with the current era, namely the era of the industrial revolution 4.0	Science teachers need to prepare learning tools and science practicums that are relevant to the era of industrial revolution 4.0 with the criteria of providing knowledge, improving 21st century skills and fostering a scientific attitude.

Learning or practical materials and media are not support by IT	The learning materials and media used by teachers in the science learning process are not yet supported by IT	Science teachers need to innovate in integrating ICT to support learning materials and media in increasing students' digital literacy
Practical tools and materials do not work	The practical equipment does not function as it should, the unscheduled implementation of the science practicum and the science teacher because this is less skilled in operating the practical equipment.	Science teachers need to schedule practical activities and use the available practical tools optimally. Science teachers also need to improve their lab management skills and use of practical tools, through training activities, good practices and/or practical visits to several nearby school laboratory
The learning and practice stages are boring	The implementation of learning and practice in the classroom or laboratory is not prepared dynamically and motivates students	Science teachers need to prepare learning and practice stages with a variety of media and varied learning resources, so that learning and practicum become dynamic and motivate students.
Does not challenge thinking and problem-solving skills	Science practicums are not designed and implemented to involve students' direct experience in completing assignments, so they do not train their thinking and problem-solving skills	Science teachers need to design and implement practicums that allow students to be directly involved in practical experiences so that they can equip thinking and problem-solving skills.
No feedback	Science classes, either during the learning process or practice, do not provide direct feedback to students when they submit assignments or work on them	Science teachers should provide feedback to students so that they are motivated and provide references for improvement, both in class and in the laboratory
Internet network is slow	Science classes are not supported by a strong internet network, this often becomes an obstacle in the learning and practice process	Science teachers need to prepare alternative independent internet networks from smartphone networks so that science learning and practice can still be supported by a strong and fast internet network.
Practicum assessment is only from report practicum	The science practicum assessment only uses the final performance report portfolio of practicum results	Science teachers need to prepare laboratory performance assessment instruments in an authentic and comprehensive manner from pre-lab, lab to post-lab performance in a fair manner

Table 5. Comparison of conceptual models and real-world conditions in policy activities

Policy Activities	Real-World Conditions	Recommendation
Learning Innovation and Practicum	Learning and practicums still use a verification model which does not provide opportunities to train students' thinking skills in concept discovery	Science teachers must innovate learning and practicums by using innovative learning and practicum models such as project-based learning and practicums, based on inquiry and problem solving.
Continuous improvement of teacher's professional	science teachers are not motivated to take part in continuous professional development programs such as training and workshops.	Science teachers need to make it a priority in taking the fight to be actively involved in independent learning programs, driving schools, as well as training or workshops to improve teaching and classroom management skills as part of a continuous professional development program
Regular Best Practices	There are no best practice activities carried out regularly, especially for science lessons, science teachers do not collaborate well with colleagues	Science teachers need to increase collaboration with colleagues in carrying out good practices related to learning innovation and science practice
MGMP Learning Teacher Forum	MGMP Science activities are not carried out routinely and have not had a significant impact on science lessons	Science teachers need to coordinate and communicate with colleagues to reactivate the MGPM teacher learning and deliberation forum

The following recommendation is that science teachers consider classroom conditions supporting science learning. The characteristics of science material or topics are very diverse, and it is necessary to provide students with direct learning experiences according to the topic's characteristics (Coman et al. 2020). Some topics are suitable for discussion and implementation in routine classes. Still, some other courses require deeper exploration of the surrounding environment or even present simulators, special tools for simulating proof of concept in science. Classroom management also determines the seriousness of learning; the layout of tools and demonstration materials that are easy to access and pay attention to security can provide learning comfort (Zainuddin and Hardiansyah 2023).

The following action is implementing recommended policy activities as plans and guidelines for improving the science learning process. Science teachers need to determine learning models and strategies that suit the characteristics of specific science topics procedurally to improve services and quality of learning (Tekin, Aslan, and Yýlmaz 2020). It is also essential for science lesson teachers to pay attention to elements of local wisdom integrated into learning to reduce the distance between science topics and students and better provide positive perceptions that align with their expectations of science (Pamenang 2021). One example of an element of local wisdom applied is using the sound of several dry coconuts in coastal and mountainous areas in science learning on Sound. Students become challenged and more motivated with a strong sense of curiosity. Finally, science lesson teachers need to innovate learning through the application of technology and collaboration with colleagues, regular best practices, and participating in continuous professional improvement activities so that they have a direct impact on the learning process (Delgado, Enríquez-Flores, and Jaimes-Nájera 2021)and impact the success of science lessons in reconstructing thinking skills and scientific attitudes (Haleem et al. 2022).

Determine Changes

The next step is to determine changes to achieve the targeted goals by carrying out improvement efforts based on the recommendations given in the previous stage. Teachers must study, understand, evaluate, and implement recommendations to improve teacher professional performance and impact students' perceptions, responses, and interest in the quality of science learning services. This is relevant to the results of (Tanti et al., 2020), which state that students' attitudes and behavior toward science learning have an impact on improving the quality of learning services. Students with positive attitudes and behavior will have higher motivation and interest in learning science, so they are expected to increase learning outcomes (Maison et al., 2021).

Corrective action

The final step is to determine the best strategy to overcome the problem of students' interest and enthusiasm for physics lessons. Therefore, science teachers need to define concrete steps that should be implemented, evaluated, and monitored so that the conclusions produced are correct and on target.

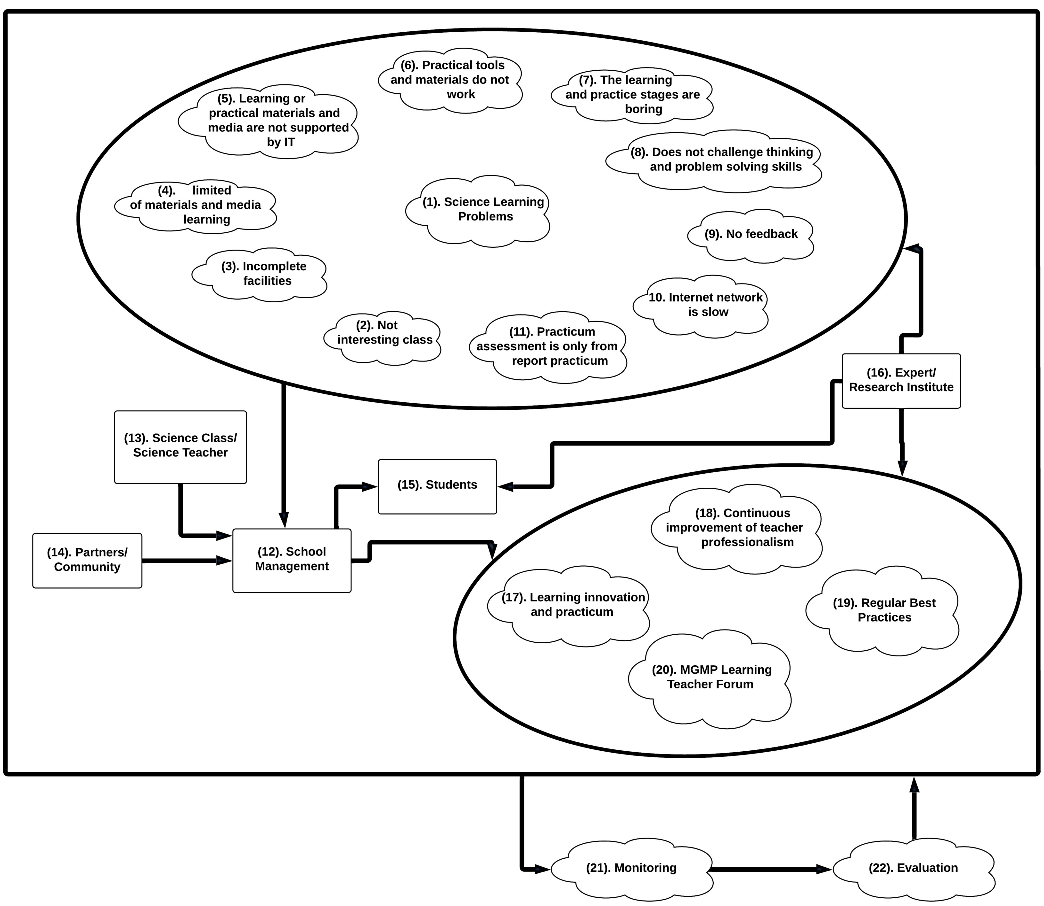

Figure 5. Formulation of conceptual models in science classes

The solution to this problem is to carry out two recommendation activities: recommendations from the results of technical comparisons between conceptual models and real-world conditions and recommendations based on policy activities. Technically, science teachers need to prepare teaching materials and learning tools that are interesting and appropriate to the characteristics of students, reflect on the models, strategies, and approaches that will be used in the science learning process so that they have an impact on achieving learning objectives, prepare media and learning resources that are easily accessible and be friendly with students, and choose a variety of teaching materials, media, and learning resources.

■ CONCLUSION

The results of this research summarise several factors that students consider when choosing and determining science lessons as engaging. These factors include the fact that science classrooms are neatly arranged, determining the location of tools and demonstration or practical materials that are easy to access, having impressive quality learning services, having a variety of learning models and strategies, having learning products, and implementing appropriate procedures in authentic and comprehensive assessment of the learning process. However, there are also several problems with human resources for science teachers who need to be more optimal in providing learning process services. These include limitations in mastering the material and providing relevant teaching materials, a few variations of learning media and learning resources, and a monotonous choice of learning locations. Therefore, a soft systems methodology (SSM) approach is proven to explain problems concretely. SSM can formulate a conceptual model as a strategy formulation for science teachers. Comparing the model with actual world conditions resulted in two recommended activity recommendations, including technical and policy activities. As these recommendation activities progress, the problems faced will be resolved by improving the professionalism performance of teachers with sustainable professionalism programs and creating productivity in the quality of science teaching program services.

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