JPPIPA 9(1) (2023)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Mapping Environmental Hidden Curriculum in Physics Learning

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Received: September 11, 2022
Revised: January 11, 2023
Accepted: January 25, 2023
Published: January 31, 2023

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DOI: 10.29303/jppipa.v9i1.2127

Abstract: Environmental problems that occur today have reached an alarming level. Global warming, flooding in the rainy season, and summer drought are environmental problems troubling people. These problems result from human behavior that is not wise in managing the environment. The trigger for this problem is human behavior, so the solution is to change behavior. Changes in human behavior toward the environment can be done by integrating various subjects, such as a "Hidden Curriculum." One of the subjects that can integrate environmental education is high school physics. For the integration to be right on target, it is necessary to design a curriculum. It is necessary to create a matrix of integration of education in learning senior high school vision. This article was written to convey the results of research in the form of environmental integration design in class XI semester two high school physics learning, mapping subject matter, and environmental competencies. The results obtained are in the form of an integration matrix. This matrix becomes a reference for developing programs and learning tools for implementing environmental education integration in physics learning class XI, semester 2. To achieve the objectives, qualitative research methods are applied.

Keywords: Environmental Hidden Curriculum; Mapping; Physics Learning Materials

Introduction

Environmental problems that occur today have reached an alarming level. Global warming, flooding in the rainy season, and drought in summer are examples of environmental problems that have been troubling people. These problems are a result of human behavior that is not wise in managing the environment. Another problem that is often heard is environmental damage due to illegal logging and excessive use of natural resources without any sustainable conservation efforts. Indonesia is a country with extraordinary natural resources because it has a variety of abundant natural resources such as oil, gas, coal, and vast forests (Roqoyyah, 2016). The environment and humans are two things that cannot be separated and influence each other. Humans use the environment to meet their needs, the environment requires humans to maintain and preserve it.

Law of the Republic of Indonesia Number 32 of 2009 states that the environment is a unitary space with all objects, forces, conditions, and living things, including humans and their behavior, which affect nature itself, the continuity of life, and the welfare of humans and other living creatures. People's behavior that destroys the environment, such as forests, causes the forest area to shrink. The increase in cases of environmental destruction and pollution is considered a major factor in the occurrence of disasters such as floods, landslides, forest and land fires (Ilhami, 2019). The low public awareness of the environment and the increasing environmental problems are caused by the low level of community environmental literacy. This requires understanding, skills, attitudes, and real action from all components of society as early as possible. The synergy between community components is needed to solve environmental problems through formal and informal education (Desnita, 2016).

How to Cite:
Marzuki, Y., & Desnita, D. (2023). Mapping Environmental Hidden Curriculum in Physics Learning. *Jurnal Penelitian Pendidikan IPA*, *9*(1), 197–206. https://doi.org/10.29303/jppipa.v9i1.2127

One of the efforts to increase public awareness of the environment is through formal education by implementing environmental literacy learning activities for students (Mauludah, 2018). Humans have a role and responsibility in empowering environmental wealth for the survival of the ecosystem. Humans are also one of the determining factors in preserving the environment (Karim, 2018). Environmental education is one of the efforts in providing environmental knowledge among school students. This is indicated by the assumption that if environmental knowledge increases, human behavior in caring for the environment will also increase and reduce environmental damage in the future (Nuzulia et al., 2020). Efforts to maintain and preserve the environment are not only carried out at home but also at school must maintain and preserve the environment.

The existence of an environmental crisis, must be immediately addressed through existing education. In education, it is not only formal education with an ideal curriculum that we usually get. Education with an actual currm that can be applied to increase students' awareness of the environment. The actual curriculum is the curriculum implemented in the teaching and learning process. The reality generally differs from expectations, but it should be close to the ideal curriculum. The actual curriculum is the development of values, attitudes, character, and may be influenced by the existence of a hidden curriculum

A hidden curriculum is everything that happens when the implementation of the ideal curriculum becomes the actual curriculum. Another meaning of the hidden curriculum is anything that is not planned or programmed that can affect changes in student behavior. This awareness is also interpreted as an environmental literacy attitude, which not only has knowledge of the environment but also has a responsive attitude and is able to provide solutions to environmental issues. Students as part of the community who are prepared as the next generation and agents of change in society need to be equipped with environmental literacy skills (Diana, 2018).

A person's environmental awareness can be seen based on the following indicators: Environmental awareness indicators include: (1) awareness of environmental problems: includes a measure of information about environmental problems that they have (2) views on environmental problems: a measure of the level of concern related to existing environmental issues (3) Environmental Optimism: includes a measure of belief in action in improving the quality of the OECD environment in (Amran, 2019).

Someone who has concern for the environment can be seen based on 3 criteria, among others, namely: (1) considers that existing environmental problems are serious problems and require solutions in their resolution; (2) support any environmental policies or provisions; (3) showing an attitude of participating in the settlement and in an effort to reduce the existing environmental damage. Various criteria above, if someone has these criteria, it is certain that that person has a sense of concern for the environment, and will always strive to protect the environment. because someone who has a sense of care and love for the environment really understands the importance of environmental values for our lives. A person's environmental awareness is influenced by various factors including: ignorance factors, poverty factors, humanitarian factors, and lifestyle factors of a person in Neolaka (Munawar, 2019).

Environmental literacy is a person's ability to understand and interpret the conditions of the environment, and from the results of this understanding and interpretation, a person can decide on appropriate actions to maintain, restore and improve the conditions of an environment (Kusumaningrum, 2018). The term "Environmental Literacy" is used in environmental education since 1969 by Roth in Amini, which means: The concept of environmental literacy is affirmed by the Environment Education and Training Partnership (EETAP) which states clearly that an environmentally literate person knows what he will do for the environment, he knows how to do it (Nasution, 2016). According to McBeth, a person's environmental literacy ability can be measured through four components, namely: (1) environmental knowledge which includes the basics of the environment; (2) attitudes towards the environment which include views about the environment, sensitivity to environmental conditions, and feelings towards the environment; (3) cognitive skills which include identification of environmental problems, environmental analysis and implementation of planning; and (4) behavior that includes concrete actions towards the environment (Aminrad, 2013).

Environmental literacy is a person's ability to understand the surrounding environment and play a role in efforts to protect, repair and improve environmental quality (Aldeva, 2019). Environmental education is a process that helps develop the skills and ethics needed to understand the relationship between humans and the environment (Febriasar, 2017). Cognitive skills are the abilities needed to analyze, and evaluate information about environmental problems/issues and to evaluate selected issues/issues based on evidence and personal values. This category also includes the skills needed to select appropriate environmental action strategies, and to create, evaluate, and implement action competencies as key constituents of functional EL (Erdogan, 2009).

These components are a reference used to assess the extent of a person's environmental literacy abilities. In

the application of environmental literacy in schools, these components should be described in the form of the criteria listed in the assessment rubric. Environmental literacy education should be instilled in children, especially in a formal education environment. This integration can develop students' knowledge, skills, technology and knowledge about the environment around them (Asrizal. 2018). This integration will of course be related to conformity with the curriculum that applies in the formal education environment (schools). The curriculum is one component of education that in general is a description of the vision, mission and educational goals of a nation.

In general it can be understood that the curriculum is an invisible curriculum, but plays a role in achieving educational goals. So that the hidden curriculum in this case is something that becomes a certain mission that is only known by a teacher or education manager. Hidden curriculum can be seen as an unwritten (hidden) goal. The hidden curriculum can be interpreted as everything that happens without being planned in advance which can be utilized by the teacher to achieve learning objectives (Mustaghfiroh, 2014).

Changes in human behavior towards the environment can be done through integration in various existing subjects, as a "Hidden Curriculum". One of the subjects that can integrate environmental education is high school physics. So that the integration is right on target, it is necessary to make a curriculum design in the form of teaching materials. It is necessary to create a matrix of integration of education in learning senior high school vision. One of them is by mapping the analysis and matrix of environmental integration on the subject matter that will be taught to students, for example on physics subject matter. Physics is one part of the branch of Natural Sciences that discusses everything that exists in this universe, and it contains facts, concepts, principles and procedures used to explain existing phenomena. Physics material also contains the concept of environmental literacy because this subject cannot be separated from the context of nature and human life, for that an analysis matrix of the material is needed. The physics material that will be analyzed is physics material for senior high school class XI semester 2.

The current environmental problems are worrying. Environmental problems have been troubling, such as flooding during the rainy season, drought and global warming. The trigger for this problem is human behavior, so the solution is to change behavior. Changes in human behavior towards the environment can be done through integration in various existing subjects, as a hidden curriculum. One of the lessons that can be integrated is learning physics. Physics learning is learning that is able to relate environmental phenomena to everyday life.

Based on research conducted, the environmental literacy of students in five ASEAN countries, one of which is Indonesia, is in the poor predicate (Marsha, 2020). This is due to several factors, namely: 1) The existing curriculum is only limited to the depth of content and the breadth of the study scope, 2) Teachers who are less trained in environment-based learning, 3) Teachers are more focused on achieving the objectives of the material and provide less special attention to environmental education, 4) Teaching environmental material focuses more on the cognitive aspects, 5) The strategies used in the learning process are more material oriented, 6) Local knowledge and environmental conditions at present are not used as learning resources (Aulia, 2019). As well as learning resources that are used to support the learning process only in the form of tetextbooksworksheets, non-text books, and contextual videos that are not integrated with the environment (Kusumaringrum, 2018). Overcoming these problems, it is necessary to develop teaching materials that are used as support in learning.

Teaching material is a generic term that is used as a support by teachers in the learning process to increase success in the teaching and learning process (Suwandari, 2018). The teaching materials to be developed are in the form of electronic worksheets. Electronic worksheets are student worksheets that use computer media. Before developing teaching materials, an analysis is needed related to the curriculum, teaching resources and materials, and the material to be taught. One of the material analyzes to be carried out is physics subject matter. Physics is a branch of Natural Science that discusses everything that exists in this universe, and contains facts, concepts, principles and procedures used to explain existing phenomena (Yeritia, 2017).

Efforts that can be made to be right on target need to be done in curriculum design. It is necessary to map the hidden curriculum in order to find out the integration of environmental education in high school physics learning. So that the results of this mapping can be used as a reference for the development of programs and learning tools for the implementation of integration of environmental education in learning physics in high school class XI semester 2. The purpose of this research is to map the environmental hidden curriculum in learning physics in high school class XI semester 2.

Method

This research is a descriptive study with a qualitative approach. Descriptive research aims to describe or describe systematically, factually, and accurately about the phenomena or relationships between the phenomena being investigated (Suprayogo, 2003). This study describes the physics material for

grade XI semester 2 which contains environmental literacy. The procedure in this study is divided into three stages, namely: the preparation stage, the implementation stage, and the completion stage. The preparation stage for obtaining information about the physics material for grade XI semester 2 which contains environmental literacy is conducting a preliminary study, preparing a research design, determining the subject and object of the study. The implementation stage collected data as needed, namely by analyzing the physics material for grade XI Isemester 2 which contained environmental literacy. Finally, the completion stage, there are several things that must be done, namely: processing the research data, drawing conclusions from the research conducted and reporting the results of the research. The data collection techniques used in this study were through documentation study and data analysis techniques used in this study. is a content analysis technique, namely by analyzing the content of written data.

Result and Discussion

One of the subjects that can integrate environmental education is high school physics. In order for the integration to be right on target, it is necessary to design a curriculum. The curriculum analysis carried out is basic competency analysis, student analysis, and environmental literacy analysis on Physics material for class XI semester 2.

Analysis of Basic Competencies in Physics for Class XI semester 2

This is done by solving the problems faced by the material being studied. Based on the analysis that has been carried out on the basic competencies of Physics material for class XI semester 2 and refers to competency standards and learning indicators so that the results of the basic competency analysis can be obtained as follows:

Table 1. Analysis of Basic Competencies for Grade XI Second Semester.

Basic competencies	Competency Level	Essential Concepts	Media & Teaching Materials Needed	Application
3.7 Analyze changes in the ideal gas state by applying the laws of thermodynamics 4.7 Creating works/models of the application of thermodynamic I and II laws	Analyze (C4) operational verb (OV) To Measure Achievement: • Analyze charts P, V, and T • Explain the concept ✓ Isothermal ✓ Isokhorik ✓ Isobarik ✓ Adiabatic • Formulate the first and second laws of thermodynamics • Analyze the carnot cycle process (W, T, P dan V)	• Heat • Temperature • Pressure • Effort/Energy • The kinetic energy of the substance • Volume of substance • Entropy • Carnot cycle	• Powerpoint (PPT), • Video. • Textbook • Student worksheet • Handout • Module	• AC • Thermos • Refrigerator • Vehicle engines
3.8 To analyze wave mechanical characteristics 4.8 Conducting an experiment on one of the characteristics of mechanical waves and the presentation of the results	Analyze (C4) OV To Measure Achievement: • Identifying symptoms: ✓ Reflection ✓ Refraction ✓ Diffraction ✓ interference • Analyze Characteristics: ✓ Transverse waves ✓ Longitudinal waves • Explain the concept of mechanical waves	• Reflection • Refraction • Diffraction • Polarization	• Trial Set • Powerpoint • Video. • Textbook • Student worksheet • Handout • Module	• Ripple tank • Flashlight • Rainbow • TV remote • Spectrometer • Objects placed in water
3.9 AnalyzeAnalyze Magnitude Wave physics walking and stationary waves in real cases 4.9 Conducting a traveling wave and stationary wave experiments, along with a	Analyze (C4) OV To Measure Achievement: • Formulate the wave equation: ✓ Frequency ✓ Fast wave propagation ✓ Phase angle • Analyze relationships *f,* T, n, t, V , λ	✓ Wavelength ✓ Period ✓ Fast wave propagation ✓ Equation deviation ✓ Speed equation ✓ The equation for acceleration	• Trial Set • Power point • Video. • Text book • Student worksheet • Handout • Module	• Wave the strings on the guitar when plucked • Silinki • Wave rope

Basic competencies	Competency Level	Essential Concepts	Media & Teaching Materials Needed	Application
presentation of the experimental results and their physical meanings	• Analyze equations : ✓ Walking waves ✓ Stationary waves	✓ Wave phase angle ✓ Wave phase ✓ Different phases ✓ amplitude		
3.10 Applying Applying the concepts and principles of sound and light waves in technology 4.10 Conducting experiments on waves	Analyze (C3) OV To Measure Achievement: • Formulate the speed of propagation of sound waves • Explain the concept: ✓ Sonar waves ✓ Effect Doppler ✓ The organa tube opens and closes ✓ Sound intensity level (I, I_1 dan I_0) • Menjelaskan gejala: ✓ Diffraction ✓ Grid	• The frequency of the sound waves • The principle doppler • Intensity and level of intensity • Hearing threshold • Surface area • Medium density • Energy, wave propagation • Light Spectrum	• Trial Set sound waves • Powerpoint • Video. • Textbook • Student worksheet • Handout • Module	**Sound wave:** • Sonar as to measure the depth of sseawater • To detect damage to metal • To detect abnormalities in • the body • Ultrasonoc Sensor Generator (USG) • Earing test **Light waves:** • Radar • Rontgen • Radio wave • Photocopy • Laser knife • Microwave • Photography • Lighting Technology
3.11 Analyze how the optical instrument works using the properties of light reflection and refraction by mirrors and lenses 4.11. Create works that apply the principle of reflection and / or refraction to mirrors and lenses	Analyze (C4) OV To Measure Achievement: • Identify optical instrument uses • Analyze image formation on: ✓ Mikroscope ✓ Lup ✓ Binoculars ✓ Camera ✓ Eyes • Analyze how the eye works	• Distance of accommodation • Shadow objects	• Trial Set optical • Power point • Video. • Text book • Student worksheet • Handout • Module	• Eyes and glasses. • Magnifying glass (loop). • Optic Microscope • Binoculars • Camera
3.12 Analyzing the symptoms of global warming and its impact on life and the environment 4.12 Proposing ideas / ideas for solving the problem of global warming in relation to its symptoms and impacts on life as well	Analyze (C4) OV To Measure Achievement: • Analyze the phenomenon: ✓ Global warming ✓ Green house effect ✓ Change • Explain the results of the agreement ✓ VCC ✓ Kyoto protocol ✓ APPCOD • Analyzing alternative energy sources	• Carbon emissions and climate change • efficient use of energy • search for alternative energy sources such as nuclear energy	• Power point • Video. • Text book • Student worksheet • Handout • Module	• Land use Change • Forest burning • Factory waste • Motor vehicle waste • CFC and Insecticides • Flood and drough • Solar panels • Power plants

The material analysis relates to competency levels, essential concepts, and applications. The material is analyzed on the application of the material that occurs in everyday life. The essential concept analysis is the basic key used to explain the phenomena encountered with the material being studied.

Student Analysis

After the analysis of the material is carried out, the analysis of students is carried out which is intended to identify the characteristics of students as a whole, including an analysis of interests, motivations, attitudes, and learning styles. Interest is a sense of preference, a sense of interest, interest in giving a positive influence on academic learning, domains of knowledge, and certain fields of study for individuals. Interest in learning can be measured through 4 indicators of learning, attention to learning, motivation to learn, and knowledge. Interest in learning is defined if someone who is interested in a lesson and will have a feeling of interest in the lesson. He will study hard and continue to understand all the knowledge related to the field, he will follow the lessons enthusiastically and without any burden on him.

Motivation is an effort or encouragement that is made consciously to take action to learn and realize directed behavior for the achievement of the expected goals in learning interaction situations. Motivation can be measured by 5 indicators as mentioned by UNO, namely the existence of a desire and desire to succeed, the existence of a drive and need in learning, the existence of hopes and aspirations for the future, the existence of interesting activities in learning, the existence of a conducive learning environment, thus enabling a person to learn. students can study well (Putri, 2020). According to Harlen, attitudes have five curiosity, perseverance, creativity and inventiveness, cooperation with others, and sensitivity to the environment. Learning style is the tendency of students to adapt certain strategies in their learning as a form of responsibility to get a learning approach that is in accordance with the demands of learning in the classroom/school as well as the demands of the subjects (Sulis, 2013).

Analysis of Integrated Physics Materials Environmental Literacy

Furthermore, an analysis of the material for Physics class XI semester 2 which contains environmental literacy is carried out. The Minnesota Office of Environmental Assistance states that environmental literacy is an individual's knowledge and understanding of aspects that make up the environment, and is able to act to maintain the environmental quality that is applied in everyday life. Therefore, in order to develop environmental literacy, environmental education must develop an understanding of life in the environment, the causal relationship between human attitudes and behavior towards the environment, and foster environmentally responsible behavior. A person's environmental literacy status can be measured based on 4 components of environmental literacy, namely: knowledge (Knowledge), cognitive skills (cognitive skills), attitudes (attitude) and environmentally responsible behavior (Behavior). From the point of view of the role of education in environmental literacy, it can be exemplified, for example, a teacher may one day become part of the most effective local government council, if he can successfully weigh options, identify alternatives, communicate, ask the right questions, analyze input, and make decisions. In other words, in learning, it is not only the knowledge aspect that is emphasized, but thinking, affective and behavioral abilities are also the main benchmarks for the success of environmental education programs (Saribas 2015).

Furthermore, environmental literacy has 3 aspects, namely the three aspects of environmental literacy which include knowledge, attitude, and concern have been strengthened through education. The choice of problems is associated with phenomena and events that are close to students' lives, making it easier for students to understand the concept of the environment in depth. Furthermore, media development is also carried out by considering student learning activities so that learning outcomes are designed to include cognitive, functional, and behavioral components with the aim of training students in environmental literacy (Ulfa, 2020). Strengthening environmental literacy is expected to support the formation of an attitude towards behavior accompanied by the presence of subjective norms and perceived behavioral control so as to form behavioral intentions. Behavioral intention as a form of behavior (Syamsiah, 2017). Knowledge has an important role in bringing about behavioral changes in a person. Environmental education is a way that can be taken to impart knowledge about the environment (Pothitou, 2016).

Environmental literacy-based learning aims to understand the concepts and principles of the environment and individuals are able to apply them in daily life and play an active role in overcoming environmental damage, both individually and in groups. In addition, environmental-based learning aims to make students care and protect the surrounding environment. Environmental literacy is very appropriate if it is integrated in the 2013 Curriculum which focuses on character and competence. The environmental literacy ability can be adjusted to the learning material. The following are the results of the

analysis of Physics material which includes environmental literacy.

Table 2. Analysis of Physics Material grade XI Second Semester which contains Environmental Literacy

Basic Competencies	Environmental Literacy			
	Environmental Knowledge	Attitude to the Environment	Environmental Behavior	Environmental Problem-Solving Skills
3.7 Analyze changes in the ideal gas state by applying the laws of thermodynamics 4.7 Creating works / models of the application of thermodynamic I and II laws	• Each air conditioner compressor releases heat from cold temperatures to hot temperatures that can cause global warming	• Invite others to turn off the air conditioner when not needed	• Use the air conditioner as needed	• Avoid using the air conditioner for too long • Use the timer on the air conditioner
3.8 To analyze wave mechanical characteristics 4.8 Conducting an experiment on one of the characteristics of mechanical waves and the presentation of the results	• The waves on the sonar can be used to catch fish in the sea	• Using sonar waves to find fish in the ocean without damaging coral reefs	• Using sonar to find fish	• Sonar waves can detect fish without damaging coral reefs
3.9 AnalyzeAnalyze Magnitude Wave physics walking and stationary waves in real cases 4.9 Conducting a traveling wave and stationary wave experiments, along with a presentation of the experimental results and their physical meanings	-	-	-	-
3.10 Applying the concepts and principles of sound and light waves in technology 4.10 Conducting experiments on waves	• Noise affects environmental health	• Build a house soundproof to avoid noise	• Wear appropriate and appropriate noise protection equipment	• Avoid building settlements or houses in factory areas, airports • Keep the house away from noise places
3.11 Analyze how the optical instrument works using the properties of light reflection and refraction by mirrors and lenses 4.11. Create works that apply the principle of reflection and / or refraction to mirrors and lenses	• Glasses are useful for clarifying vision	• Tell others to watch out for eyes • Check the eyes to an ophthalmologist to find out the right glasses	• Wear glasses in accordance with eye complaints	• Avoid watching TV and do not look too closely at the cellphone • Avoid reading lying down • Expand to eat vitamin A
3.12 Analyzing the symptoms of global warming and its impact	• Greenhouse gases contribute to the depletion of the ozone	• Encourage the community to plant trees and not to cut	• Planting trees to protect the earth from	• Save the earth by protecting the forest and planting trees

Basic Competencies	Environmental Literacy			
	Environmental Knowledge	Attitude to the Environment	Environmental Behavior	Environmental Problem-Solving Skills
on life and the environment 4.12 Proposing ideas / ideas for solving the problem of global warming in relation to its symptoms and impacts on life as well	layer and global warming • Drought is a risk from global warming • Drought is a risk from global warming • Plastic waste can damage the environment • Save electrical energy • Solar panels reduce global warming and save energy	down the forest carelessly • Inviting people to overcome drought with greening • Telling others to avoid using plastic bags when shopping • Invite others not to be lazy to turn off the light • use less electronic devices • Turn off electronics manually • Using solar panels to save dependence on coal-based electricity	global warming • Doing reforestation by planting trees so that they can absorb rainwater • Do not use items with small plastic packaging as this will increase waste • Use energy efficient lighting and electronic devices • Solar panels do not take up a large area and are easy to use	• Overcoming drought by saving water • Dredge the reservoir to make it deeper so that it can accommodate more water • Bring a place to eat when buying food outside the home • Bring a drinking bottle from home • Optimizing sunlight in everyday life • Replace light bulbs at home with energy efficient CFL or LED bulbs • Solar panels can be installed in homes, offices, hospitals and buildings by relying on solar energy

Based on table 2 of the analysis of environmental integration material, learning programs and environmentally integrated learning tools can be developed in physics learning to achieve Basic Competencies 3.7, 3.8, 3.10, 3.11, and 3.12. The basic competencies contain environmental literacy, namely environmental knowledge, attitudes, behavior, and skills toward the environment.

Conclusion

Based on the results and discussions that have been carried out, the design of environmental integration in physics learning in senior high school class XI semester 2 is in the form of mapping subject matter and environmental competencies. The results obtained in the form of an integration matrix, namely the analysis of environmental literacy in the Physics material of senior high school class XI semester 2, is the achievement of basic competencies containing environmental literacy. This matrix becomes a reference for developing programs and learning tools for implementing environmental education integration in physics learning class XI, semester 2.

Acknowledgments

Thank you very much to Mrs. Dr. Desnita, M.Si who has guided me in this research.

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