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The Role of the ASICC-SLICES Model in Promoting Science Literacy and Collaboration Skills: A Pathway to Educational Sustainable Development

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Abstrak: Kurangnya literasi sains dan keterampilan kolaborasi dapat menghambat siswa SMA dalam menghadapi tantangan global dan mendukung aksi kelestarian lingkungan. Oleh karena itu, mengembangkan literasi sains dan keterampilan kolaborasi sangat penting, terutama dalam pendidikan biologi. Model ASICC-SLICES (*Adapting, Searching, Interpreting, Createing, and Communicate based on Science Literacy Circles*) meningkatkan literasi sains dan keterampilan kolaborasi siswa. Studi kuasi-eksperimental ini, menggunakan desain kelompok kontrol *pretest-posttest*, bertujuan untuk mengevaluasi efek model ASICC-SLICES dalam meningkatkan literasi sains dan keterampilan kolaborasi siswa dan kontribusinya terhadap Pembangunan Berkelanjutan Pendidikan. Populasi penelitian terdiri dari siswa kelas sepuluh dari sekolah menengah negeri di Lampung, dengan sampel 70 siswa diperoleh dengan menggunakan teknik Cluster Random Sampling. Instrumen penelitian meliputi tes literasi sains, kuesioner, lembar observasi keterampilan kolaborasi, dan dokumentasi. Data dianalisis menggunakan MANOVA dengan α 0,05. Hasil penelitian menunjukkan bahwa penerapan model ASICC-SLICES secara signifikan meningkatkan literasi sains dan keterampilan kolaborasi siswa, dengan skor n-gain untuk kelompok eksperimen dan kelompok kontrol (sig) 0,000<0,05 (α). Temuan ini menunjukkan bahwa model ASICC-SLICES berkontribusi positif terhadap kesadaran dan tindakan siswa dalam mendukung kelestarian lingkungan.
Kata kunci: Keterampilan Kolaborasi; Pendidikan Pembangunan Berkelanjutan; Model ASICC-SLICES; Literasi Sains 4.

Abstract: The lack of science literacy and collaboration skills can hinder high school students in facing global challenges and supporting environmental sustainability actions. Therefore, developing science literacy and collaboration skills is crucial, particularly in biology education. The ASICC-SLICES model (Adapting, Searching, Interpreting, Creating, and Communicating based on Science Literacy

Circles) enhances students' science literacy and collaboration skills. This quasi-experimental study, using a pretest-post-test control group design, aims to evaluate the effect of the ASICC-SLICES model on improving students' science literacy and collaboration skills and its contribution to Educational Sustainable Development. The study population consisted of tenth-grade students from a public high school in Lampung, with a sample of 70 students obtained using the Cluster Random Sampling technique. The research instruments included a science literacy test, questionnaires, observation sheets for collaboration skills, and documentation. Data were analysed using MANOVA with an α of 0.05. The results showed that the implementation of the ASICC-SLICES model significantly improved students' science literacy and collaboration skills, with n-gain scores for the experimental and control groups (sig) 0.000<0.05 (α). These findings indicate that the ASICC-SLICES model contributes positively to students' awareness and actions in supporting environmental sustainability.

Keyword: Collaboration Skills; Education Sustainable Development; ASICC-SLICES model; Science Literacy.

1. Introduction

The 21st century is a century of social development marked by technological progress and the use of information technology in all aspects of life, including education [1]. This development not only brings positive impacts but is also accompanied by negative impacts such as environmental damage and pollution. So that the need for commitment from the entire world community to implement sustainable development as a principle in life [2].

Education for sustainable development (ESD) is a process based on noble ideals and principles that are based on sustainability by focusing on all levels and types of learning in order to provide high-quality education and promote sustainable human development. One of the goals of ESD according to UNESCO is to make students learn to utilize, care for, and improve the condition of our nature [2].

To realize ESD in order to create a sustainable future, education is the main priority that plays an important role in forming and preparing a world society that supports sustainable development. There are several ESD criteria, namely student-centered learning, learning that uses a variety of method approaches, education based on daily life and education that prioritizes local issues [3].

Science literacy and collaboration skills are two important pillars that support the achievement of ESD. Science literacy is fundamental knowledge that underlies understanding and skills in a field of study or discipline that includes facts, concepts, principles, and basic information needed to understand more complex topics that enable society to be responsible and care about the problems around them and those they are facing [4]. So that every society must have science literacy skills [7].

In addition to scientific literacy, the competencies required in the 21st century framework include three skill groups, one of which is learning and innovation skills, with one of the demands that students must have is being able to communicate and collaborate, which allows individuals to work effectively in teams to achieve common goals [5]. Collaboration skills are included in meta knowledge which includes an understanding of how knowledge is obtained, how knowledge is used, and how best to process and manage knowledge. This is in line with previous research that educators must teach academic and collaborative skills. because it has an impact on learning and knowledge retention [6].

A preliminary study of scientific literacy conducted in class X of SMA Negeri 1 Bumi Agung obtained a very low category with an average result of 34%. On the other hand, the survey results regarding student collaboration skills are in the low category, with an average of between 24% and 26%.

To overcome the challenges that exist when implementing ESD in schools, a new pedagogical approach is needed that focuses on sustainable development goals. This approach will help students learn about things other than the environment. One of the innovative learning models that can orient the goals and criteria of sustainable development education is the ASICC learning model based on Science Literacy Circles.

The ASICC model has stages of Adapting, Searching, Interpreting, Creating, and Communicating, giving students the opportunity to build their understanding through group learning. This learning model is based on the

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concept of learning that is built on social interaction or zone proximal development [8].

Meanwhile, Science Literacy Circles is a learning method that focuses on student participation in analyzing science concepts and dividing students into several roles or responsibilities in learning groups called literacy circle roles. The division of roles includes discussion leaders, word explorers, visionaries, thought connectors, webmasters, and development of big ideas [9].

The difference between this study and previous studies is that there has been no research that maps the SLC-based ASICC learning model to Student Science Literacy and Collaboration Skills. This learning model also has advantages that not only focus on the development of understanding but also on the skills and emotions of students [8].

2. Research Method

The research was conducted on May 6-23, 2024 with the material of Biological Technology Innovation for the even semester in class X of SMA Negeri 1 Bumi Agung, Way Kanan Regency, Indonesia. The type of quantitative research uses the following quasi-experimental design approach.

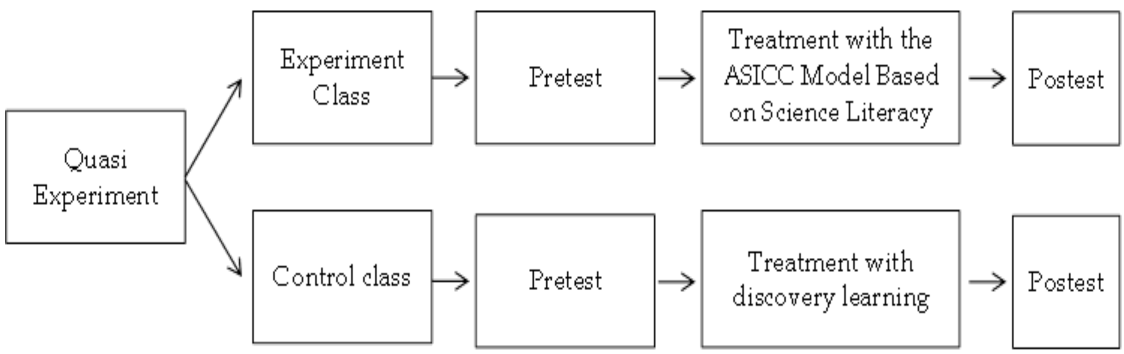

Figure 1. Research Procedure

The population used was class X even semester with cluster random sampling technique which obtained two groups, namely group X 1 (34 students) as the experimental group will use the ASICC model based on science literacy circles, and group X 2 (36 students) as the control group using the Discovery Learning model. The indicators of science literacy used are as follows [2].

Table 1. Grid of Scientific Literacy Instruments

Aspects of Scientific Literacy	Science Literacy Indicators	Amount
Science process	Explaining scientific phenomena Designing and evaluating science investigations Interpreting data and evidence scientifically	16
Science content	Health and Disease Technology and science Environmental Quality	10
Context of science applications	Personal context	4

The non-test techniques used are questionnaires and observation sheets to measure collaboration skills. The following is a description of the collaboration skills indicators that will be used.

Table 2. Science Literacy Questionnaire Grid [10].

Indicator	Sub Indicators	Amount
Responsibility	Have high responsibility in completing tasks Submit assignments on time	6
Respect	Behave well and politely to teammates or other classmates. Respect other people's opinions and points of view	6
Contribution	Contribute knowledge, opinions and skills actively and consistently Providing constructive feedback	6
Organize work	Create a detailed to-do list Set schedules and progress updates on goals and deadlines Store materials, drafts, and notes in an organized manner	6
Work as a whole team	Recognizing the special abilities of the team Work on individual tasks separately and bring them back to the team to discuss together.	6

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Data analysis calculations using the assistance of the IBM SPSS statistics 23 program at a significance level of 5% or 0.05. Then the hypothesis test is used, namely the MANOVA test [11].

3. Results and Discussion

The following is a description of each ASICC model syntax based on Science Literacy circles.

Table 3. Syntax of ASICC Learning Model.

Syntax	Learning Activities
Adapting	Presentation of contextual stimulus of local issues and division of roles in literacy circles
Searching	Students with the role of web master search, find and examine various facts about science concepts from relevant sources to solve the problems being discussed. Students in the role of thought connectors connect with everyday life.
Interpreting	Students discuss to convey ideas from the problems in their respective groups. Students with the role of word explorers reprocess the results of their group members' discussions with new, more interesting words to be filled in the LKPD.
Creating	Students with visionary roles fill out the LKPD.
Communicating	leader presents a report on the results or conclusions that have been obtained by his group regarding the problems contained in the LKPD. Other groups are given the opportunity to respond and provide arguments about the results of the discussion that have been presented. The teacher equates the concepts.

a. Science Literacy Results Data

Table 4. Comparison of Science Literacy Results of Experimental and Control Classes

Information	Experimental Class (X 1)			Control Class (X 2)		
	Pretest	Posttest	N-Gain	Pretest	Posttest	N-Gain
Average	29%	84%	0.78	30%	82%	0.53
Criteria	Very Low	Good	Tall	Very Low	Enough	Currently
Number of Students	34 Students			36 Students		

Table 4 shows that the scientific literacy of the experimental class (X 1) obtained a higher score than the control class with an initial test score of 29% then becoming 73% and an N-Gain value of 0.63.

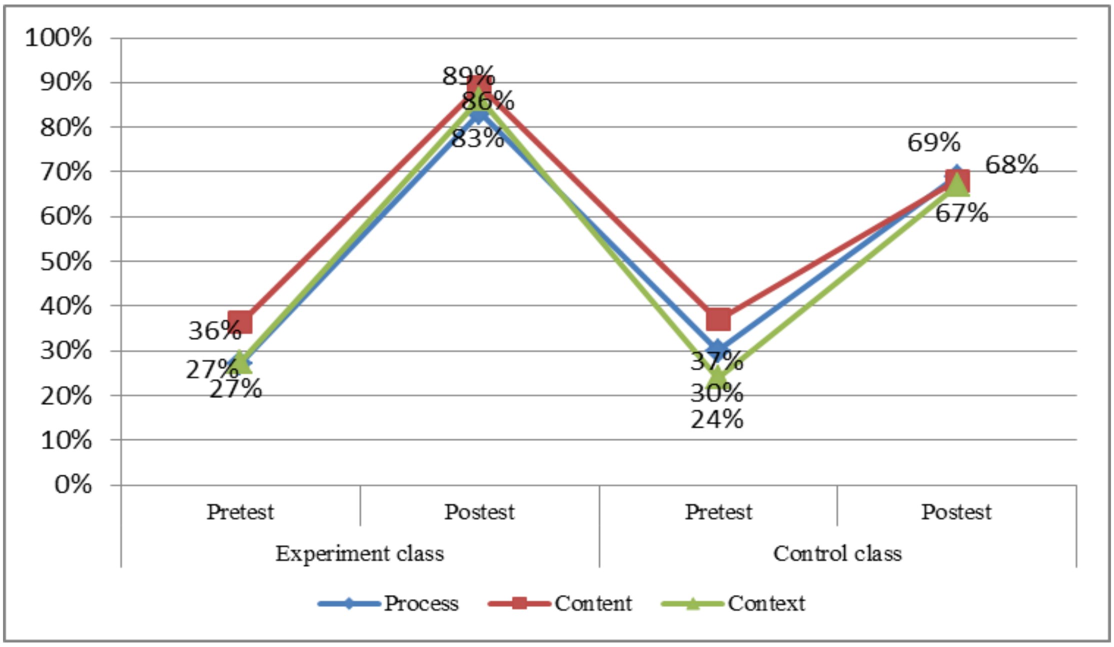

Figure 2. Percentage of Science Literacy Aspect Values for Experimental and Control Classes

In the picture, the experimental class process aspect obtained the highest posttest score, namely 89%. Cognitive learning theory explains that students will use new information and integrate it with previous knowledge [12]. In other words, the cognitive level of students will have an impact on the formation of understanding, thinking skills, and students' ongoing awareness behavior [13].

The content aspect of the experimental class was initially 36% and increased to 89% at the time of the posttest or greater than the posttest score in the control class, which was 68%. The increase in score was due to the presence of scientific content related to basic scientific concepts needed to explain the phenomenon of biological technology innovation related to everyday life [14].

The third aspect is the context of science in the experimental class, students answered correctly during the pretest, which was 27% and increased to 86% during the posttest. The context aspect includes important problems presented in the form of scientific problems related to everyday life, which includes school problems and life as a whole [15].

b. Collaboration Skills Result Data

Information	Experimental Class (X 1)			Control Class (X 2)		
	Pretest	Posttest	N-Gain	Pretest	Posttest	N-Gain
Average	68%	83%	0.48	67%	78%	0.33
Criteria	Tall	Very high	Currently	Tall	Tall	Currently
Number of Students	34 Students			36 Students		

From table 5, it can be seen that the value of collaboration skills in the experimental class is higher than the control class. Below is a graph of the analysis of collaboration skills indicators in the experimental class and the control class.

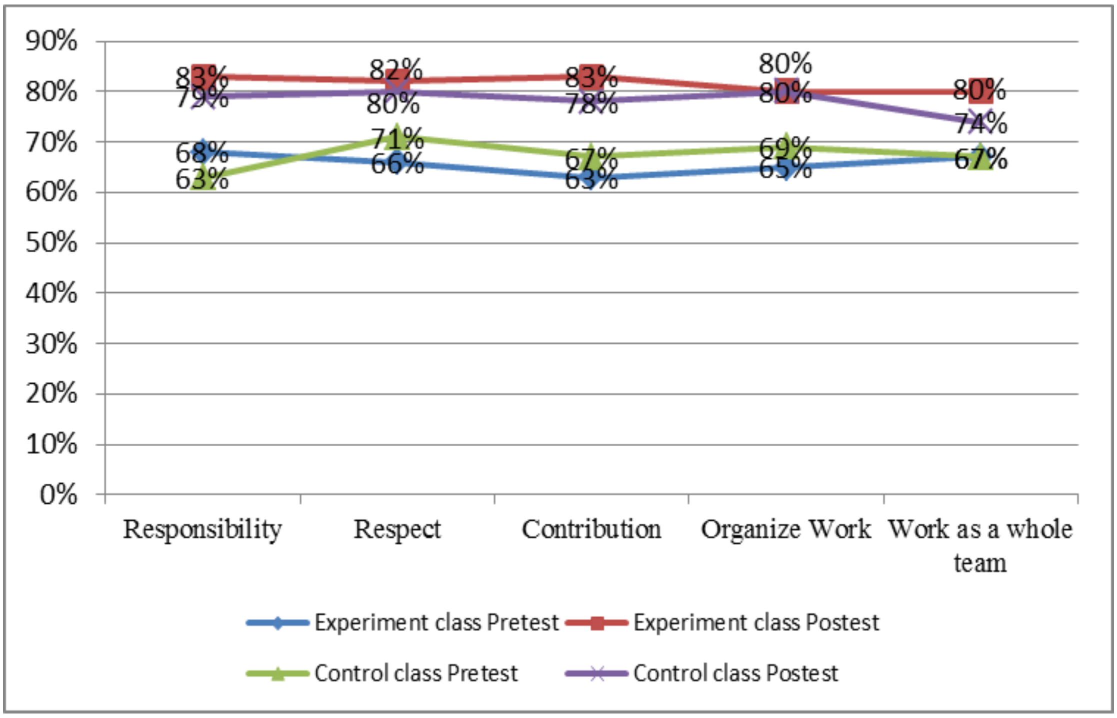

Figure 3. Percentage of Collaboration Skills Indicator Values for Experimental and Control Classes

Based on Figure 3, the average results of each indicator show better results during the posttest compared to the pretest with the average value of the experimental class being higher than the control class.

The results of the analysis have different results. The responsibility indicator of the experimental class is 83% and the control class obtained a value of 79%. The division of literacy circle roles fosters a sense of responsibility in students by completing tasks well [17].

The respect indicator in the experimental class was 82% while in the control class the average score was 80%. Students not only expand their own knowledge, but also learn from the experiences or ideas of other students so that it will help improve understanding effectively [21].

The contribution indicator in the experimental class obtained an average of 83% while in the control class it obtained a value of 78%. Students are required to be able to complete the responsibility in the division of literacy circles roles so as not to hinder the progress of the group [16]. So that students actively contribute actively and consistently [19]. The organize work indicator with an average value of 80% in the experimental class and 80% in the control class. In the experimental class, the indicator of organizing work is practiced when dividing roles for each individual [5].

The indicator of work as a whole team with an average value of 80% in the experimental class and 74% in the control class. Students can work together in teams and can recognize the special qualities of each group member. So that group goals will be more easily achieved through the process of sharing knowledge and skills [18]. Then the researcher also assessed the collaboration skills of students using the observation sheet which will be presented in Figure 4 below.

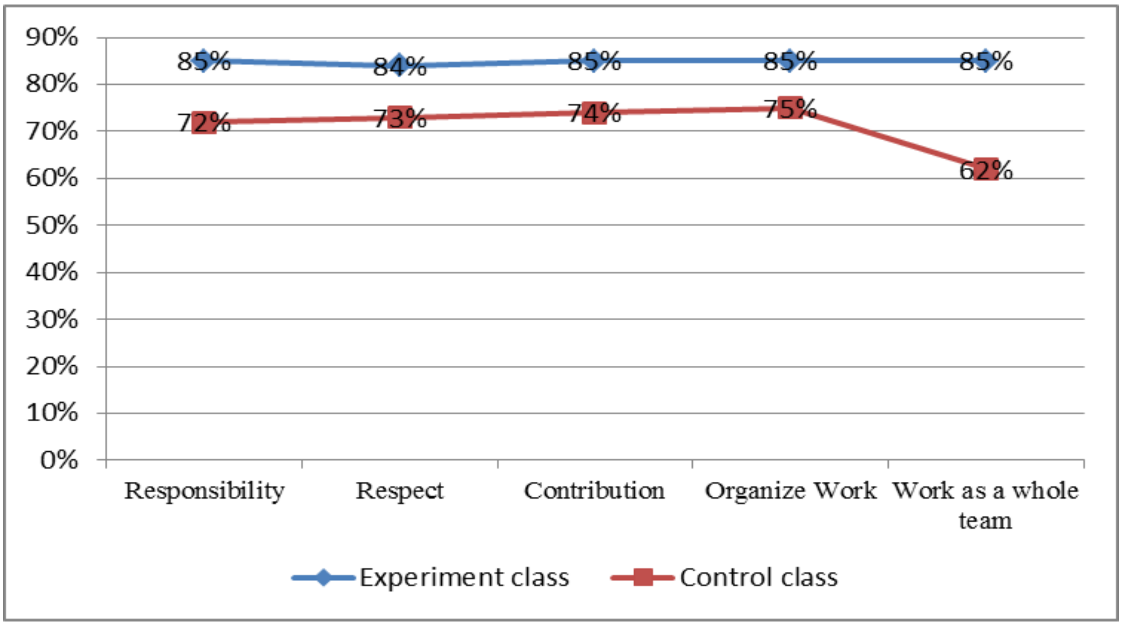

Figure 4. Results of the Experimental and Control Class Collaboration Skills Observation Sheet

Based on the image, it can be seen that the results of the experimental class observation sheet show better results than the control class.

c. Hypothesis Testing

The MANOVA hypothesis test was conducted after the data was confirmed to be distributed homogeneously and normally.

Table 6. MANOVA Hypothesis Test Results.

Dependent Variable	Independent Variables	Type III Sum of Squares	df	Mean Square	F	Sig.
SLC-based	Science Literacy	4202.714	1	4202.714	30,821	0,000
ASICC model	Collaboration Skills	719,950	1	719,950	16,762	0,000

The calculation results in table 6 show that both variables meet the significance value <0.05 so that there is an influence of the ASICC model based on Science Literacy Circles Circles on students' scientific literacy and collaboration skills

4. Conclution

Referring to the results and discussions that have been presented, it is known that the hypothesis test obtained a significance value of 0.000 <0.05 so that the results indicate that the ASICC-SLICES learning model can be used to improve students' scientific literacy and collaboration skills towards sustainable education development.

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