

Participatory Action Learning of Pre-Service Teachers to Develop Learning Materials with Plastic Recycling for Primary School Students in Central Thailand

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Abstract

The research aimed 1) to study the need in developing learning materials with plastic recycling for primary school students in Central Thailand, 2) to develop learning materials with plastic recycling for primary school students in Central Thailand based on action learning of pre-service teachers and 3) to distill the lesson learned from developing learning materials with plastic recycling for primary school students in Central Thailand based on participatory action learning of pre-service teachers. Participatory Action Research (PAR) was used. The sample in the research consisted of (1) school administrators, teachers, staff of teachers, and student representatives, accounting for 30 people; 2) experts in learning management, accounting for 9 people; and 3) pre-service teachers, accounting for 100 people, coming with a total of 139 people. The instrument used in the research consisted of 1) unstructured interview forms, 2) assessment forms of learning materials, and 3) recording forms of focus group discussion. Qualitative data was analyzed based on content analysis and the presentation was in the form of descriptive analysis. The study results revealed that:

1) Regarding the need for developing learning materials with plastic recycling for primary school students in Central Thailand, it was found that recycling is suitable for being developed as learning materials for students due to utilizing recycled materials worthily. Moreover, durable learning materials can be built as well and can be used for a longer period of time. This does not increase the budget burden of schools and is consistent with the concept of education for sustainable development. The researchers have synthesized the obtained data to be the participatory action approach for developing learning materials or 4P consisting of (1) Plan, (2) Process, (3) Present and (4) Practice.

2) Regarding developing learning materials with plastic recycling for primary school students in Central Thailand based on action learning of pre-service teachers, it was found that the pre-service teachers were able to design and develop learning materials from plastic recycling creatively and to use them in schooling management efficiently.

3) Regarding distilling the lesson learned from developing materials with plastic recycling for primary school students in Central Thailand based on participatory action learning of pre-service teachers, the competency of being professional teachers important of pre-service teachers in 4 aspects or so-called LISA consisting of (1) Learning Management, (2) Innovation (3) Self-development and (4) Assessment of Learning This helps promote the competency of earning a living of the pre-service teachers to be more efficiently.

Keywords: participatory action learning, learning materials, pre-service teachers, education for sustainable development

1. Introduction

From the concept of the fourth goal for sustainable development (SDGs) in confirming equitable and thorough education, and promoting lifelong learning for everyone, being successful covers quality education. This

emphasizes the already proven belief that education is one of the driving forces efficient for sustainable development. Moreover, the objective is to arrange occupational training with proper prices equally and get rid of sexual inequality and differences with an intention to succeed in accessing the universal principle for higher education with qualities and developing learning skills entering the local community of one's own. The environment must be relied on as import lesson in integrating learning in the science of other fields. One of the approaches to the operation is building and upgrading educational equipment and instruments sensitive to children, the disabled with impairments, and genders, and there should be a learning environment that is safe, violence-free, inclusive, and effective for everyone. The objective is to guarantee that every student will receive the knowledge and skills required for sustainable development. This also includes education for sustainable development, having a sustainable way of life through cultural diversities, and cultural participation towards sustainable development (United Nations, 2015; Mangkhang, 2021).

The vision of the basic education core curriculum B.E. 2551 focuses on developing every student who is national power to be human beings with physical, knowledgeable, and moral balance. They should have a conscience of being a Thai citizen and a world citizen who holds on to democracy with the King as the head of the state. They should also have the knowledge and basic skills, including attitudes necessary to education, occupations, and lifetime education. Students are focused importantly on the basis of the belief that everyone can learn and develop themselves according to potential (Ministry of Education, 2008). Therefore, it is essential indeed that educational management must focus on arranging education for all. This is the main approach according to the National Economic and Social Development Plan, Edition 13 (B.E. 2566–2570) which must arrange education in the form of No Child Left Behind (Office of the National Economics and Social Development Council, Office of The Prime Minister, 2022; Mangkhang, Muangjai, Jarupongputtana, Kaewpanya, & Kaewpa, 2022). Moreover, educational management must focus on using the concept of educational management for sustainable development to be consistent with the international direction in developing education together with developing the society to be sustainable among social and environmental changes.

Sustainable development is to connect concepts with the principle of organizing a society to achieve the goal of developing humans sustainably. At the same time, natural resources and the ecosystem must be taken care of to be consistent with the same direction economically and socially based on interdependence with balance. The objective is to achieve social progress, environmental balance, and economic growth. This is the guideline for development revised to use resources for the next generation in the future. Sustainable development must integrate the concept of economics, ecology, and sociology by combining the three principles as the development principle which will help bring about guidelines or directions of development in the same direction or lead towards the same goal completely, which meet the needs and urgent necessity at present. In any case, the standard of sustainable development must take into consideration long-term sustainability. This also includes measures of keeping resource heritage which will be passed on to the next generation and is the development that distributes benefits of economic progress thoroughly as well as being the development that protects the environment locally and globally in an overall picture. It is the development that makes life qualities better indeed. It is the form or the development plan which builds balance to human beings, society, nature or the environment, and technology. It can correspond to using limited resources to be under changes not exceeding the competency of available environmental structures for maximum benefits to human beings. The important principle of sustainable development is to build balance between 3 dimensions of development, namely: the dimension of sustainable economic development: which is developing the economy to grow qualitatively, distributing incomes to benefit most people in the society, especially for low-income people; dimension of developing sustainable society which is developing people to have the knowledge, competency and higher productivity, promoting society to bring about qualities and to become a society of learning; and the dimension of developing a sustainable environment which is using natural resources in the quantity for which the ecosystem can recover to be back to its original conditions. Pollutants must be emitted to the environment at the level that the ecosystem can absorb and destroy whereby they can be produced to replace exhausted resources (Ministry of Natural Resources and Environment, 2013; Rakthin Laoha, 2018; Evers, 2017; Kua, 2002; Mohieldin, 2017).

Education is an important instrument in society all over the world used to develop citizens to build strength in the community. For developed countries, all people in the society are developed with quality education at first and then other aspects are focused to be developed further. Due to this important reason, every sector starts to be aware of placing importance more. It becomes more evident when National Education Act B.E. 2542 and additional amendment (2nd ed.) B.E. 2545 prescribes the essence of the participation of parents, stakeholders, organizations, and agencies in managing education and developing education. For example, the society can participate in educational management. Educational institutions coordinate with stakeholders, and communities

of every sector to jointly develop students according to their potential. The mentioned essence and the principle are specified in National Education Act. Regarding guidelines for educational management for sustainable development, the principle of educational management consists of 1) competency in competition based on resources and competency of the institutes, 2) competency in responding to the needs of students and the group of stakeholders and 3) competency in adapting oneself to the local context and universality (Anurak Panyanuwat et al., 2014). The important approach is to develop teacher competency. The concept of teacher competency is based on the emphasis on reinforcing competency to human resources on the belief that when teachers are developed to have the competency, the teachers will use the competency they have to push educational development to achieve the goal. This is also the main key to developing a vocation continuously. Professional competency is the behavioral characteristics resulting from knowledge, skills, abilities, and other attributes. The way a person can show any competency requires the component of knowledge, skills, abilities, and other characteristics (Ministry of Education, 2010). Developing teacher competency must start with the mechanism of producing teachers in the institute which produces teachers with duties to nurture being professional teachers to pre-service teachers to have good knowledge, skills, and attitudes toward having teacher professions in the future.

Currently, the trend of reusing recycled materials before degradation or destruction is an important approach in managing environmental problems which the world is facing now. A lot of countries make recycled materials useful to the society such as creation of fibers in the textile industry with plastic etc. As a result, the amount of waste and the energy use in destroying these materials have been reduced much.

From the above-mentioned statements, the researcher is interested in building the process of Participatory Action Learning of Pre-service Teachers to develop learning materials with plastic recycling for primary school students in Central Thailand. The objective is to use the material of plastic recycling as an important material in building learning materials for students and to reduce the amount of plastic waste. It is the matter of using things worthily according to the concept of education for sustainable development further.

2. Method

Step 1 Research form

This research was conducted in the form of Participatory Action Research: PAR through collecting and analyzing data obtained from analysis of interviews, assessment forms, and focus group discussions. Study results were presented in the form of descriptive analysis by using quantitative and qualitative data to support data synthesis and narration.

Step 2 Population and samples in the research

The population used in the study consisted of 3 main target groups: (1) Informants of the needs for developing learning materials, namely school administrators, teachers, staff of teachers and student representatives, accounting, (2) the group of experts assessing learning materials, namely the staff of teachers, science teachers and experts of science learning management and (3) the group of distilling lessons learned, namely pre-service teachers. Purposive sampling was used by the researcher to come up with a total of 139 people making up for samples in the research as follows:

- 1) Informants of the need for developing learning materials, accounting for 30 people
- 2) The group of experts assessing learning materials, accounting of 9 people
- 3) The group of distilling lessons learned accounting for 100 people.

Step 3 The instruments used in the study

The instruments used in data collection consist of:

- 1) Unstructured interview forms on the need for developing learning materials with plastic recycling for primary school students in Central Thailand
- 2) Assessment forms of learning materials qualities
- 3) Recording forms of focus group discussion

Step 4 Data collection

1) Documentary study is conducted by collecting data from documents, books, journals, and other secondary data sources appearing in the database to collect basic data to synthesize the data together with the data from interviewing the group of informants. Then, the obtained data are used as guidelines for studying further.

2) Design and development are arranging the process so that pre-service teachers can design and develop learning materials with plastic recycling for primary school students. After that, the pre-service teachers present the learning materials to the experts to have them assessed in terms of the qualities of learning materials before implementing them in schools.

3) Distilling the lesson learned is conducted after implementing the learning materials together with schooling management in schools. The researcher arranges a focus subgroup discussion jointly with pre-service teachers regarding issues in developing teacher professional competency, knowledge obtained from developing the learning materials, skills, and attitudes acquired from participating in the participatory action learning activities through developing learning materials with plastic recycling.

Step 5 Data analysis

1) Regarding qualitative data, the research team analyzed the data according to the intention of education based on the method of content analysis obtained from documentary analysis, interviews, and focus group discussion to conclude issues according to the data group. Then, data relationships were analyzed.

2) Regarding quantitative data, the researcher team used the data from the assessment form to analyze the data with the statistical package which could analyze the data appropriately. This was analysis based on descriptive statistics by showing results of statistical data analysis as mean and standard deviation.

3. Results

For this research, the researcher team classified the data obtained from the study and presented research results according to the determined objectives. Study results can be summarized as follows:

1) Regarding the study on the need in developing learning materials with plastic recycling for primary school students in Central Thailand, it was found that plastic recycling is suitable for being developed to be learning materials for students due to using recycled materials worthily. Durable learning materials can be built as well and can be used for a longer period. This does not increase the budget burden of schools and is consistent with the concept of education for sustainable development. Moreover, the informants also indicated that developing learning materials from materials available in the area will help reduce the budget burden and make the community able to have a role in helping the educational management of schools. The learning materials built from plastic materials are durable and can be used for a long period. The amount of waste occurring in schools and communities can be reduced as well. The researchers have synthesized the obtained data to be the participatory action approach for developing learning materials or 4P consisting of (1) Plan, (2) Process, (3) Present, and (4) Practice with the following details.

1.1) (Plan: P1) is the planning step for designing and developing learning materials. For this step, the pre-service teachers must study the conditions and the context of the area where the learning materials will be implemented. This also includes the content to be designed for the learning materials to be consistent with the needs of students and schools. After that, the plan of developing the materials and equipment to be used in development is determined in the form of an Action Plan.

1.2) (Process: P2) is the step for proceeding to design and develop learning materials. For this step, the pre-service teachers will take action as planned and present progress together receiving advice from faculty advisors from time to time. The advisors have important duties to support them in terms of related knowledge and advice so that developing the materials proceeds with orderliness.

1.3) (Present: P3) is the step of presenting the developed learning materials to the experts in learning management for assessing the qualities of the learning materials. After receiving suggestions, the pre-service teachers will develop the learning materials at the final stage before the actual implementation.

1.4) (Practice: P4) is the step of implementing the learning materials together with schooling management in the actual classroom. The pre-service teachers will observe the conditions of using the learning materials together with students to use the data as guidelines in developing the learning materials further in the future. This can be summarized as a diagram as follows:

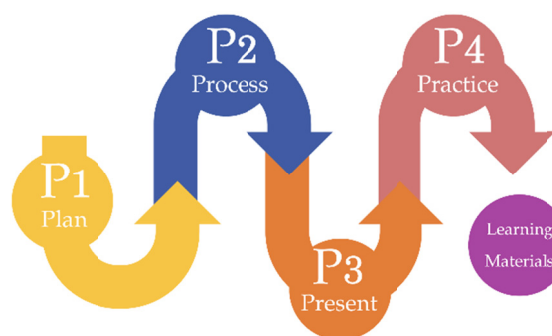


Figure 1. Participatory action approach for developing learning materials

Source: Chaijalearn et al., 2023.

2) Regarding developing learning materials with plastic recycling for primary school students in Central Thailand based on action learning of pre-service teachers, it was found that the pre-service teachers were able to design and develop the learning materials from plastic recycling creatively. The pre-service teachers have designed and developed the learning materials regarding knowledge in the science subject. After designing, the pre-service teachers presented the concept and samples of the learning materials to the staff of teachers, and advisors in order to use the suggestions to develop the learning materials before presenting them to the experts in learning management to consider the suitability of the learning materials. The results of assessing the learning materials of the pre-service teachers are as follows:

Table 1. Results of assessing the qualities of the learning materials from plastic recycling of pre-service teachers (n = 9)

No.	Items of assessment	\bar{x}	SD	Interpretation
1	The learning materials promote the perception of scientific concepts.	4.78	0.44	Highest
2	The learning materials promote awareness of the importance of scientific learning in living the everyday life of students.	4.89	0.33	Highest
3	The learning materials promote understanding of the content used to support learning.	4.22	0.97	High
4	The learning materials have a process suitable to the contents and the class level.	4.89	0.33	Highest
5	The learning materials help promote educational management for sustainable development.	4.67	0.50	Highest
6	Learning materials and learning activities allow bringing about discussion and exchanging ideas to find solutions together.	4.56	0.73	Highest
7	The learning materials promote to bring about meaningful learning.	4.56	0.88	Highest
8	The learning materials have diversity and can be used to manage schooling at several class levels.	4.56	0.88	Highest
9	The learning materials help to be important guidelines in developing scientific learning management in the next century.	4.44	0.73	High
10	The learning materials promote and reinforce the scientific literacy of students.	4.78	0.67	Highest
Overview of assessment results		4.63	0.65	Highest

Source: Chaijalearn et al., 2023.

From Table 1, the assessment results of qualities of the learning materials of plastic recycling of pre-service teachers were at the highest level ($\bar{x} = 4.63$, $SD = 0.65$). When individual items were taken into consideration, it was found that the issue of the assessment with the highest level for the first top three consisted of (1) The learning materials promote awareness of the importance of scientific learning on living in everyday life of students ($\bar{x} = 4.89$), (2) The learning materials have the process suitable with contents and the class level students ($\bar{x} = 4.89$), (3) The learning materials promote the perception of scientific concepts. students ($\bar{x} = 4.89$) and (4) The learning materials promote and reinforce scientific literacy of students ($\bar{x} = 4.78$) respectively.

3) Distilling the lesson learned from developing the learning materials with plastic recycling for primary school students in Central Thailand based on action learning of pre-service teachers discovered competency of being professional teachers importantly of pre-service teachers in 4 aspects called Experience based Action Learning Competency or LISA consisting of (1) Learning Management, (2) Innovation (3) Self-development and (4)

Assessment of Learning with following details:

Table 2. Details of the experience-based action learning competency obtained from distilling the lesson learned from developing the learning materials with plastic recycling for primary school students in Central Thailand based on action learning of pre-service teachers

Experience based Action Learning Competency	Characteristics of the competency
1) Learning Management	Planning, designing, and developing schooling management with a variety of techniques and approaches which are consistent with the real context and conditions of the classroom. This also includes promoting to bring about activities of learning which develop the potential of students all around, building an environment and atmosphere in the classroom to favor learning, and assessing learning with understanding in diverse areas in the classroom with pluralism.
2) Innovation	Being an innovator in developing schooling innovation used in managing to learn wisely, knowing designing and developing the form of learning management consistent with the context of the school and the classroom, being an action researcher in the classroom to study and develop the innovation which meets the needs of students, believing in potentials of students and believing that every human can learn and develop at the most according to potentials and support
3) Self-development	Self-development in terms of developing oneself and developing the profession of pre-service teachers through self-review in knowledge, skills, and skilled potentials, and planning and seeking methods of developing one's capabilities to upgrade abilities and being a professional teacher, such as developing the skilled second language and the third language, developing technological capabilities, developing academic work and educational research work, etc.
4) Assessment of Learning	Collecting empirical evidence and data according to actual conditions regarding the learning process which occurs to students in aspects by using various assessment methods to bring about an understanding of the process and seeking learning methods of students in aspects cautiously in terms of assessment for learning. It is a matter of assessing the process and learning methods of students to obtain information essence for determining potentials in current learning and direction of learning in the future

Source: Chaijalearn et al., 2023.

From Table 2 (the Experience-based Action Learning Competency) obtained from distilling the lesson learned from developing the learning materials with plastic recycling for primary school students in Central Thailand based on action learning of pre-service teachers reflects learning competency from taking actions and actual experiences from developing learning innovation, seeing actual conditions of educational management in the area in contexts which will have an effect to pre-service teachers to have skills and knowledge from learning in which the pre-service teachers design and allocate the learning process by themselves. This can be summarized as a diagram as follows:

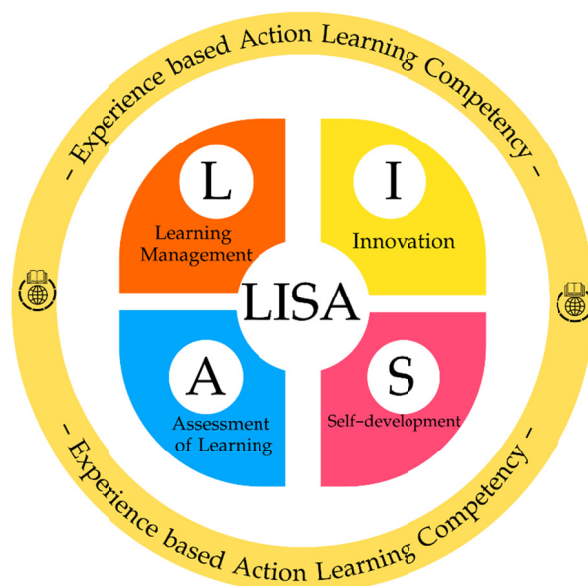


Figure 2. Experience based action learning competency or LISA

Source: Chaijalearn et al., 2023.

4. Discussion

1) Regarding the need for developing learning materials with plastic recycling for primary school students in Central Thailand, it was found that plastic recycling is suitable for being developed to be learning materials for students due to using recycled materials worthily and durable learning materials can be built. They can be used for a longer period and do not increase the budget burdens of schools, and this is following the concept of education for sustainable development. The researchers have synthesized the obtained data to be the participatory action approach for developing learning materials or 4P consisting of (1) Plan, (2) Process, (3) Present, and (4) Practice. This is consistent with the concept of education for sustainable development of Kaewpanya (2022) stating that educational management for sustainable development requires all-around development in terms of human resource development, economy and society, natural resources and environment, educational management, and technology. This can be done by relying on cooperation from every sector in jointly building visions, which leads to determining roles and duties in educational management. The objective is to focus on developing educational management for sustainability further. This is in the same direction as the concept of Chaiso P. et al. (2015), stating that producing teachers under contexts of a lot of aspects to have competency according to the professional standard requires indeed the study of the context of producing teachers to be used as basic data for developing competency of the pre-service teachers to be in line with the goal and the needs for using teachers. Moreover, Dewi (2018) states that learning innovation is the key to education to be considered. This is because learning activities are changing concepts, values, and integrated learning materials are related to needs in the future. This does not only render competitiveness but is also related to technological progress and data very much. The qualities of the developed learning system should be able to improve weak points quickly.

2) Regarding developing learning materials with plastic recycling for primary school students in Central Thailand based on action learning of pre-service teachers, it was found that pre-service teachers can design and develop learning materials from plastic recycling creatively and they can be used in managing schooling efficiently. This is consistent with the concept of Dewi (2018) stating that one method which can develop education is to change technical innovation in learning through the traditional learning system to the new innovative learning system with more efficiency and effectiveness by using the support system. The infrastructure enough for learning based on using data and internet tool technology is an appropriate choice and can overcome problems of learning although educational systems are different due to geographical allocation influencing greatly the progress of information technology. This is in the same direction as the concept of Boonmee (2021) stating that instructional materials are tools that help act as intermediaries to bring about learning between teachers and students. Instructional materials can be in the form of material, equipment, and

methods, including learning sources that help transfer knowledge and experiences to students. This will bring about behavioral changes as needed. Students can build knowledge by themselves and achieve the objective of schooling management.

3) Distilling the lesson learned from developing the learning materials with plastic recycling for primary school students in Central Thailand based on action learning of pre-service teachers discovered competency of being professional teachers importantly of pre-service teachers in 4 aspects called Experience based Action Learning Competency or LISA consisting of (1) Learning Management, (2) Innovation (3) Self-development and (4) Assessment of Learning, which helps promote occupational competency of pre-service teachers to become more efficient. This is in line with the concept of Panich (2015) stating that arranging schooling activities so that students can take actions with true contact or receive emotional experiences will help students practice understanding values and this can lead to changing the paradigm or ideas or higher thinking, which is consistent with the concept of Piaget (1986). This concept states that building knowledge is the process occurring between experiences and ideas. The foundation in which students build knowledge from schooling activities focuses on the practices of students, taking action on real practices and schooling management connecting knowledge and skills. This makes students have higher academic achievement. Moreover, Watcharanimit, Pimsan, & Tanawutpornpinit (2020) reiterates that developing teacher competency to have knowledge and abilities so that teachers will have the potential in changing the process of schooling management through learning design based on the community. This also includes changing attitudes to become a person of high public consciousness, having morals and ethics according to the principle of the teaching profession, loving and having professional ties, and being proud to be a teacher. The right development is the way teachers develop competency in developing themselves and this is in the same direction as the concept of Mangkhang, Yimsawat, Nettip and Kaewpanya (2021) indicating that competency is deemed to be an important thing in the teaching profession in terms of being standards of working and professional goals. Promoting competency to pre-service teachers before serving will help promote driving policies and the mechanism of educational reform in Thailand and can develop the Thai educational system to be on par with other countries qualitatively.

5. Conclusion

The research is interested in building the process of Participatory Action Learning of Pre-service Teachers to develop learning materials with plastic recycling for primary school students in Central Thailand. The objective is to use the material of plastic recycling as an important material in building learning materials for students and to reduce the amount of plastic waste. It is the matter of using things worthily according to the concept of education for sustainable development further.

6. Suggestions from the Research

6.1 Suggestions for Implementing Research Results

- 1) Teachers can arrange learning activities integrating learning materials in learning management.
- 2) Learning materials with plastic recycling for primary school students in Central Thailand should be used together with digital learning tools such as online videos etc.
- 3) Methods of using learning materials should be studied expertly before implementing them in schooling management.

6.2 Suggestions for Next Research

- 1) Learning materials with plastic recycling for primary school students in Central Thailand should be developed in the special education system and informal education.
- 2) Learning materials with plastic recycling for primary school students in Central Thailand should be developed with local materials and equipment.
- 3) Training should be arranged regarding the course of developing media from plastic recycling materials for teachers at the primary school level and the secondary school level.

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Appendix A

Examples of learning materials



Figure A1. Anemometer



Figure A2. Time box

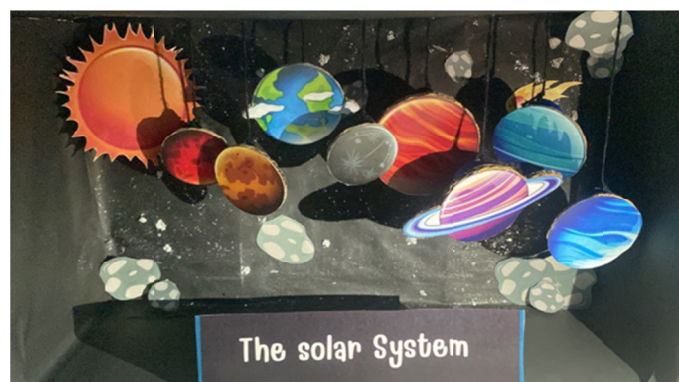


Figure A3. The solar system



Figure A4. Parts of a Flower



Figure A5. Volcano

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