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Development of the WASAKA Learning Model on Heat and Temperature Topics for Higher Education

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Abstract

Lecturers are required to carry out learning as well as professionally. Lecturers must apply student-centered learning models in lectures so students can study well. This research aimed to develop a valid WASAKA (Write, Analyze, Argue, Knowledge Development, and Act) learning model that can be implemented in the classroom and gets a good response from students who study heat and temperature in higher education. This research used Educational Design Research (EDR) research. The subjects of this study were 28 students studying heat and temperature in the Fundamental Physics course. Data collection techniques in this research were observation and an online survey using the Google form with the cross-sectional survey design method. The research instruments used were validation sheets, observation sheets, and response questionnaires. The data obtained were then analyzed using the Aiken formula and descriptive statistics. The results showed that the WASAKA learning model had content validity of 0.87-0.93 with valid categories; the average implementation of the model in terms of lecturer activities is 4.99 with a very good category; the average implementation of the model in terms of student activities is 4.87 with a very good category, and students gave a very good response to the model. This research concluded that the learning model developed was valid, implemented, and responded well by students. Thus, the learning model can be applied in Fundamental Physics lectures, especially in Higher Education heat and temperature topics.

Keywords: Development; Heat and Temperature; WASAKA Learning Model

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INTRODUCTION

A lecturer is obliged to carry out the tri dharma of higher education. This tri dharma includes education and teaching, research and scientific publications, and community service. Thus, lecturers are

required to carry out classroom learning professionally (Inaltekin & Akcay, 2021; Tasbih, 2021). In addition to fulfilling their obligations, the optimal implementation of classroom learning certainly affects the achievement of



learning objectives and student learning outcomes. To achieve learning objectives and meet student needs, lecturers must apply student-centered learning models in lectures (Assya'bani & Majdi, 2022).

Based on the results of observations of Fundamental Physics lectures and assessments of students, it is known that students have difficulties with the material of heat and temperature. This is evidenced by the low test scores on this material and the finding of misconceptions before, during, or after learning. Research results by Fitriah (2017), Puspitasari & Munawi (2018), Saparini et al. (2021), and Stylos et al. (2021) stated that misconceptions often occur when students study heat and temperature material affects mastery of concepts. Students also have difficulty using formulas and solving mathematical problems (Astuti et al., 2018; Yeo et al., 2019). Another difficulty is that students often equate the terms temperature and heat, even though the two are not the same (Yeo et al., 2019) and misunderstand the definitions of physical quantities in terms of heat and temperature (Stylos et al., 2021; Inaltekin & Akcay, 2021). The difficulty in mastering temperature and heat is because both are abstract (Yeo et al., 2019; Duruk et al., 2021), misunderstood the basic concept, academic variables, and socio-demographics (Stylos et al., 2021).

Lecturers have implemented innovative learning so that students can master the material well (Fitriah, 2021). Also, Lecturers have provided textbooks for students (Fitriah, 2020b; Fitriah, 2020a; Fitriah et al., 2021). However, there are still students whose learning outcomes are not optimal. Therefore, lecturers need to think creatively so that classroom learning can support the achievement of learning outcomes (Assya'bani & Majdi, 2022).

One of the ways taken by lecturers to help students learn well is by developing innovative and up-to-date learning models. The learning model is the WASAKA learning model. This learning model is so named because it is an acronym for the six stages of learning from the model itself, namely, Write, Analyze, Argue, Knowledge Development, and Act. This learning model is rooted in the motto of South Kalimantan. The motto is the character of the Banjar people, coined by Prince Antasari, namely *waja sampai kaputing* (wasaka) (Syaifullah & Surawardi, 2020; Wati et al., 2021; Annisa et al., 2022). This motto means to work hard without giving up or trying to the end (Anissa et al., 2020; Wati et al., 2021). Thus, the WASAKA learning model contains the character of wasaka. So, this model participates in introducing and preserving the motto of South Kalimantan and instilling the unyielding spirit of Prince Antasari in the students, especially when they learn about heat and temperature.

In previous studies, a series of studies have been conducted on learning containing local wisdom, especially those related to the character of wasaka. The research includes the development of practical instructions to train wasaka characters (Misbah et al., 2018), wasaka value-based guidance and counseling service module (Wineini, 2019), teaching materials for fluid materials with wasaka characters (Wati & Misbah, 2020), wasaka character assessment instrument (Wati & Misbah, 2021), and wasaka self-instruction technique module (Sari et al., 2022). However, no researchers have developed the WASAKA learning model, so this research contributes to it.

The WASAKA learning model has several advantages. This model contains local wisdom, so students learn from a concrete environment close to

themselves. This further makes learning more meaningful and easier for students to understand the material (Hartini et al., 2017; Wati et al., 2019). Learning that contains local wisdom also helps students to build noble character (Wati et al., 2019; Misbah et al., 2020). In addition, learning containing local wisdom is proven to be able to train creative thinking skills (Almuharomah et al., 2019), develop social knowledge and attitudes (Uge & Neolaka, 2019), and improve learning outcomes (Wati et al., 2019; Hirani et al., 2020; Bulkani et al., 2022). This learning also received a good student response (Almuharomah et al., 2019; Misbah et al., 2020).

Different from existing studies, this model is intended for students who are prospective physics teachers at universities. Thus, the learning model developed in this study can be used in university lectures. In addition, it is hoped that they can adapt this learning

model to be applied at the Senior High School or the equivalent level. This research aims to develop a valid learning model that can be implemented in the class and get a good response from students who study heat and temperature material in higher education. Thus, this article focuses on examining the validity of the learning model, its implementation in classroom lectures, and student responses to the learning model.

METHOD

This research used Educational Design Research (EDR) research. EDR research consists of two main stages: preliminary and formative evaluation (Tessmer (2016)). Furthermore, the formative evaluation stage is further divided into self-evaluation, expert review, one-to-one tests, small group tests, and field tests. The procedure of this study can be seen in Figure 1.

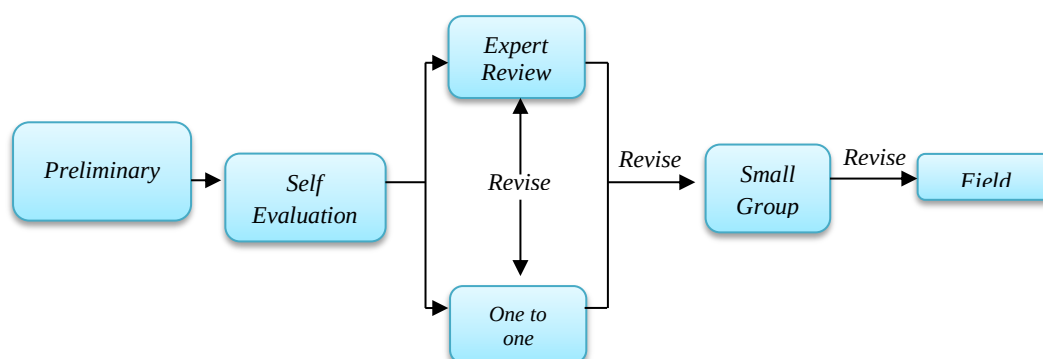


Figure 1 Research procedure

The research was conducted from February to September 2022 at one of the universities in South Kalimantan. The subjects of this study were 28 students, which consisted of 4 male students and 24 female students. Their age range was 17-18 years. They studied heat and temperature in the Fundamental Physics course at the time of the research.

The data sources for this research were validators who were experts, lecturers, and students who carried out Fundamental Physics lectures on heat and temperature material. Data was collected using observation and survey techniques. The survey was conducted using the Google form. The survey used a cross-sectional survey design method

because survey data was collected only once for the sample.

This data collection used research instruments such as validation sheets, observation sheets, and response questionnaires. The three instruments were adapted from research (Ita & Fitriah, 2022; Fitriah, 2021) and declared valid by experts based on the criteria of Aiken (1985) dengan $V_{count} = 0,92-1,00$.

After the data was obtained, the data was then analyzed using the formula of Aiken (1985) and descriptive statistics. The descriptive statistics used were the

average (mean) and percentage. The data were then grouped into several categories based on the average obtained. This category is based on (Widoyoko, 2019).

RESULT AND DISCUSSION

Learning Model Validity

The validity of the WASAKA learning model was seen from the validity of the Weekly Lesson Plan. This is because the Weekly Lesson Plan fully includes the components and steps of learning. The following Table 1 shows the validity of the Weekly Lesson Plan.

Table 1 Validity of weekly lesson plans

No.	Assessed Aspects	V_{Count}	V_{table}	Category
1.	Completeness of Weekly Lesson Plan components (subject identification, Study Program Graduate Learning Outcome, Course Learning Outcome, Subject Sub- Learning Outcome, Indicators, subject matter, learning strategies, learning steps, learning media and tools, learning resources, and assessment)	0.93	0.87	Valid
2.	Clarity and logic in the formulation of Graduate Learning Outcome Study Programs, Learning Outcome Courses, Sub-Learning Outcome Courses, lecture indicators, and encouragement to improve learning outcomes and student character	0.87	0.87	Valid
3.	There is an integration of character education and national culture in the Weekly Lesson Plan	0.87	0.87	Valid
4.	Up-to-date learning strategies used	0.87	0.87	Valid
5.	Utilization of potential learning strategies to activate students	0.93	0.87	Valid
6.	Inclusion of student preparation activities for learning, motivating, apperception, and material information	0.87	0.87	Valid
7.	The suitability of learning steps with Study Program Graduate Learning Outcome, Learning Outcome Courses, Learning Outcome Courses, and lecture indicators	0.87	0.87	Valid
8.	Clarity, sequence, and organizational systematic learning steps	0.87	0.87	Valid
9.	The learning steps are following the established learning strategy	0.87	0.87	Valid
10.	The learning steps are following the research-dependent variable	0.87	0.87	Valid
11.	The suitability of the learning steps with the level of student development, material, and student contextual environment	0.87	0.87	Valid
12.	Suitability of learning steps with time allocation	0.87	0.87	Valid
13.	Variety of learning activities	0.87	0.87	Valid

No.	Assessed Aspects	V_{Count}	V_{table}	Category
14.	Learning steps allow a constructivist learning process to occur	0.93	0.87	Valid
15.	Inclusion of preliminary, core, and closing activities in the learning experience that describes learning strategies, media, tools, and learning resources and involve students	0.87	0.87	Valid
16.	Learning steps allow the growth (emergence) of various life skills (personal, academic, and social skills)	0.87	0.87	Valid
17.	Learning steps can train students' character	0.87	0.87	Valid
18.	Learning activities emphasize more on student learning experiences, not lecturers' teaching experiences	0.93	0.87	Valid
19.	The suitability of media and learning tools with the level of student development, material, and student contextual environment	0.87	0.87	Valid
20.	Inclusion of learning resources	0.93	0.87	Valid
21.	The suitability of learning resources with the level of student development, material, and student contextual environment	0.93	0.87	Valid
22.	Utilization of the student's immediate environment as a medium, tool, and source of student learning	0.87	0.87	Valid
23.	Include an assessment of learning processes and outcomes using instruments for authentic assessment oriented to the cognitive and affective domains	0.87	0.87	Valid
24.	The suitability of the assessment instrument with the Graduate Learning Outcome of Study Programs, Learning Outcome of Subjects, Sub-Learning Outcome of Subjects, and lecture indicators	0.87	0.87	Valid

Based on the results of the data analysis in Table 1, it can be seen that the 24 (twenty-four) aspects assessed are in the valid category. This shows that the arranged learning model is feasible in the classroom (Sofyan et al., 2019; Ramdiah et al., 2020; Yusuf et al., 2022). Anissa et al. (2020b) stating a valid learning plan shows that this plan has clear learning indicators, is prepared with systematic content, and is allocated at the right time. There is a match between the learning strategies chosen and the learning indicators to be achieved. The results of this validity also mean that the Weekly Lesson Plan includes the components of the Weekly Lesson Plan completely, and it is of high quality so that it can be used (Edi & Rosnawati, 2021). In line with that statement, Bhatnagar et al. (2021) stated that this validity means that the Weekly Lesson Plan is of quality in terms of content validity.

The validity that shows this quality Weekly Lesson Plan is important for research so that the data obtained is meaningful and reliable (Sabarudin et al., 2022). This validity also shows that experts are involved in this research process, especially in providing feedback on the prepared Weekly Lesson Plan and giving legitimacy that the Weekly Lesson Plan compiled is indeed good (Beck, 2020). In line with this, Yusuf et al. (2022) also stated that learning tools, including Weekly Lesson Plan, were valid, indicating that Weekly Lesson Plan could guide lecturers when carrying out lectures in class. Thus, the Weekly Lesson Plan that includes the WASAKA learning model is proven valid for learning.

Implementation of the Learning Model

The implementation of the WASAKA learning model is viewed from two aspects, namely, the activities of lecturers and student activities during lectures. Table 2 shows the implementation of

lecturer activities during the field test. The following Table 3 shows the implementation of student activities during the field test.

Table 2 Implementation of lecturer activities in class

Lecturer Activities	Mean Score in Each Meeting			
	1	2	3	4
Introduction				
Write				
1. The lecturer starts the lecture by reading a prayer.	5.00	5.00	5.00	5.00
2. Lecturer submits Sub-Learning Outcome Subjects, indicators, and titles of teaching materials.	5.00	5.00	5.00	5.00
3. The lecturer presents information related to the material discussed.	5.00	5.00	5.00	5.00
4. The lecturer gives assignments to students to write important things (summarizing) from the material that the lecturer had delivered.	5.00	5.00	5.00	5.00
5. Lecturers give assignments to students to find information from other learning sources related to the material discussed and write down important things (summarizing) the information they get.	5.00	5.00	5.00	5.00
Main				
Analyze				
1. The lecturer gives students problems in the form of analysis questions.	5.00	5.00	5.00	5.00
2. The lecturer gives assignments to students to solve the problems given.	5.00	5.00	5.00	5.00
Share				
1. The lecturer divides the students into small groups.	5.00	5.00	5.00	5.00
2. The lecturer asks students to share the information notes they have made.	5.00	5.00	5.00	5.00
3. The lecturer asks students to share the answers to the results of the problem-solving analysis.	5.00	5.00	5.00	5.00
Argue				
1. The lecturer asks students to argue with each other to determine the answer to the analytical question.	5.00	5.00	5.00	5.00
2. The lecturer assigns small groups to present the answers to the questions in front of the class.	5.00	5.00	5.00	5.00
3. The lecturer asks other students to give arguments to the answers presented in front of the class.	5.00	5.00	5.00	5.00
4. Lecturers provide feedback on student work.	5.00	5.00	5.00	5.00
Knowledge Development				
1. The lecturer gives practice assignments to students with a higher cognitive level than the questions given in class to be solved independently outside the classroom.	5.00	5.00	5.00	5.00
Act	5.00	5.00	5.00	5.00
1. The lecturer gives 1 (one) task that makes a positive contribution to the community to be done outside the classroom.	5.00	5.00	5.00	5.00
Closing				
1. The lecturer asks students to conclude the material.	4.50	5.00	5.00	5.00

Lecturer Activities	Mean Score in Each Meeting			
	1	2	3	4
2. Lecturers reflect on learning.	5.00	5.00	5.00	5.00
3. The lecturer ends the lecture by reading a prayer.	5.00	5.00	5.00	5.00
Mean	4.97	5.00	5.00	5.00
Total Mean	4.99			
Category	Very Good			

Table 3 Implementation of student activities

Student Activities	Mean Score in Each Meeting			
	1	2	3	4
Introduction				
Write				
1. Students pay close attention to the material information presented by the lecturer.	5.00	5.00	4.50	4.50
2. Students write important things (summarize) the material that the lecturer delivered.	4.50	4.50	4.50	4.50
3. Students seek information from other learning sources related to the material discussed.	4.50	4.50	5.00	5.00
4. Students write down important things (summarize) the information they get.	4.50	4.50	5.00	5.00
Main				
Analyze				
1. Students analyze problem-solving independently by using various information they have obtained.	5.00	5.00	5.00	5.00
Share				
1. Students form small groups.	5.00	5.00	5.00	5.00
2. Students share and compare the information obtained with their group of friends.	5.00	5.00	5.00	5.00
3. Students share and compare answers to questions with their group of friends.	5.00	5.00	5.00	5.00
Argue				
1. Students argue with each other to determine the final answer to the analysis question.	5.00	5.00	5.00	5.00
2. Students present the answers to the questions in front of the class.	5.00	5.00	5.00	5.00
3. Students give responses and arguments to their classmates' answers.	4.50	4.50	4.50	4.50
4. Students pay attention to the lecturer's explanation.	5.00	5.00	4.50	4.50
Knowledge Development				
1. Students accept assignments given by lecturers.	5.00	5.00	4.50	5.00
Act				
1. Students accept assignments given by lecturers.	5.00	5.00	5.00	5.00
Closing				
1. Students conclude the material.	5.00	5.00	5.00	5.00
2. Students read prayers.	5.00	5.00	5.00	5.00
Mean	4.88	4.88	4.84	4.88
Mean Total	4.87			
Category	Very Good			

Based on the results of data analysis from Tables 2 and 3, it can be seen that lecturers and students can implement the learning model very well. Pulu & Widia (2022) state that the very good implementation showed that the stages of learning implemented in the classroom were following the prepared Learning Plan. In addition, this shows that arranged learning is practical because it can be implemented in real life in the classroom (Pulu & Widia, 2022; Yusuf et al., 2022; Arifuddin et al., 2022). In line with this, Wati et al. (2021) stated that the very good implementation shows that the quality of learning in the classroom is very good, and students are very active in participating in learning activities.

The lecturer's activity during lectures was very good. The performance of this lecturer affected students. Tambunan et al. (2021) stated that teacher performance affected the motivation and interest of students. Thus, student activity during lectures was also very good.

Students were active during learning because the WASAKA learning model was based on the constructivism learning theory. This theory states that students actively build their knowledge (Campbell et al., 2019; Hanfstingl et al., 2019; Songkram et al., 2021; Nasir et al., 2022). In addition, students also build knowledge by connecting new knowledge with old knowledge and discussing it with others (Hanfstingl et al., 2019; Pande & Bharathi, 2020). Songkram et al. (2021) stated that learning based on constructivist learning theory must actively process knowledge so that it is natural for students to be active during learning.

Based on research by Banihashem et al. (2021), it was known that learning models designed based on constructivist learning theory could increase student involvement in learning activities and increase students' self-regulation. In

addition, learning with a constructivist character enables students to think critically and creatively and improves students' scientific mastery (Supena et al., 2021). So, the WASAKA learning model has a positive impact on students.

The developed learning model also allowed students to learn real heat and temperature material in everyday life. So, this model made learning to be authentic. Authentic learning can increase student involvement in learning, learning experience, and learning satisfaction, then encourage them to try to achieve learning goals (Sokhanvar et al., 2021).

The very good implementation of the review of lecturer activities and student activities also means that the learning is carried out effectively (Zakwandi et al., 2020). Zakwandi et al. (2020) also added that these results indicate that students follow the directions and instructions well. Anissa et al. (2020a) stated that implementing excellent learning means that learning is appropriate for use in the classroom. So, the WASAKA learning model can indeed be implemented in lectures.

This excellent implementation is due to the WASAKA learning model being student-centered. Student-centered learning focuses on how lecturers facilitate and guide students to learn and how students can learn well (Lee & Branch, 2022). Lee & Branch (2022) also stated that students were required to be active in their learning environment and were responsible for their learning process. Thus, it is natural for students to be active during lectures.

This excellent implementation is due to the learning model containing local wisdom. Anissa et al. (2020a) state that if learning and physics materials are associated with local wisdom familiar to students, they will be motivated and feel happy to follow each stage of learning. This high motivation will increase

student learning desire, involvement in learning activities, and learning success (Lin et al., 2021). In line with this, Raza et al. (2021) dan Herpratiwi & Tohir (2022) stated that motivation is one factor that influences learning outcomes. Students with high learning motivation can achieve high learning outcomes as well. As a result, the implementation of the learning model was very good. Oktavia et al. (2018) also stated that learning with local wisdom encourages students to apply their knowledge in everyday life. This further makes them feel it is important to follow the lesson well so that learning has deep meaning for them (Oktavia et al., 2018). Learning containing local wisdom also encourages students to construct meaningful learning experiences so that it is natural for students to be very well involved in the learning process (Fadli & Irwanto, 2020).

Each stage of learning carried out by students also contains the value of character education in the motto *waja sampai kaputing* (wasaka). These values are responsibility, hard work, discipline, independence, perseverance, and toughness (Wati et al., 2021; Annisa et al., 2022). Trisanti et al. (2021) stated that implementing learning in the classroom affects the effectiveness of student material mastery and the process of internalizing character in students. If learning can be carried out very well, then the effectiveness of mastery and character internalization is also very good. Thus, students are trained to internalize these values so that after learning is carried out, they can show noble character. Thus, the development of the WASAKA learning model, which is one of the learning innovations, leads

to an increase in the quality of education (Sofyan & Abdullah, 2022).

Student Response to Learning Model

Students respond by filling out a response questionnaire to the learning model. Based on the results of filling out the questionnaire, data were obtained as listed in Table 4. These results indicate that students responded positively to the learning model developed. This result is caused by the learning model that is composed of local wisdom. Hartini et al. (2018) mention that learning containing local wisdom encourages students to build their knowledge and connects that knowledge with the realities of everyday life. This further makes them interested and motivated in learning and enthusiastic about learning, so their response to learning becomes good (Hartini et al., 2018). In line with that, Mustika Wati et al. (2019) stated that learning that contains local wisdom helps provide contextual and meaningful learning for students so that they are motivated to achieve learning goals and responses are positive. Purwanti et al. (2019) added that this excellent response was caused by the learning containing local wisdom, which attracted students' attention and made the material studied uncomplicated. They are easy to learn because the material is related to real life and their habits that are relevant to the local wisdom in their residence (Purwanti et al., 2019). Lubis et al. (2022) also stated that learning containing local wisdom had a positive effect on students' environmental literacy and conceptual knowledge, so it was natural to get a good response from students.

Table 4 Student responses to the WASAKA learning model

No.	Response Indicator	%
1.	Student opinion about the WASAKA learning model	
	a. fun and interesting	100
	b. not fun and boring	0

No.	Response Indicator	%
2.	Student opinion about the WASAKA learning model	
	a. is something new and very helpful for student learning	100
	b. is not new but helps students learn	0
	c. is something that is not new and does not help student learning	0
3.	Activities carried out during the learning process	
	a. can rewrite the material that had been delivered by the lecturer	100
	b. can perform problem-solving analysis	94.44
	c. can share ideas and problem-solving results with friends in a group	100
	d. can convey arguments related to the final answer to the problem that must be resolved through discussion forums	100
	e. can develop knowledge through assigned tasks	100
4.	During the activity, students can take real action as a result of understanding the material through the tasks presented	
	a. Yes	94.44
	b. No	5,56
5.	Students are interested in participating in similar learning activities	
	c. Yes	94,44
	d. No	5,56

WASAKA learning model is a new learning model that has never been developed by previous research and has never been applied in class. This learning model consists of 6 stages: Write, Analyze, Argue, Knowledge Development, and Act. Based on the responses given by students to the learning model, it showed that the six stages of learning were fun and interesting. These six stages were new to students and could help them learn. So, based on the results of student responses, it is known that students easily learned heat and temperature material. In contrast to before, this model was applied, where students found it difficult.

The activities carried out while studying with the learning model according to students were able to make them able to rewrite the material about heat and temperature that the lecturer has delivered, perform problem-solving analysis, share ideas and problem-solving results with friends in a group, convey arguments related to the final answer to the problem that must be resolved through discussion forums, and

develop knowledge through assigned tasks. In addition, according to students, the six stages of the WASAKA learning model could make them able to take real action as a result of understanding the material about heat and temperature through the tasks presented, and they were interested in using this model again in classroom learning.

A very good response to the learning model also indicates that the learning is fun (Misbah & Wati, 2020). This response also means that students easily understand the lecturer's teaching (Astutik & Prahani, 2018). This excellent result also means that students are interested in the learning model and hope that the learning model can be implemented in the next lecture (Pulu & Widia, 2022). The very positive response to the learning model also showed that the WASAKA learning model could attract students' attention, help them understand the material, and make it easier for them to learn (Ramdiah et al., 2020). So, the WASAKA learning model that had been developed in this study can be applied again to the next lecture.

CONCLUSION

The WASAKA learning model that had been developed in this study was declared valid by experts with a validation coefficient of 0.87-0.93. In addition, lecturers and students can implement this learning model very well. This was evidenced by the average score of 4.99 lecturer activity and 4.87 student activity average score. The two average scores are in the very good category. The student response to this learning was also very good, as indicated by the percentage of students who gave a good response above 90%. In conclusion, the learning model was valid, implemented, and responded to well by students. Thus, the learning model developed can be used in Higher Education's Fundamental Physics lectures on heat and temperature material. The limitation of this study is that the number of samples was still small, and the physics material tested was only heat and temperature. Further research should research and develop the WASAKA learning model for other physics materials and try it out on a larger sample.

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