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The effect of Project Based Learning (PJBL) and inquiry learning models on learning outcomes of IPAS in elementary school

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Abstract

This study aims to determine the effect of using Project Based Learning (PjBL) and Inquiry Learning models on learning outcomes. The research used is quantitative research with experimental methods. The design in this study uses a Quasi Experimental design with the form of Nonequivalent Control Group Design. The location of this research is at SD Negeri 007 Tebing. The sampling technique in this study is total sampling where all members of the population are used as research samples, so the sample in this study amounted to 33 fourth grade students of SD Negeri 007 Tebing. The data source used is primary data, namely the researcher went directly to collect data. Data collection techniques in this study are: observation, interviews, documentation, and tests. The research instrument used is a test instrument with a data analysis technique in the form of a t-test. Based on data analysis, the results of the study showed that: 1) There is an effect of using the Project Based Learning (PjBL) learning model on the learning outcomes of science in the material of changes in the state of matter in fourth grade students of SD Negeri 007 Tebing, with t count 6.97> t table 2.080. 2) There is an influence of the use of the Inquiry Learning model on the learning outcomes of science in the material of changes in the state of matter in grade IV students of SD Negeri 007 Tebing, with t count 4.00 > t table 2.228. 3) There is a significant difference in the influence of the use of the Project Based Learning (PjBL) and Inquiry Learning models on the learning outcomes of science in the material of changes in the state of matter in grade IV students of SD Negeri 007 Tebing, with t count 2.564 > t table 2.040.

Keywords: *Project Based Learning; Inquiry Learning; Learning Outcomes; Changes in the Form of Matter*.

INTRODUCTION

Education is the main foundation for the development of a nation, which is the key to social, economic and cultural progress. In Indonesia, efforts to improve the quality of education have become the government's main agenda in welcoming the era of globalization and industrial revolution 4.0 (Hasibuan et al., 2023)

Curriculum is closely related to Education. According to Law Number 20 of 2003 Article 1 paragraph 19, the curriculum is a set of plans and arrangements regarding the objectives, content, and learning materials as well as the methods used as guidelines for organizing learning activities to achieve certain educational goals. The curriculum is dynamic and static, meaning that the curriculum will change based on the progress of the times. Kartel et al., (2022) explains that the curriculum occupies a central position in all kinds of educational activities, in order to create educational goals, the curriculum must be able to improve its quality, where the curriculum must be able to adapt to the situation of each good school, pay attention to the needs and development stages of students, the needs of national development while keeping in mind that national education originates from national culture and national education based on Pancasila and the 1945 Constitution. In accordance with the Decree of the Minister of Education, Culture, Research and Technology of the Republic of Indonesia Number 56/M/2022 concerning guidelines for implementing the curriculum in

the context of learning recovery, the independent curriculum is a step taken by the government to deal with the education crisis after Covid-19. The independent curriculum is implemented as a form of assistance to improve the curriculum in Indonesia in making Indonesia advanced, sovereign, independent and have personality through the formation of Pancasila Students. According to Aini (2023) the curriculum is a reflection of the formation of character education that fully contributes to the future of the nation. The pattern of life is increasingly dynamic as if there are no limits, this is evidenced by the development of the world of technology which is growing rapidly and has a full role in everyday life. Thus, the role of the curriculum is very important so that students can achieve educational goals in a structured and sustainable manner. Based on this understanding, curriculum management can be interpreted as management in the field of curriculum so that the learning process runs well, effectively and efficiently, as well as providing feedback and interrelationships with each other (Hasibuan et al., 2023).

The implementation of the independent curriculum is currently not evenly distributed, schools in Indonesia have not all implemented the independent curriculum, especially elementary schools. According to Wiguna & Tristaningrat (2022) stated the preparation of implementation Independent Curriculum has not been ready yet because the human resources applying this curriculum has not been qualified yet. Other opinions by Sumarsih, et al., (2022) that in the beginning of its implementation, teachers and school staffs experienced the difficulties in terms of applying learning and teaching process with new paradigm and preparing school administration based on Independent Curriculum guidelines. Implementation of the independent curriculum is still being carried out in stages, namely only classes 1 and 4. Basically, the implementation of the independent curriculum is quite easy, there are only two criteria needed, namely: the readiness of the principal and teachers to study the material distributed by the Ministry of Education and Culture and filling out forms and brief observations by the school (Ardianti & Amalia, 2022).

In Karimun Regency, one of the primary schools that has implemented the independent curriculum is SD Negeri 007 Tebing. SD Negeri 007 Tebing began implementing the independent curriculum in the 2023/2024 school year which was only applied to grade 1 and grade 4.

One of the characteristics of the independent curriculum is project-based learning to support attitude improvement according to the Pancasila learner profile in line with the vision and mission of the Ministry of Education, Culture, Research and Technology outlined in Permendikbud No. 22 of 2020 concerning the Ministry of Education and Culture's Strategic Plan 2020-2024. Project-based learning (PjBL) provides students with extensive opportunities, experiences and knowledge of the information obtained from the projects undertaken. (Dewi, 2023). The *Project Based Learning* (PjBL) learning model is student-centered, so students become more active in learning. another opinion by Nurhidayah et al., (2021) Through this PjBL learning process, it will train students' thinking in dealing with problems. (Sari et al., 2023) The independent curriculum gives schools the freedom to implement learning projects that are close to the environment, so that students are able to be creative and think critically, so that it will improve and optimize student learning outcomes. In addition to project-based learning, the *Inquiry Learning* model can be a reference for natural teachers to implement an independent curriculum. (Rina Febrian & Muhtadin, 2022). According to Esta et al.,

(2021: 30) the inquiry model is a learning model that allows students to construct their own knowledge, because the teacher is no longer a source of learning, but acts as a facilitator, so that it can increase students' self-confidence.

In the independent curriculum at the primary school level, science and social studies subjects are combined into Natural and Social Sciences (IPAS). According to Sugih et al., 2023) IPAS learning helps learners grow their curiosity towards knowledge of phenomena that occur around them. These subjects are combined because students at elementary school age still think simply, this will make it easier for them to understand their natural environment and social environment at the same time. (Marwa et al., 2023). as for according to Azzahra et al., (2023) IPAS is a science that studies about living and non-living things in the universe and their interactions, and examines human life as an individual as well as a social creature that interacts with its environment IPAS teaching helps learners foster their curiosity towards knowledge of phenomena that occur around them.

Based on observations, the implementation of the independent curriculum is still not effective, especially in the IPAS subject. The learning model used in teaching IPAS is still lacking because the teacher still uses conventional models such as lectures and question and answer which seem boring in the implementation of learning, students tend to be inactive because the interaction process during learning only goes one way from teacher to student. This results in students not getting a thorough understanding of the concept of the material so that the daily test learning results are still relatively low.

Some previous studies have shown efforts to solve learning problems effectively by using *project-based learning* and *inquiry learning* models. As the results of research by Windi Asytri, Anita Trisiana, and Mukhlis Mustofa (2023) which revealed that student learning outcomes increased after being given treatment using a *project-based learning* model. This is in line with research conducted by Anisa Nathasyah, Muhamad Idris, and Ida Suryani (2023) showing that the inquiry learning model is effective in improving learning outcomes and students' logical thinking skills.

Based on interviews with IVA and IVB homeroom teachers, students' understanding of the material on changes in the form of substances, students are still mistaken about the changes that occur between substances, this is because during learning takes place there is a lack of projects and student activeness during learning, students tend to read and record the material in notebooks. In this material, students do not get real experience in solving the problems given so that students' understanding of the material tends not to last long.

Based on the description above, the researcher is interested in conducting a study entitled The Effect of *Project Based Learning* (PjBL) and *Inquiry Learning* Models on Learning Outcomes of IPAS Material Changes in Substance Forms in Class IV Students of SD Negeri 007 Tebing.

The aim of this research are: 1) To determine the effect of using the *Project Based Learning* (PjBL) learning model on the learning outcomes of IPAS material on changes in the form of substances in class IV SD Negeri 007 Tebing. 2) To determine the effect of using the *Inquiry Learning* model on the learning outcomes of IPAS material on changes in the form of substances in class IV SD Negeri 007 Tebing. 3) To determine the significant difference in the effect of using the *Project Based Learning* (PjBL) and *Inquiry Learning* learning models on the learning outcomes of IPAS material on changes in the

form of substances in grade IV students of SD Negeri 007 Tebing.

The hypotheses in this study are: 1) There is an effect of using the *Project Based Learning* (PjBL) model on the learning outcomes of IPAS material on changes in the form of substances in grade IV students of SD Negeri 007 Tebing. 2) There is an effect of using the *Inquiry Learning* model on the learning outcomes of IPAS material on changes in the form of substances in class IV SD Negeri 007 Tebing. 3) There is a significant difference in the effect of using the *Project Based Learning* (PjBL) and *Inquiry Learning* models on the learning outcomes of IPAS material on changes in the form of substances in grade IV students of SD Negeri 007 Tebing. The assessment criteria are the significance value $\alpha = 0.05$. If $t_{count} >$ ttabel , then H0 is rejected and Ha is accepted, while if $t_{count} <$ ttable , then H0 is accepted and Ha is rejected.

RESEARCH METHODS

The type of research used is quantitative research with experimental methods. According to Sugiyono (2022: 111) experimental method is a quantitative research method used to determine the effect between independent variables on the dependent variable under conditions that can be controlled. The design in this study used a *Quasi Experimental* design with the form of *Nonequivalent Control Group Design.* In this design there are two groups selected, namely class IV A and IV B. Class IV A (experimental class) was treated using the *Project Based Learning* (PjBL) model, while class IV B (control class) was treated using the *Inquiry Learning* model.

The population in this study were all fourth grade students of SD Negeri 007 Tebing. The sampling technique is total sampling, total sampling is a sampling technique where all members of the population are sampled (Sugiyono, 2022). The sample in this study were all fourth grade students of SD Negeri 007 Tebing, totaling 33 people with the following details:

Table 1
Research Sample

NO	Class	Male	Female	Total
1	Class IV A	12	10	22
2	Class IV B	6	5	11
Total				33

Data collection techniques in this study are: observation, interviews, documentation and tests. Tests were conducted in the form of *pretests* before students were given treatment and *posttests* after students were given treatment. The test scores obtained will be analyzed in stages, namely descriptive analysis, prerequisite test analysis (normality and homogeneity), and hypothesis testing using the t-test.

RESULT AND DISCUSSION

Pretest Description of Student *Learning* Outcomes *Project Based Learning* Model (PjBL)

Based on data analysis of *pretest* scores of fourth grade students of SD Negeri 007 Tebing using the *Project Based Learning* (PjBL) model with a sample size of 22 students, the highest score was 90, the lowest score was 25, the average was 56.14, the median was 57.5, the mode was 50, and the standard deviation was 17.38.

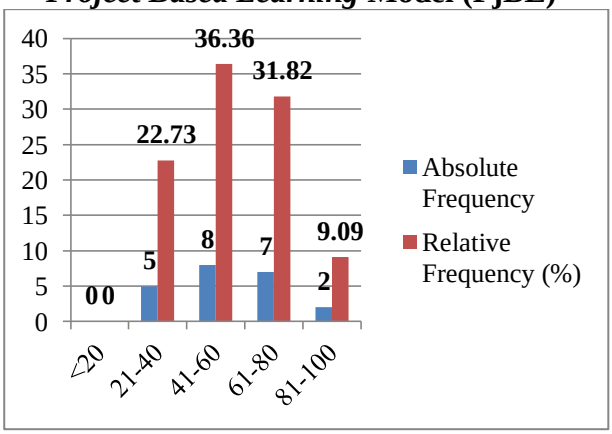
Table 2
Analysis of *Pretest Learning* Outcomes of *Project Based Learning* (PjBL) Group

No	Interval Class	Frequency		Category
		Fa	Fr	
1	81-100	2	9,09%	Very good
2	61-80	7	31,82%	Good
3	41-60	8	36,36%	Medium
4	21-40	5	22,73%	Less
5	<20	0	0%	Not at all
Jumlah		22	100%	

Description:
Fa : Absolute Frequency
Fr : Relative Frequency (%)

Based on this table, the frequency of *pretest* scores of class IV A using the *Project Based Learning* (PjBL) model with a sample of 22 students obtained the results of class intervals 81-100 as many as 2 students (9.09%) in the very good category, intervals 61-80 as many as 7 students (31.82%) in the good category, intervals 41-60 as many as 8 students (36.36%) in the moderate category, intervals 21-40 as many as 5 students (22.73%) in the poor category, and intervals <20 in the very poor category as many as 0 students (0%). For more details, it can be seen in the following graphic image:

Figure 1
Pretest Analysis Bar Chart
***Project Based Learning* Model (PjBL)**



***Posttest* Description of Student *Learning* Outcomes *Project Based Learning* (PjBL) Model**

Based on the analysis of *posttest* scores of fourth grade students of SD Negeri 007 Tebing using the *Project Based Learning* model with a sample size of 22 students, the highest score is 100, the lowest score is 45, the average is 73.86, the median is 77.50, the mode is 60, and the standard deviation is 16.61. Complete calculations can be seen in the appendix page. For more details about the *posttest* results of the *Project Based Learning* (PjBL) model can be seen in the following table:

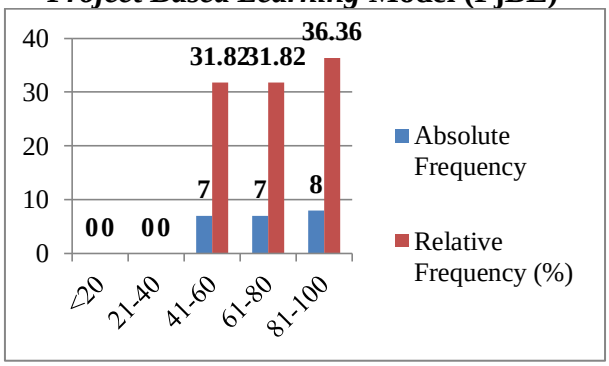
Table 3
Analysis of *Posttest Learning* Outcomes of *Project Based Learning* (PjBL) Group

No	Interval Class	Frequency		Category
		Fa	Fr	
1	81-100	8	36,36%	Very good
2	61-80	7	31,82%	Good
3	41-60	7	31,82%	Medium
4	21-40	0	0%	Less
5	<20	0	0%	Not at all
Jumlah		22	100%	

Description:
Fa : Absolute Frequency
Fr : Relative Frequency (%)

Based on this table, the frequency of *posttest* scores of class IV A using the *Project Based Learning* (PjBL) model with a sample of 22 students obtained the results of class intervals 81-100 as many as 8 students (36.36%) in the very good category, intervals 61-80 as many as 7 students (31.82%) in the good category, intervals 41-60 as many as 7 students (31.82%) in the moderate category, intervals 21-40 as many as 0 students (0%) in the poor category, and intervals <20 in the very poor category as many as 0 students (0%). For more details, it can be seen in the following graphic image:

Figure 2
Posttest Analysis Bar Chart
***Project Based Learning* Model (PjBL)**



***Pretest* Description of Student Learning Outcomes *Inquiry Learning* Model**

Based on data analysis of *pretest* scores of fourth grade students of SD Negeri 007 Tebing using the *Inquiry Learning* model with a sample size of 11 students, the highest

score was 70, the lowest score was 15, the average was 42.73, the median was 45, the mode was 45, and the standard deviation was 16.03. Complete calculations can be seen in the appendix page. For more details about the *pretest* results of the *Inquiry Learning* model can be seen in the following table:

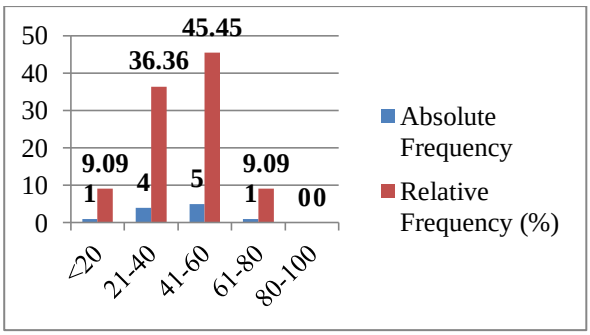
Table 4
Analysis of *Pretest* Learning Outcomes *Inquiry Learning* Model

No	Interval Class	Frequency		Category
		Fa	Fr	
1	81-100	0	0%	Very good
2	61-80	1	9,09%	Good
3	41-60	5	45,45%	Medium
4	21-40	4	36,36%	Less
5	<20	1	9,09%	Not at all
Jumlah		11	100%	

Description:
Fa : Absolute Frequency
Fr : Relative Frequency (%)

Based on this table, the frequency of *pretest* scores of class IV B using the *Inquiry Learning* model with a sample of 11 students obtained the results of class intervals 81-100 very good categories as many as 0 students (0%), intervals 61-80 as many as 1 student (9.09%) good category, intervals 41-60 as many as 5 students (45.45%) medium category, intervals 21-40 as many as 4 students (36.36%) less category, and intervals <20 less category as many as 1 student (9.09%). For more details, it can be seen in the following graphic image:

Figure 3
***Pretest* Analysis Bar Chart**
***Inquiry Learning* Model**



***Posttest* Description of Student Learning Outcomes *Inquiry Learning* Model**

Based on data analysis of *posttest* scores of fourth grade students of SD Negeri 007 Tebing using the *Inquiry Learning* model with a sample size of 11 students, the highest score was 80, the lowest score was 30, the average was 60.91, the median was 70, the mode was 70, and the standard deviation was 17.29. Complete calculations can be seen in the appendix page. For more details about the *posttest* results of the *Inquiry Learning* model can be seen in the following table:

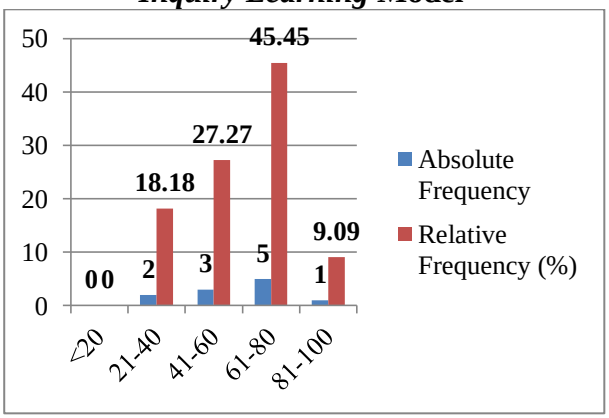
Table 5
Analysis of *Posttest* Learning Outcomes *Inquiry Learning* Model

No	Interval Class	Frequency		Category
		Fa	Fr	
1	81-100	1	9,09%	Very good
2	61-80	5	45,45%	Good
3	41-60	3	27,27%	Medium
4	21-40	2	18,18%	Less
5	<20	0	0%	Not at all
Jumlah		11	100%	

Description:
Fa : Absolute Frequency
Fr : Relative Frequency (%)

Based on this table, the frequency of *posttest* scores of class IV B using the *Inquiry Learning learning* model with a sample of 11 students obtained the results of class intervals 81-100 very good categories as many as 1 student (9.09%), 61-80 intervals as many as 5 students (45.45%) good categories, 41-60 intervals as many as 3 students (27.27%) medium categories, 21-40 intervals as many as 2 students (18.18%) less categories, and intervals <20 very less categories as many as 0 students (0%). For more details, it can be seen in the following graphic image:

Figure 4
***Posttest* Analysis Bar Chart**
***Inquiry Learning* Model**



Normality Test

The data used for the normality test were the *pretest* and *posttest* results from both classes. The normality test in this study used the *Liliefors* test with a significant level of 0.05. The test criteria if the Observation value < Ltabel then the data is normally distributed. Meanwhile, if the Observation value> Ltabel then the data is not normally distributed.

Table 6
Normality Test of *Pretest* and *Posttest of Project Based Learning* (PjBL) and *Inquiry Learning* Models

Class	Group	$L_{observation}$	L_{table}	Criteria
Pretest	PjBL	0,092	0,189	Normal
	Inquiry Learning	0,105	0,249	Normal
Post test	PjBL	0,116	0189	Normal
	Inquiry Learning	0,118	0,249	Normal

Based on the table above, it can be seen that the $L_{observation}$ value of all data is < L_{table}. Then it can be concluded that all data is normally distributed.

Homogeneity Test

The data used for the homogeneity test is the final test results from both classes. The homogeneity test in this study used the F test with a significant level of 0.05. The test criteria if F_{count} < F_{table} then the data of the two groups are homogeneous. Meanwhile, if the value of F_{count}> F_{table} then the data of the two groups are not homogeneous.

Table 7
Homogeneity Test of *Project Based Learning* (PjBL) and *Inquiry Learning* Models

SampleVariance		F_{hit}	F_{tab}	Ket
Large Variance	Small Variance			
299,091	276,028	1,084	2,32	Homogen

Based on the table of homogeneity test results using the F test above, the largest variance value is 299.091 and the smallest variance is 276.028, based on these two variances, the Fcount value is 1.084 and Ftable is 2.32. Thus it can be concluded that the data of the two groups are homogeneous.

Hypothesis Test

Hypothesis testing in this study used the t test. Decision making is done by comparing tcount and ttabel with the provisions:

If t_{count}> ttable then Ha is accepted and Ho is rejected.

If t_{count} < ttable then Ha is rejected and Ho is accepted.

Ha : there is an influence between variables and other variables, while Ho : there is no influence between variables and other variables.

Hypothesis 1

The statistical test used is the *t-test*, which is to see the effect of the average count in one group with a significant level of 0.05. Hypothesis testing in *Microsoft Excel 2010-assisted* research to determine the effect of the *Project Based Learning* (PjBL) model on IPAS learning outcomes. The results of this hypothesis testing is:

Table 8
Hypothesis 1 Testing Results

No	PjBL Learning Model	Mean	SD	t_{count}	t_{table}	Test Results
1.	*Pretest*	56,14	17,38	6,97	2,080	Significant
2.	*Posttest*	73,86	16,61			

Based on the table, it can be seen that t_{count} 6.97> t_{table} 2.080. This shows that the research hypothesis can be accepted. then it can be concluded that the *Project Based Learning* (PjBL) learning model has a significant effect on the learning outcomes of IPAS material on changes in the form of substances in class IV students of SD Negeri 007 Tebing.

Hypothesis 2

The statistical test used is the *t-test*, which is to see the effect of the average count in one group with a significant level of 0.05. Hypothesis testing in *Microsoft Excel 2010-assisted* research to determine the effect of the *Inquiry Learning* model on IPAS learning outcomes. The results of this hypothesis testing is:

Table 9
Hypothesis 2 Testing Results

No	*Inquiry* Learning Model	Mean	SD	t_{count}	t_{table}	Test Results
1.	*Pretest*	42,3	16,03	4,00	2,228	Significan
2.	*Posttest*	60,91	17,29			

Based on the table, it can be seen that t_{count} 4.00> t_{table} 2.228. This shows that the research hypothesis can be accepted. So it can be concluded that the *Inquiry Learning* model has a significant effect on the learning outcomes of IPAS material on changes in the form of substances in class IV students of SD Negeri 007 Tebing.

Hypothesis 3

The statistical test used is the *t-test*, which is to see the effect of the average count in one group with a significant level of 0.05. Hypothesis testing in *Microsoft Excel 2010-assisted* research to determine significant differences in the use of *Project Based Learning* (PjBL) and *Inquiry Learning* models on IPAS learning outcomes. The results of this hypothesis testing is:

Table 10
Hypothesis 3 Testing Results

No	*Posttest*	Mean	SD	t_{count}	t_{table}	Test Results
1.	PjBL	73,86	16,61	2,564	2,040	Significant
2.	*Inquiry Learning*	60,91	17,29			

Based on the table, it can be seen that t_{count} 2.564> t_{table} 2.040. This shows that the research hypothesis can be accepted. So it can be concluded that there is a significant difference in the effect of using the *Project Based Learning* (PjBL) and *Inquiry Learning* models on the learning outcomes of IPAS material on changes in the form of substances in grade IV students of SD Negeri 007 Tebing.

CONCLUSION

Based on the hypothesis results obtained, it can be concluded: 1) There is an effect of using the *Project Based Learning* (PjBL) learning model on the learning outcomes of IPAS material on changes in the form of substances in class IV students of SD Negeri 007 Tebing, with t_{count} 6.97> t_{table} 2.080. 2) There is an effect of using the *Inquiry Learning model* on the learning outcomes of IPAS material on changes in the form of substances in class IV SD Negeri 007 Tebing, with t_{count} 4.00> t_{table} 2.228. 3) There is a significant difference in the effect of using the *Project Based Learning* (PjBL) and *Inquiry Learning* models on the learning outcomes of IPAS material on changes in the form of substances in class IV SD Negeri 007 Tebing, with t_{count} 2.564> t_{table} 2.040.

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