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ORIGINAL RESEARCH

Analysis of changes in prospective physics teacher students' conceptions about the concept of optics-eyes using conceptual change texts

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Abstract

This research is a type of qualitative descriptive research that aims to capture conceptions and describe changes in the conceptions of prospective physics teacher students about the optical eye device after the implementation of the Conceptual Change Text (TPK). The steps taken were 1) Observation and definition, 2) Design of TPK, 3) screening of student conceptions, 4) implementation of TPK, 5) data analysis, and 5) interpretation of data on changes in student conceptions. The subjects of this study were 35 prospective physics teacher students who were programming Basic Physics II courses in the second semester of 2023 at the Physics Department, Faculty of Mathematics and Natural Sciences, Makassar State University. The results of this study indicate that on the working principle of the eye as an optical instrument, 72% experienced construction and 100% underwent reconstruction; the concept of the power of eye accommodation was obtained by 87% who underwent construction and 92% who underwent reconstruction; the concept of myopic eye defect as an optical device was obtained by 67% who underwent construction and 71% who underwent reconstruction; and the concept of hypermetropic eye defects obtained 85% who experienced construction and 58% who underwent reconstruction. It can be concluded that most student teacher candidates with different initial states of conception can achieve a deep and intact conceptual understanding through the process of construction (not having a conception to become a scientific conception) and reconstruction (misconceptions to a scientific conception).

Keywords: Conception · Conception Change · Conceptual Change Text · Misconception · Optical Device (Eye).

INTRODUCTION

Basic physics is one of the compulsory courses for students at LPTK and a course offered in the first semester because the course is a prerequisite for subsequent courses (Herausgeber, 2013) and a basic topic that will be taught at the junior high and high school levels. The development of engineering, design, planning, and technology as well as the development of the human mind are all based on the basic physics course. Basic concepts related to the subject matter are explained in the Basic Physics course which is part of the curriculum of the physics education study program at one of the LPTK in Makassar. Concepts are developed from lectures and used as a basis for further concepts and practical applications. To achieve this goal, one of the competencies that must be developed in basic physics courses is concept understanding. The National Research Council (1996) explains the implementation of NSES (National Science Education Standards) which emphasizes the acquisition of scientific knowledge and the

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development of understanding. Scientific knowledge includes facts, concepts, principles, laws, theories, models and which can be obtained in many ways.

At the high school level, it was found that some students who were taught had misconceptions, namely conceptions that were not in accordance with the scientific conceptions agreed upon by scientists (Nakleh in Balci, 2006). According to experts, many factors can be the source of misconceptions in students, including prior knowledge, daily life experiences, language, culture, teachers, textbooks and the learning process carried out by teachers (Cetin and Geban, 2011). It can be said that teachers and the learning process carried out can also be a source of misconceptions among students. Learning practices carried out by teachers that are not in accordance with the characteristics of the topic (concept) being discussed will not be able to clearly facilitate students to be able to have scientific conceptions and understand the teaching topic. Suprapto, (2020) stated that misconceptions caused by teacher factors include teacher incompetence, lack of mastery of teaching topics, inappropriate teaching methods or use of unsupportive media.

The most important thing to create an effective teaching and learning process is that teachers must have a correct understanding of concepts and of course must be in accordance with scientific concepts. However, physics teachers are still found to have misconceptions about certain topics. Misconceptions that teachers have are likely to occur when teachers are still prospective teacher students in college (Larkin, 2012). Thus, it is very important to provide conceptual understanding to prospective teacher students to prepare prospective teachers as professionals, especially for physics teachers. The understanding of students as prospective teachers in mastering physics concepts will affect the achievement of educational goals in the teaching and learning process. As a teacher, it is important to understand concepts that are in accordance with scientific concepts. The basic concepts that are very important provisions for prospective teacher students are the concepts discussed in basic physics courses, especially on the topic of optical instruments.

To prepare future prospective teachers, it is important to equip them with correct and scientific concept mastery. Therefore, it is very necessary to capture the conceptions and misconceptions of prospective physics teachers, especially in basic physics courses on the topic of optical instruments to equip them with concept mastery and prevent misconceptions. To facilitate the diversity of initial conception conditions of prospective teacher students, to achieve scientific conceptions and a complete level of understanding, a lecture model is needed that can facilitate students who initially do not have a conception to have a scientific conception (preventing misconceptions) and can also facilitate students who initially have misconceptions to have a scientific conception (changing). Thus, this study was conducted to equip prospective physics teachers with an understanding of scientific concepts, especially on the concept of optical instruments.

Basically, research related to conceptual change has great potential to improve teaching practices in science classes. To change misconceptions into scientific conceptions, an appropriate conceptual change approach is needed and is also given at the right time. Changing misconceptions into scientific conceptions can be done, among others, by presenting cognitive conflict. The presentation of cognitive conflict in the learning process must be able to shake the stability of misconceptions. If students already have doubts about the truth of their conceptions,

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then it is expected that they can reconstruct their conceptions so that at the end of the learning process only scientific conceptions remain.

A special strategy is needed to change a wrong conception (misconception) into a scientific conception. The approach that is often used to change this wrong conception is known as the conceptual change approach (Baser, 2006). One strategy that is often used in conceptual change is the cognitive conflict strategy. This strategy believes that because it is difficult to change a person's misconception because the person does not feel there is a problem with their conception, and even has high confidence in the truth of their conception, there is no other way to remediate the person's misconception except to start with the process of destroying the level of belief in their conception. With the collapse of the belief in the conception, it is hoped that the person can immediately realize the error in the conception they hold. In the cognitive conflict strategy, to destroy the level of students' belief in their conception, a process of confronting beliefs is usually carried out by clashing the conception they hold with the actual reality according to the scientific conception. One of the methods used is to use conceptual change text consisting of questions that are oriented towards conflict with the conceptions they have. The conflict situation in their minds (disequilibrium state) is expected to occur when they face the reality that what they see when answering questions is contrary to the conceptions they have held so far. When this situation has occurred, it will be easier to change their erroneous conceptions into scientific conceptions. The process of replacing old erroneous conceptions with new scientific conceptions is often referred to as the process of conceptual accommodation. The cognitive conflict strategy was developed based on constructivism (Stepans, 2011). In practice, the cognitive conflict strategy is applied in the conceptual change model (CCM). According to Posner et al (1982), there are four essential conditions to facilitate the change of conception through the accommodation process, namely: 1) Dissatisfaction with the current conception, 2) The new conception introduced must be clear (intelligible), 3) The new conception introduced must make sense (plausible) and 4) The new conception introduced must be seen to be beneficial (fruitful). Stepans developed CCM based on constructivism which consists of six stages of the process, namely: Stage 1, the process of revealing students' conceptions of an event or physical phenomenon, Stage 2, revealing the level of belief in the concept held by students, Stage 3, confrontation of students' conceptual beliefs through observation activities of real phenomena, Stage 4, the scientific explanation process to help students accommodate new scientific conceptions, Stage 5, the process of strengthening and expanding conceptions, and Stage 6, the process of finding new ideas that are in accordance with the accommodated conceptions (Stepans, 1994; 2011). Meanwhile, to facilitate students whose initial condition is completely empty (does not have an initial conception) to achieve scientific conceptions, learning is needed that uses a development approach or the formation of conceptions in the minds of students, which is often referred to as the conceptual development approach. By using this approach, students are facilitated to be able to construct their own conceptions in their minds through hands-on and minds-on activities interactively and collaboratively. Educators present stimuli that can trigger students to think and hypothesize and then continue with a series of science processes. For this purpose, inquiry-based learning models are often used, such as discovery learning (Abdisa et al., 2012), interactive lecture demonstration (Mazzolini et al., 2011), The level of Inquiry model of teaching (Wenning, 2011), context-based learning (De Jong, 2008) and others.

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To create such conditions, it is necessary to create cognitive conflict in learners. There are three strategies that involve the occurrence of a conflict in students so that old ideas with new ideas. The three strategies include: 1) learning cycle (Lawson, 1988), 2) general structure of teaching sequence (Driver, 1988), and 3) language-oriented learning cycle (Glasson, 1993). In this study, the Lawson model teaching strategy was used with three phases in its learning cycle, namely the exploration phase, concept introduction, and concept application. The three phases of the learning cycle used in this study were the exploration phase, concept introduction phase, and concept application phase. In the exploration phase, students learn through their own actions and reactions in new situations. In this phase, students often investigate a phenomenon with minimal guidance. This phenomenon is expected to raise questions or complexities that cannot be solved with existing ideas or with commonly used reasoning. Thus, this phase provides an opportunity for students to convey conflicting ideas that they have, can cause debate, and there is an analysis process regarding why the ideas that are built are like that. Through the exploration phase, students can identify a pattern of regularity in the phenomena being investigated. For example, involving their reasoning and experience in expressing ideas contained in student worksheets about optical devices (Nurzama et al., 2021), especially the eye.

Furthermore, in the concept introduction phase, it begins by introducing a concept or a concept related to the phenomenon presented in several situations and then answered based on observations, experiences, and reasoning in the exploration phase. Then continued with the provision of conceptual change text sheets based on analogy models which in this study with text structures include: dominant forms of misconceptions, correct explanations of concepts, presentation of analogy models.

Finally, in the Application phase, students are given the opportunity to use the concepts that have been introduced to further investigate the concepts discussed (for example, further investigating the properties of the shadow of an object in a different context with a new situation). In this study, a learning cycle adapted from Lawson's (1988) learning cycle has been applied with the aim of detecting the description of conceptions and misconceptions held by students. By implementing this learning cycle, it is expected to create disequilibrium, argumentation, and the use of student reasoning patterns that will describe the conceptions and misconceptions held by students. Based on the background above, the problem of this study is "How is the description of conceptual changes in prospective physics teacher students about optical instruments in basic physics II lectures after attending lectures using Conceptual Change Texts (TPK)?"

METODE

This research is a type of quantitative descriptive research that aims to analyze changes in the conception of prospective physics teacher students on the topic of optical devices-eyes in basic physics II lectures after using the Conceptual Change Text. The data collection technique used is through a test using a concept understanding test instrument. The steps taken are 1) Observation and definition, 2) Designing the Conceptual Change Text (TPK), 3) gathering student conceptions, 4) implementing TPK, 5) analyzing data using descriptive analysis, and 5)

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interpreting data on changes in students' conceptual understanding. The subjects of this study were prospective physics teacher students who programmed basic physics courses.

Descriptive analysis aims to describe the state of conception and changes in the conception of prospective teachers after the implementation of the Conceptual Change Text (TPK). Initial conceptions can be in various states, such as some are completely empty in the sense of not having an initial conception, some already have a scientific initial conception, and some have an initial concept but are not scientific. Likewise, the form of conceptual change that occurs in the learning process can also be different. The level of conceptual change shown in this context is to describe the form of conceptual change that occurs before and after the implementation of TPK. The level of conceptual change is divided into several categories as seen in Table 1.

Table 1. Scoring rubric for concept change levels (Lappi, 2013)

Concept change level	Coding	Criteria
Having a scientific conception from the start (Complementation)	Cp	have a good scientific conception both before and after the lecture and/or be able to integrate new knowledge with initial knowledge into comprehensive knowledge.
Revision	Ro	changes in prospective teachers' conceptions from a state of misconception to a state of scientific conception from before to after the lecture.
Construction	Co	changes in prospective teachers' conceptions from having no conception to having a scientific conception from before to after the lecture
Disorientation	D	changes in conception where prospective teachers' conceptions change towards a more unscientific direction between before and after the lecture, for example from a state of scientific conception to a state of misconception.
Statis (Static)	S	changes in conception where prospective teachers show ownership of conceptions that remain the same (do not change) between before and after the lecture, for example still having misconceptions or still not having conceptions.

The next level of conceptual change is determined based on the change in conception from before to after the implementation of TPK, as shown in the Figure 1.

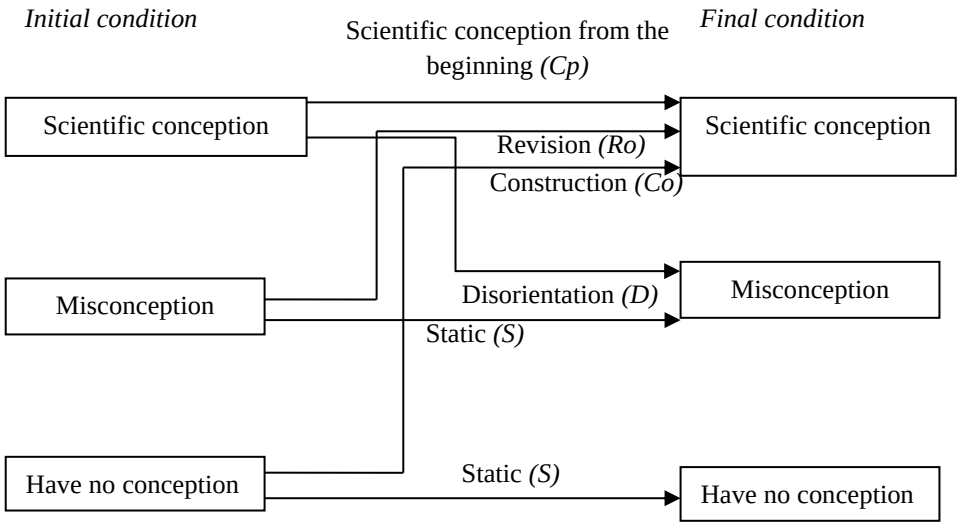

Figure 1. Levels of conceptual change that can occur in prospective teachers

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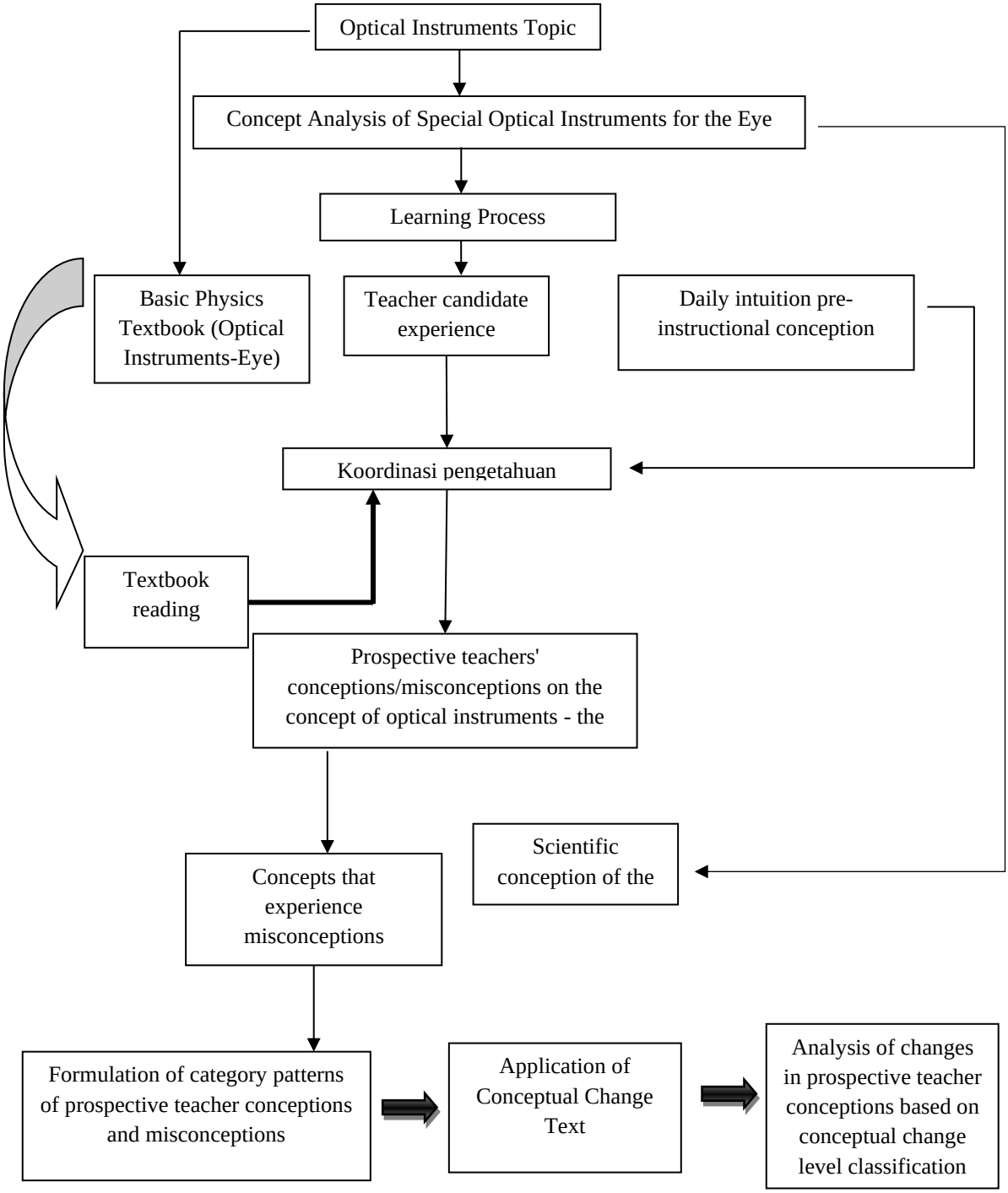

Figure 2. Research Procedure Flowchart

RESULTS AND DISCUSSION

On the topic of optical devices-eyes consists of four concepts, namely the first concept about the concept of the eye as an optical device with the first question (P1) regarding the definition of the working principle of the eye as an optical device; the second question (P2) regarding the mechanism of the process of forming an object's image in the eye due to reflection and refraction of light and the third question (P3) regarding the representation of a microscopic image of the process of forming an object's image in the eye due to reflection and refraction of light. Furthermore, the second concept is related to the concept of the eye's accommodation

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power consisting of the first question (P1) regarding the definition of the eye's accommodation power; the second question (P2) regarding the mechanism of the eye's accommodation process and the third question (P3) regarding the representation of a microscopic image of the eye's accommodation process. The third concept is about the concept of myopia eye defects consisting of the first question (P1) regarding the definition of myopia; the second question (P2) regarding the mechanism of the process of forming an object's image by myopia eye defects and the third question (P3) regarding the representation of a microscopic image of the process of forming an image by myopia. The fourth concept is about the concept of hypermetropia eye defects consisting of the first question (P1) regarding the definition of hypermetropia; The second question (P2) concerns the mechanism of the process of forming the image of an object due to hypermetropia and the third question (P3) concerns the microscopic image representation of the process of forming the image due to hypermetropia.

Scoring on this level of understanding test consists of two types, namely scoring for verbal answers/responses and scoring for picture answers/responses. The score range is between 0 and 4, both for verbal responses and for picture responses. The rubric used is in Table 1 for verbal responses and Table 2 for picture responses adapted from the rubric used by Abraham et al. (1992) and Saglam Arslan (2009).

Table 2. Scoring rubric for conceptual understanding level test for verbal descriptive responses

No.	Concept understanding level	Score	Criteria
1.	Comprehensive understanding (MSU)	4	The response includes all scientifically accepted components.
2.	Partial understanding (MSP)	3	The response includes several scientifically accepted components.
3.	Partial understanding with alternative conception (MSP-KA)	2	Responses that indicate that the concept has been understood but also contain alternative conceptions.
4.	Understanding alternative conceptions (ALC)	1	The responses given are scientifically incorrect, illogical or misinformed.
5.	Don't Understand (TM)	0	Empty, the impression given is unclear and irrelevant

Meanwhile, the scoring of the test for the level of students' conceptual understanding of the responses in the form of image descriptions, namely question 3, is shown in Table 3, which is adapted from the rubric used by Abraham et al. (1992) and Saglam Arslan (2009).

Table 3. Scoring rubric for conceptual understanding level test for image description responses

No.	Concept understanding level	Score	Criteria
1.	True depiction	4	The image reflects all scientifically accepted components.
2.	Some of the depictions are correct	3	The image reflects several scientifically accepted components.
3.	Some of the depictions are correct and some of the depictions are incorrect.	2	An image that reflects some components that are scientifically accepted and some components that are not scientifically accepted.
4.	The depiction is not true	1	Images that reflect all components are not scientifically accepted.
5	There is no filming	0	Empty

The rubrics in Tables 2 and 3 are combined to score questions on the level of students' conceptual understanding of responses in the form of verbal descriptions and picture descriptions, as shown in Table 4.

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Table 4. Rubric for students' conceptual understanding level

No.	Model mental (MM)	Content	Criteria
1.	Comprehensive understanding (MSU)	Student responses contain all scientifically acceptable components (score 3 or 4)	Question 1, question 2 and question 3 have high scores (3 or 4)
2.	Partial understanding (MSP)	Student responses contain components that are partly scientifically acceptable and partly scientifically unacceptable.	Question 1, question 2, and question 3 have scores that are partly high (3 or 4) and partly low (2 or 1 or 0)
3.	Don't understand (TM)	Student responses are not scientifically acceptable (score 0 or 1 or 2)	Question 1, question 2 and question 3 have low scores (2 or 1 or 0)

The increase in the level of conceptual understanding achieved by students is determined based on changes in the level of conceptual understanding that occurs from before the learning treatment to after the learning treatment, from the level of partial understanding or not understanding to the level of complete understanding. Table 5 shows the percentage of students for each level of conception of prospective teacher students related to the topic of optical-eye devices before and after the implementation of learning using Conceptual Change Text (TPK). Table 5 shows that there is a change in the number of students who reach the level of complete understanding (MSU) from before to after the implementation of learning using TPK, which is greater. Meanwhile, the number of students who reach the level of not understanding (TM) from before to after the implementation of learning using TPK is smaller. This shows that using TPK facilitates the achievement of an increase in the level of conceptual understanding of optical-eye devices for prospective teacher students, which is better. From Table 5, it can be seen that there is an increase in the number of prospective teacher students who achieve complete conceptual understanding, where before using TPK there was not a single prospective teacher student who fully understood the concept of the working principle of the eye as an optical instrument, while after learning using TPK it increased to 28 prospective teacher students who fully understood the concept of the working principle of the eye as an optical instrument. Thus, the number of prospective teacher students who partially understand and do not understand the concept has decreased. Likewise, in the concept of eye accommodation power, based on Table 4, it can be seen that there is an increase in the number of prospective teacher students who achieve a complete understanding of the concept, where before the implementation using TPK there was not a single prospective teacher student who fully understood the concept of eye accommodation power, while after learning using TPK it increased to 31 prospective teacher students who fully understood the concept of eye accommodation power. Thus, the number of prospective teacher students who partially understand and do not understand the concept has decreased. Furthermore, in the concept of myopia, based on Table 5, it can be seen that there is an increase in the number of prospective teacher students who achieve a complete understanding of the concept, where before the implementation using TPK there was not a single prospective teacher student who fully understood the concept of myopia, while after learning using TPK it increased to 24 prospective teacher students who fully understood the concept of myopia. Thus, the number of prospective teacher students who partially understand and do not understand the concept has decreased. Likewise, in the concept of hypermetropia eye defects (see on Table 5) it can be seen that there

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is an increase in the number of prospective teacher students who achieve a complete understanding of the concept, where before the implementation using TPK there was not a single prospective teacher student who fully understood the concept of hypermetropia eye defects, while after learning using TPK it increased to 23 prospective teacher students who fully understood the concept of hypermetropia eye defects. Thus, the number of prospective teacher students who partially understood and did not understand the concept decreased.

Table 4. Percentage of the number of students for each level of understanding of the concept of optical instruments-eyes

No	Concept	Level of Understanding	Number of Students	
			Before (%)	After (%)
1	The working principle of the eye as an optical instrument	MSU	0	80
		MSP	29	20
		TM	71	0
2	Power of accommodation of the eye	MSU	0	89
		MSP	66	11
		TM	34	0
3	Eye defect-myopia	MSU	0	69
		MSP	40	31
		TM	60	0
4	Eye defect-hypermetropia	MSU	0	66
		MSP	63	34
		TM	37	0

If analyzed about the pattern of changes in conceptions held by prospective teacher students from before the implementation using TPK to after the implementation using TPK, the increase in the number of prospective teacher students who have scientific conceptions occurs through construction and reconstruction. Prospective teacher students are said to have experienced scientific reconstruction if they experience a change from misconception to having a scientific conception, while prospective teacher students are said to have experienced scientific construction if they experience a change from not having a conception to having a scientific conception. Figure 3 shows the pattern of changes in conceptions in the concept of the working principle of the eye as an optical tool held by prospective teacher students which are differentiated by gender, namely female prospective teachers (CGP) and male prospective teachers (CGL) from before the implementation using TPK to after the implementation using TPK.

Based on Figure 3, prospective teacher students experienced reconstruction, namely a change from misconception to scientific conception, as many as 10 students or 29%. Furthermore, there were no prospective teacher students who did not experience a change in conception from misconception to remain in the same state (static). While the construction process, namely a change from not having a conception to a scientific conception, was experienced by 18 students or 51%, but no students were found who did not experience a change in conception, namely from not having a concept to still not having a conception (static). In this study, there were also prospective teacher students who experienced a change from not having a conception to a misconception (no term) as many as 7 students or 20%.

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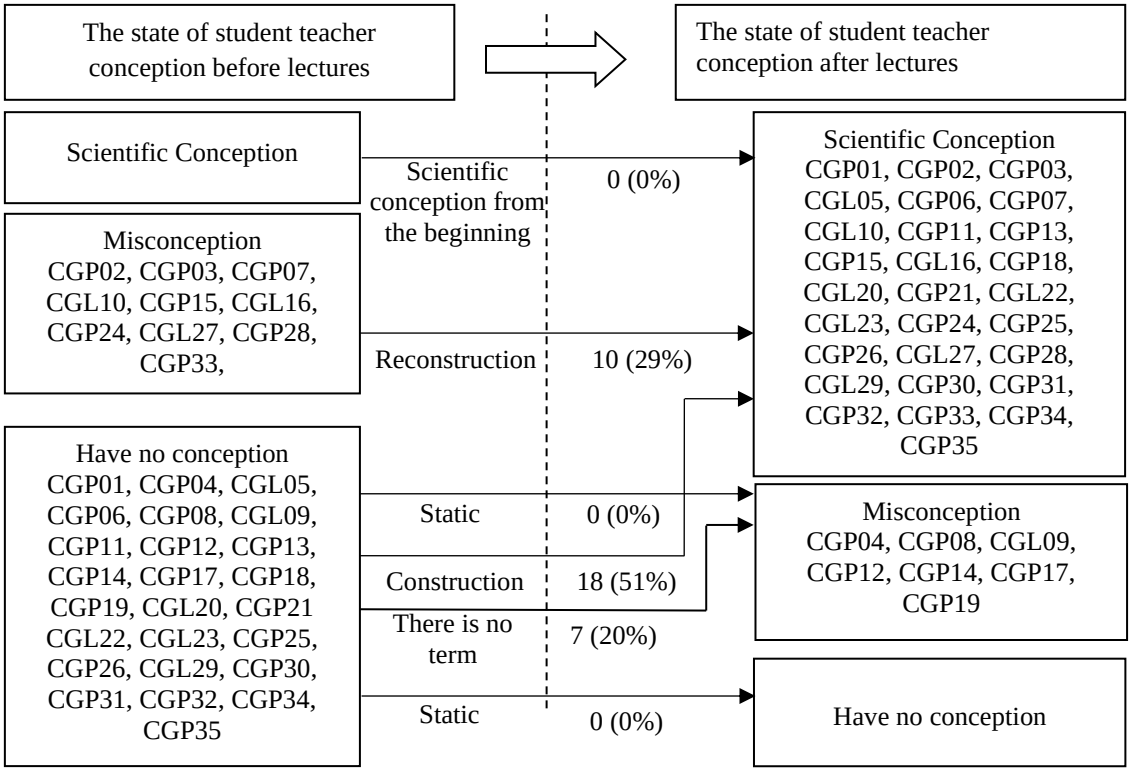

Figure 3. Patterns of changes in the conception of prospective teacher students regarding the concept of the working principles of the eye as an optical instrument between before and after attending lectures using TPK.

Figure 4 shows the pattern of changes in the concept of eye accommodation power of prospective teachers from before the implementation using TPK to after the implementation using TPK. Based on Figure 2, prospective teachers experienced reconstruction, namely a change from misconception to scientific conception, as many as 20 students or 57%. Prospective teachers who did not experience a change in conception from misconception still in the same state (static) were 3 students or 9%. While the construction process, namely a change from not having a conception to a scientific conception was experienced by 11 students or 31%, but no students were found who did not experience a change in conception, namely from not having a concept to still not having a conception (static). Furthermore, prospective teachers who experienced a change from not having a conception to misconception (no term) were 1 student or 3%.

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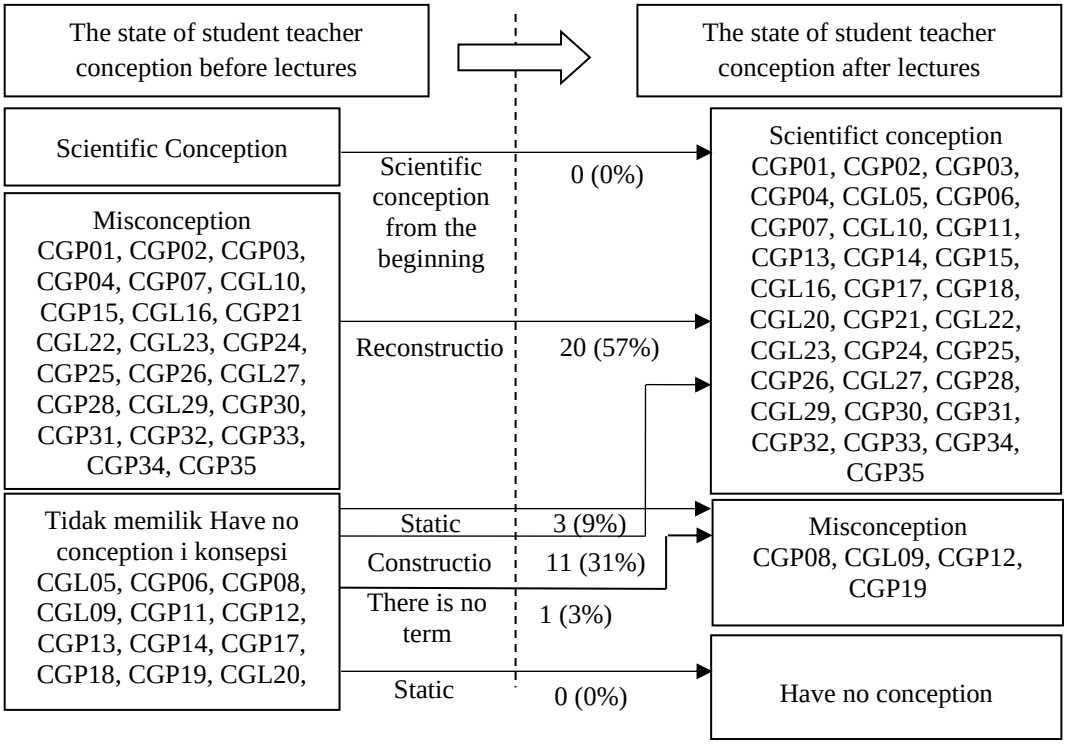

Figure 4. Patterns of changes in the conception of prospective teacher students regarding the concept of the eye's accommodation power as an optical tool between before and after attending lectures using TPK.

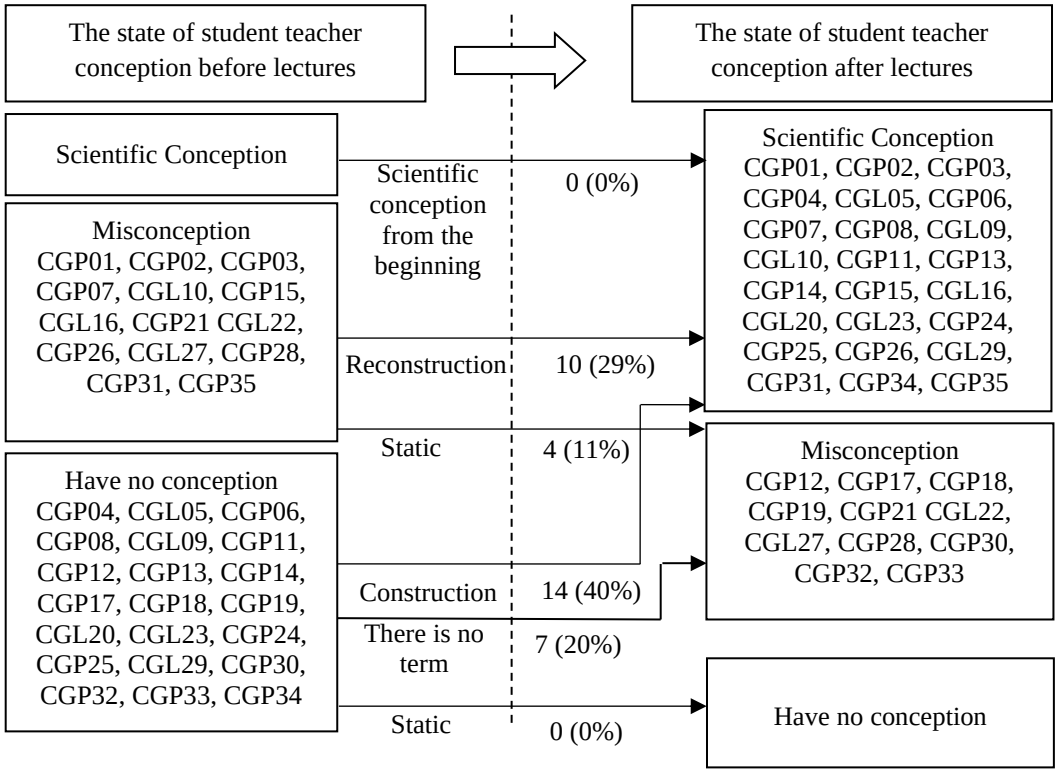

Figure 5. Patterns of changes in the conception of prospective teacher students regarding the concept of myopia between before and after the implementation of TPK

Figure 5 shows the pattern of changes in the concept of myopia eye defects held by prospective teacher students before the implementation using TPK and after the implementation using TPK.

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Based on Figure 5, prospective teacher students experienced reconstruction, namely a change from misconception to scientific conception, as many as 10 students or 29%. Prospective teacher students who did not experience a change in conception from misconception remained in the same state (static) were as many as 4 students or 11%. While the construction process, namely a change from not having a conception to a scientific conception in this limited trial was experienced by 14 students or 40%, but no students were found who did not experience a change in conception, namely from not having a concept to still not having a conception (static). At the limited trial stage, there were also prospective teacher students who experienced a change from not having a conception to a misconception (no term) as many as 7 students or 20%. Figure 6 shows the pattern of changes in conception in the concept of hypermetropia eye defects owned by prospective teacher students from before the implementation using TPK to after the implementation using TPK.

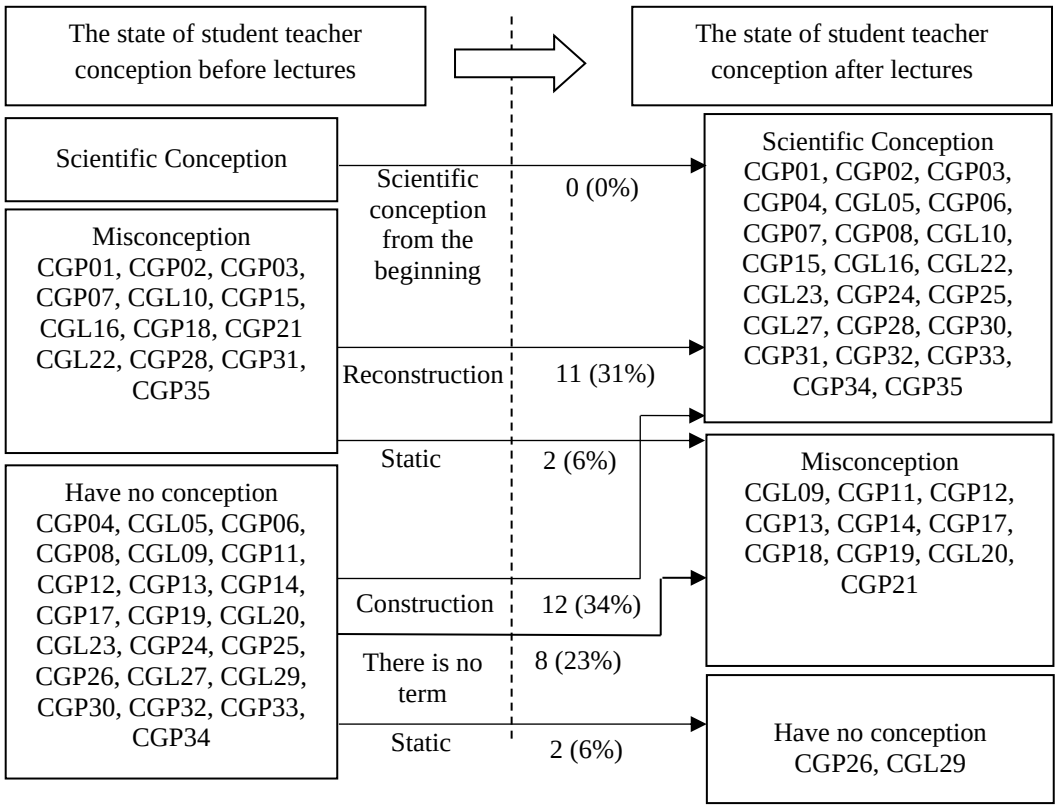

Figure 6. Patterns of changes in the conception of prospective teacher students regarding the concept of eye defects - hypermetropia between before and after attending lectures using TPK

Based on Figure 6, prospective teacher students experienced reconstruction, namely a change from misconception to scientific conception, as many as 11 students or 31%. Prospective teacher students who did not experience a change in conception from misconception remained in the same state (static) were as many as 2 students or 6%. While the construction process, namely a change from not having a conception to a scientific conception in this limited trial was experienced by 12 students or 34%, and there were also students who did not experience a change in conception, namely from not having a concept to still not having a conception (static) as many as 2 students or 6%. At this limited trial stage, there were also prospective teacher students who experienced a change from not having a conception to a misconception (no term) as many as 8 students or 23%.

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Thus, based on the results of the study in Figure 3, Figure 4, Figure 5, and Figure 6, it can be said that the application of Conceptual Change Text can reconstruct the conception of prospective teacher students to be better. This finding has implications for practitioners or teachers in providing alternative learning models that can reconstruct students' conceptions to be better. However, this study did not focus on factors other than improving students' conceptions, and this may be a limitation of this study (Samsudin, et al.: 2024).

Table 5. The number of prospective teacher students who experienced construction and reconstruction of concepts related to the concept of optical eye instruments after attending lectures using TPK.

No	Sub-Concept	Types of Conceptual Changes		Percentage of Conceptual Change (%)	
		Construction	Reconstruction	Construction	Reconstruction
1	The working principle of the eye as an optical instrument	18 of 25	10 of 10	72	100
2	Power of accommodation of the eye	20 of 23	11 of 12	87	92
3	Myopia eye defect	14 of 21	10 of 14	67	71
4	Hypermetropia eye defect	11 of 13	12 of 22	85	55

Table 5 shows that all prospective teacher students (100%) who have misconceptions on the concept of the working principle of the eye as an optical tool can achieve conceptual reconstruction towards scientific conception ownership and most prospective teacher students (72%) who initially did not have a conception, achieved conceptual construction to have a scientific conception. Furthermore, on the concept of eye accommodation power, generally prospective teacher students (92%) who have misconceptions can achieve conceptual reconstruction towards scientific conception ownership and most prospective teacher students (87%) who initially did not have a conception, achieved conceptual construction to have a scientific conception. Likewise, on the concept of myopia, generally prospective teacher students (71%) who have misconceptions can achieve conceptual reconstruction towards scientific conception ownership. Furthermore, it appears that most prospective teacher students (67%) who initially did not have a conception, achieved conceptual construction to have a scientific conception. This shows that using TPK has high effectiveness in facilitating the conceptual reconstruction process for prospective teacher students who initially had misconceptions, and also has high effectiveness in facilitating the conceptual construction process for prospective teacher students who initially did not have a conception. Thus, this study contributes to the quality of education to be better. Based on the findings of this study, a description of the misconceptions experienced by prospective teacher students was obtained and remediating these misconceptions so that prospective teachers experience the construction and reconstruction of knowledge into scientific conceptions, especially on the topics of Optical Instruments (eyes). The results of this study are in line with previous studies, namely that after the application of conceptual change texts (TPK), 15 misconceptions experienced by students were successfully reduced. The decrease in misconceptions ranged from 0.71 to 1.00 with an average decrease of 0.79 which is included in the high category. Based on these findings, the application of TPK learning to Vocational High School students can reduce the number of students who have misconceptions about the concept of static fluids. This shows that TPK learning can be the right alternative to correct misconceptions (Maknun & Marwiah: 2022). Misconceptions are a common problem in physics learning that should not be ignored by

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teachers. The consequences of misconceptions are very important in achieving learning objectives, especially on the topics of optical instruments-eyes. The results of this study indicate that research on misconceptions is still challenging and interesting to continue to be studied. The three most important areas in misconceptions are identifying misconceptions through diagnostic tests, understanding their causes, and correcting misconceptions.

CONCLUSION

The results of this study indicate that there is a significant potential for the implementation of using Conceptual Change Text (TPK) in facilitating the achievement of a complete and comprehensive understanding of concepts. This potential is possible because all prospective teacher students with different initial conceptions can be facilitated to achieve a deep and complete understanding of concepts through the process of constructing and reconstructing concepts. It can be concluded that using TPK can be used to build conceptions and remediate misconceptions in prospective teacher students related to the concept of the working principle of the eye as an optical tool, the accommodation power of the eye, myopia and hypermetropia.

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