

Design of Cognitive Conflict-Based Teaching Materials Integrating Real Experiment Video Analysis on Momentum and Impulse to Improve Students' Concept Understanding

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ABSTRACT

Students do not understand concepts and misconceptions occur in momentum and impulses. Less available teaching materials that can remediate misconceptions. This study aims to design cognitive conflict-based teaching materials that integrate video analysis of real experiments to improve students' conceptual understanding of momentum and impulses. This research is a development research using the Plomp model. In the preliminary research, journal analysis, interviews with physics teachers, and literature studies were conducted. At the prototyping stage, teaching materials are designed, self-evaluation is carried out, validation by 3 lecturers and one-to-one practicality test for 3 students. The data analysis technique used descriptive analysis for interviews, the Aiken-V formula for validation and percentage techniques for practicality tests. The results of the preliminary research, it was found that students' understanding of concepts was low and there were still misconceptions, the unavailability of teaching materials that corrected misconceptions. The results of the prototyping stage, momentum and impulse teaching materials were designed based on four syntaxes of cognitive conflict-based learning model (CCBL Model). In the third syntax, real-experiment video analysis is integrated using the tracker program. The results of the self-evaluation showed that the teaching materials were complete with very good criteria. The results of the validation test obtained a very valid value of 0.81. The results of the practicality test obtained a very practical value of 90.27. So, the design of cognitive conflict-based teaching materials integrating video analysis of real experiments on momentum and impulses is very valid and practical in one-on-one evaluation.

Keywords: *Cognitive conflict, Real experimental video analysis, Understanding of concepts, Momentum and impulses.*



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I. INTRODUCTION

Education in Indonesia has an important role in the progress of the nation. The purpose of education is to create a generation that is faithful, knowledgeable, competent, critical, and creative that is able to compete with the outside world in facing the times. To achieve this goal, the government made improvements in education in Indonesia in accordance with the times, namely changing the curriculum to the 2013 curriculum, holding a teacher certification program and providing facilities and infrastructure in stages to support the learning process in schools.

Curriculum 2013 requires teachers to master the development of science and technology so as to facilitate teachers in applying learning methods in the classroom and make lessons interesting. Teaching materials are very useful in building understanding concepts of students. Understanding the concept of students in physics learning is inseparable from the possibility of misconceptions. In physics learning, students' thinking increases in analyzing the phenomena that occur around them. This phenomenon is explained through concepts, laws and mathematical equations in finding the real answer. The explanation of this phenomenon is not only obtained

from learning in the classroom but also outside of school. The possibility of misconceptions in students causes differences in the level of understanding of learning. Learning that is carried out rarely looks at the preconceptions possessed by students so that the possibility of misconceptions is not identified even though the subject matter has been studied. Misconception is an understanding of a concept that is not in accordance with the agreement of the experts in the field. Misconceptions are caused by a person's mistake in understanding the concept based on his experience [1].

The problem of misconceptions is often found in the study of physics. Based on the study of literature found that misconceptions quite a lot occur in mechanical materials. In momentum and impulse materials, student misconceptions were found at 48.61% [2]. Maulida and Suliyanah's research [3] on understanding students' concepts of momentum and impulse material. Students who experienced misconceptions on momentum material as much as 73.1%, impulse material as much as 86.1% and collision material as much as 84.3%, and obtained from interviews with physics teachers that the learning process is still centered on the teacher and every physics material taught is rarely practiced. Furthermore, Sutrisno's research, et al. [4] obtained students' ability on momentum and impulse material is still low. Judging from the category of misconceptions as much as 33.1%, do not know as much as 32.1%, guess as much as 17.1% and don't answer as much as 0.9% .

Based on the results of teacher interviews conducted in three senior high schools, namely SHS A, SHS B and SHS C, there were several problems in the learning process: (1) Physics learning in schools has not fully implemented the model in accordance with the 2013 curriculum; (2) The teaching materials used have not used certain models that can improve the understanding concepts of student , especially remediate misconceptions; (3) Experiments on momentum and impulse matter are rarely conducted due to the limitations of available tools. During the covid19 pandemic, experiments are needed that students can use IT-based devices, as a supporter of online learning, therefore an innovation is needed that can overcome the problem of low understanding of concepts and limitations of teaching materials and facilities that can overcome misconceptions even during the covid19 pandemic.

One solution is to develop teaching materials that can improve the understanding of concepts and remediate misconceptions. This teaching material have cognitive conflict models integrate real experiment video analysis. Teaching materials are prepared based on the syntax of cognitive conflict-based learning models (CCBL Model) consisting of 4 syntax namely [5]: (1) activation of preconceptions and misconceptions, (2) presentation of cognitive conflicts, (3) the discovery of concepts and equations, and (4) reflections. The advantages of this teaching material are can make students realize that they are experiencing concept misconceptions, improve the understanding of student concepts, straighten students' view that the equations and concepts of physics is one unity whole so that the new knowledge that students later have, will be in accordance with the scientific concept. In the third syntax of CCBL model integrated real experiment video analysis using Tracker program. The Tracker program is very appropriate to use for motion-related experiments [6]. Several cognitive conflict-based teaching materials have been designed on atomic nucleus matter [7] and direct current electrical matter [8] by integrating virtual laboratory. In materials related to the motion of an object, it can be done experiment real video analysis, one of which is on the momentum and impulse.

On momentum and impulse material, Basic Competence 4.10 expected capable students to presents the test results of the application of the law of conservation of momentum. This material is suitable for using real experimental video analysis because it can make it easier for students to observe the motion of a colliding object. Real experimental video analysis is an experiment that is carried out by recording the motion of an object, then analyzing the motion through the Tracker program. Through real experimental video analysis, students can do real experiments by recording movement phenomena and observing the movement process that occurs using a tracker application [6]. Tracker is a modeling tool on open source physics with a java framework for analyzing videos. This tracker combines video with computer models and is used to analyze the motion video of an object [9]. The study aims to design and validate cognitive conflict-based teaching materials that integrate real experiment video analysis into momentum and impulse.

II. METHOD

The type of research used is development research or design research. The object in this study is cognitive conflict-based teaching materials integrating real experiment video analysis. Cognitive conflict-based teaching materials are designed to improve understanding of student concepts on momentum and Impulse materials. The development of teaching materials using Plomp model consists of three stages, namely 1) preliminary research, 2) development or prototyping phase, and 3) assessment phase. This research is limited to two stages, namely preliminary research and development or prototyping phase. Technical data analysis in preliminary research is by descriptive analysis.

Preliminary research conducted a needs analysis and problem analysis by interviewing three high school teachers and analyzing 9 journal articles on understanding the concepts and misconceptions of students on momentum and impulse materials. The instruments used are interview guidelines and journal article analysis sheets. Preliminary research aims to find out common problems in the field and conduct literature studies to find solutions. Table of literature studies on misconceptions that occur in momentum and impulse material.

In the development phase or prototyping is designed teaching materials that can overcome the low understanding of concepts and remediate misconceptions on material the momentum and impulses. Furthermore, formative evaluation consists of self-evaluation, expert review and one to one evaluation. Revisions are corrected at each stage of formative evaluation. Self-evaluation is done by the researchers themselves to check the completeness and see the obvious errors in the prototype. The instrument used for self-evaluation is a self-assessment questionnaire with an assessment score using the Likert scale. The data analysis technique used is a percentage technique with the following equations:

$$P = \frac{f}{N} \times 100$$

Information:

P = final grade

F = Obtained score

N = maximum score

Interpretation of self-evaluation results is found in Table 1.

Table 1. Results Interpretation of self-evaluation

No.	Total Score	Criteria
1	0-20	Not good
2	21-40	Not good
3	41-60	Pretty good
4	61-80	Good
5	81-100	Very good

(Source: modified from Riduwan) [10]

After the self-evaluation is carried out, it is followed by prototype validation through expert reviews. The instrument used was a validity questionnaire with four aspects of assessment, namely content validity, construct validity, language validity and face validity. Evaluation of the validity of the teaching materials prototype was carried out by three physics lecturers. The technique of analyzing the validity evaluation data uses the Aiken V formula (Aiken, 1985), namely:

$$V = \frac{\sum s}{[n(c-1)]}$$

Interpretation of validity evaluation results is found in Table 2.

Table 2. Aiken's V Rating Index

Validity Index	Assessment
V < 0.4	Less valid
0.4 < V < 0.8	Valid
V > 0.8	Very valid

(Source: Aiken, 1985) [11]

After the prototype is declared valid, then done one to one evaluation to see the practicality of the prototype. The instrument used is a practicality questionnaire consisting of practical aspects, namely: easy to use, usable, benefit and efficiency. Scoring on the practicality sheet uses the Likert scale. Data analysis techniques use percentage techniques as in equations (1). The interpretation of the practicality of the prototype is found in Table 3.

Table 3. Product Practicality Criteria

Practicality	Criteria
0-20	Impractical
21-40	Less Practical
41-60	Quite Practical
61-81	Practical
81-100	Very Practical

(Source: modified from Riduwan [10])

III. RESULTS AND DISCUSSION

A. Research result

Preliminary research has two research results. First, the results of interviews with three physics teachers at senior high school. Second, the results of analysis of journal articles on understanding the concept and misconceptions of students on momentum and impulse material. The results of interviews with three physics teachers are found in Table 4.

Table 4. Results of Interviews with Physics Teachers

Senior High School	Learning Model Used	Instructional Materials Used	Learning Media Used	Understanding Student Concepts
SHS A	Discovery learning model, problem based learning model or using other models that students like	There has not been any use of cognitive conflict syntax.	Virtual Lab and videos on the internet.	Learners memorize formulas.
SHS B	Discovery learning model, using other models that are suitable for students	There has not been any use of cognitive conflict syntax.	Virtual Lab, Teaching is as simple as possible.	Many have memorized formulas, explaining material that is prone to repeated misconceptions.
SHS C	Discovery learning model, problem based learning model or using other models according to student interests	There has not been any use of cognitive conflict syntax.	Virtual Lab or learning videos.	Students memorize formulas.

The results in Table 4 show that the learning model used by teachers is in accordance with the 2013 curriculum but in its implementation teachers are still using models that are not yet in accordance with the 2013 curriculum. So students memorize formulas more often than understand the meaning of the formula itself. Teachers have not used cognitive conflict-based teaching materials, teachers already use virtual labs but still rarely apply them in all physics learning materials.

The results of the analysis of 9 journals related to students' understanding of concepts on momentum and impulse material showed that students experienced many misconceptions in the material. Momentum and impulse material discusses sub topics: momentum, impulse, conservation of momentum and collisions. The results of the analysis of articles on understanding the concept of momentum and impulses are found in Table 5.

Table 5. Journal Article Analysis Results

Journal	Misconception			
	Momentum (%)	Impulse (%)	Conservation of Momentum (%)	Collision (%)
Lusiana, et al (2016)	91	87	91	97
Maulida and Suliyannah (2016)	73.10	86.10	-	84.30
Anggraeni and Suliyannah (2017)	20.59		19.61	35.29
Arifin et al (2019)	82.76	86.21		
Hikmatunnisa (2019)	96.68	98.68		
Masril (2012)			48.61	
Alawiyah (2017)			37.80	
Agustin et al (2016)			63.10	
Sutrisno et al (2015)			33.10	

The results in Table 5 show that the number of students who experience misconceptions on momentum and impulse material. From 2012 to 2019, misconceptions were found in the sub-material of momentum, impulse, conservation of momentum and collisions. The percentage of misconceptions is different in each research result, but in general the percentage of student misconceptions is quite large so that a solution needs to be found to overcome them.

Once known problems in preliminary research then conducted a literature study to find a solution. The results obtained in the form of an effective learning model to improve concept understanding and mediate misconceptions is a model of cognitive conflict-based learning (CCBL) by integrating real experiment video analysis[6].

The results on the development or prototyping phase, began by designing a prototype of teaching materials that was prepared in accordance with four syntax models of cognitive conflict-based learning (CCBL) models. The CCBL model consists of four syntax: (1) activation of preconceptions and misconceptions, (2) presentation of cognitive conflicts, (3) discovery of concepts and equations, and (4) reflections. In the third stage integrated real experiment video analysis by writing down the steps of student activities by recording the phenomenon of motion objects and analyzing using the Tracker program. The first evaluation conducted on the design of the prototype of the teaching material is self-evaluation. The results of self evaluation are in Figure 1.

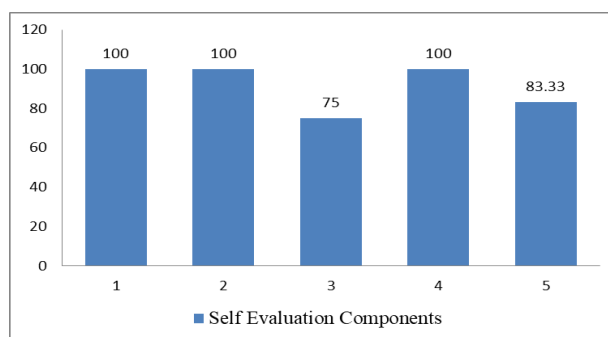


Fig. 1. Self-Evaluation Results

In Figure 1 there are five components that are assessed in self-evaluation, namely: 1) completeness of teaching material structure in accordance with the Ministry of Education 2008, 2) completeness of CCBL model syntax on teaching materials, 3) Integration of real experiment video analysis on the third syntax, 4) Language, 5) Graphing. Based on Figure 1, the value of each component ranges from 75 to 100, with an average score of 91.67 which is in the excellent category. Excellent categories range in numbers from 81 to 100. Furthermore, expert review of teaching materials is carried out. The results of an expert review by three physics lecturers are found in Figure 2.

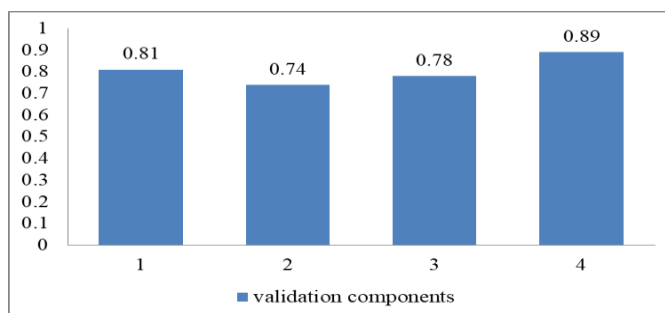


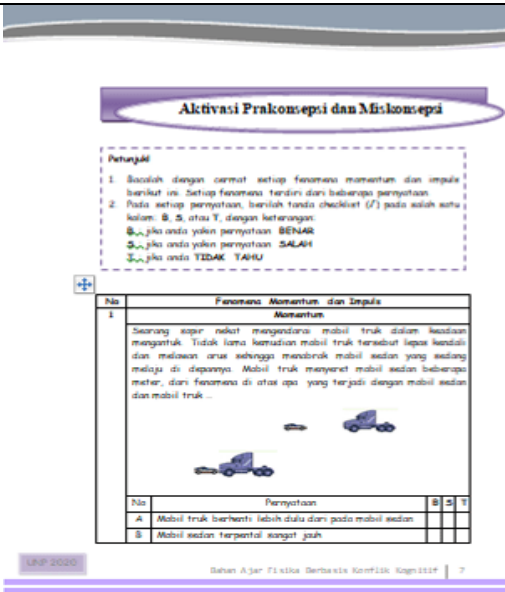
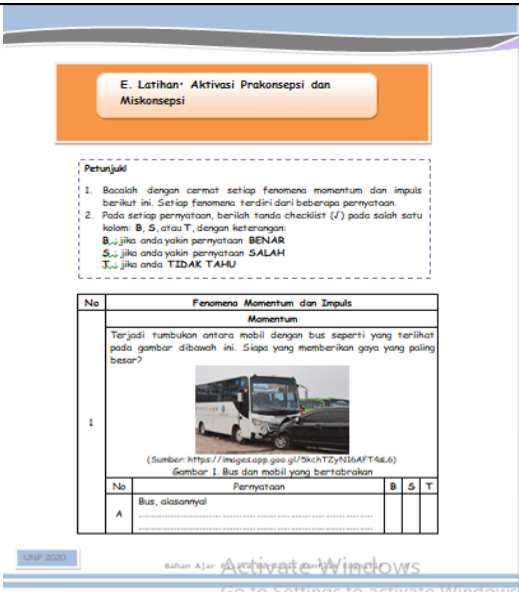


Fig. 2. Average Validation Results Through Expert Review

Based on Figure 2, it is obtained an average value on each aspect of the assessment of validity in teaching materials ranges between 0.74 and 0.89, with an average value for all aspects of 0.81. Based on the results of the value obtained that overall teaching materials of cognitive conflict-based momentum and impulse have been valid in terms of (1) content validity, (2) construct validity, (3) language validity and (4) face validity. The average validity of teaching materials is very valid. During the validity evaluation process, there were several suggestions from experts, so that revisions were made to the teaching materials. Among them are revisions to the


cover design to make it more attractive in terms of selecting background colors, writing and images. Revision of prototypes as suggested by experts is in Table 6.

Table 6. Revision of Teaching Material Prototypes According to Expert Advice

A. Cover Design	
Before the Revision	After the Revision
	
<p>On the cover, the validator's comments are that the colors, writing, images and background are less attractive. The revision made is to provide brighter colors with attractive images and clear writing.</p>	
B. First Syntax Design: Activation of Preconceptions and Misconceptions.	
Before the Revision	After the Revision
	
<p>In the 1st syntax, expert comments are questions that arise from a phenomenon that contain unclear and immeasurable meanings. The revision made is to make questions that are in accordance with the phenomena that occur in the daily environment.</p>	
C. Second Syntax Design: Presentation of Cognitive Conflict	
Before the Revision	After the Revision

Penyajian Konflik Kognitif


Ayo renungkan dan pikirkan fenomena momentum dan impuls berikut ini! (15 menit)

No	Fenomena Momentum dan Impuls	Hipotesis
1	<p>Pada saat jam istirahat sekolah biasanya ada dua orang siswa yang bermain lempak kelenteng masing-masing satu di antaranya berbadan gemuk dan yang satu lagi berbadan kurus. Karena terburu-buru diemangnya mereka berdua bertabrakan yang membuat siswa berbadan kurus ikut terdorong ke belakang sebelum diemangnya jatuh sedangkan yang berbadan gemuk tidak jatuh sama sekali, mengapa hal tersebut bisa terjadi...</p> 	
2	<p>Seorang lelaki hendak memecahkan tumpukan kayu maka dia harus memberikan kecepatan yang tinggi pada tangannya agar kayu menjadi terpecah, mengapa hal tersebut harus dilakukan.</p>	

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F. Penyajian Konflik Kognitif

Ayo renungkan dan buat hipotesis... (jawab sementara)... dari fenomena momentum dan impuls berikut ini.

No	Fenomena Momentum dan Impuls	Hipotesis
1	<p>Perhatikan gambar dibawah ini! Ketika sebuah peluru yang lepas dari pistol dapat menembus dinding tembok, bagaimana jika peluru tersebut diarahkan dari ketinggian 100 m, apakah masih dapat menembus dinding tembok? alasannya!</p>  <p style="font-size: x-small; text-align: center;">(Sumber: https://images.apnews.com/6577418-1147660000-23) Gambar 1. Pistol dan peluru</p>	Momentum
2	<p>Ada dua buah peristiwa, dimana seorang anak yang menendang bola dan batu seperti gambar di bawah ini. Anak itu merasa lebih kesulitan menendang batu daripada bola? Kenapa hal itu bisa terjadi, alasannya!</p>	Impuls

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In the second syntax, expert comments are questions that arise in the presentation of confusing and illogical cognitive conflicts, such as people shooting a beehive and others. The revision made was to make questions logically and in accordance with the phenomena that occurred in the students' daily environment.

D. Third Syntax Design: Discovery of Concepts and Equations

Penemuan Konsep dan Persamaan

Ayo lakukan eksperimen sederhana untuk menjawab rasa keingintahuanmu..!

Lembar Kerja Siswa (LKS)

Pastikan alat dan bahan dilengkapi untuk merekam video yang dianalisis serta ikut langkah berikut.

No	Eksperimen Sederhana Momentum dan Impuls
1	<p style="text-align: center;">Membuktikan Momentum dan Impuls</p> <p style="text-align: center;">Eksperimen Momentum dan Impuls</p> <ul style="list-style-type: none"> • Momentum Alat dan bahan praktikum <ol style="list-style-type: none"> 1. Bola 2 buah 2. Penimbang/Neraca 3. Penggaris 4. Tempat lintasan bola Langkah Kerja <ol style="list-style-type: none"> 1. Buatlah kelompok belajar 4-5 orang 2. Lakukanlah percobaan dengan bekerja sama dan jujur 3. Batalkan prosedur di bawah ini dengan teliti 4. Prosedur Praktikum <ul style="list-style-type: none"> ➢ Timbang massa kedua bola menggunakan neraca ➢ Hitung besar ubin keramik dalam satu petak ➢ Letakkan bola pada tempat lintasan bola ➢ Beri gaya kepada masing-masing bola secara bersamaan agar bergerak ➢ Rekam praktikum di atas dan pastikan kamera tidak bergerak ➢ Menuliskan hasil praktikum pada tabel untuk tiga kali kegiatan

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H. Penemuan Konsep dan Persamaan

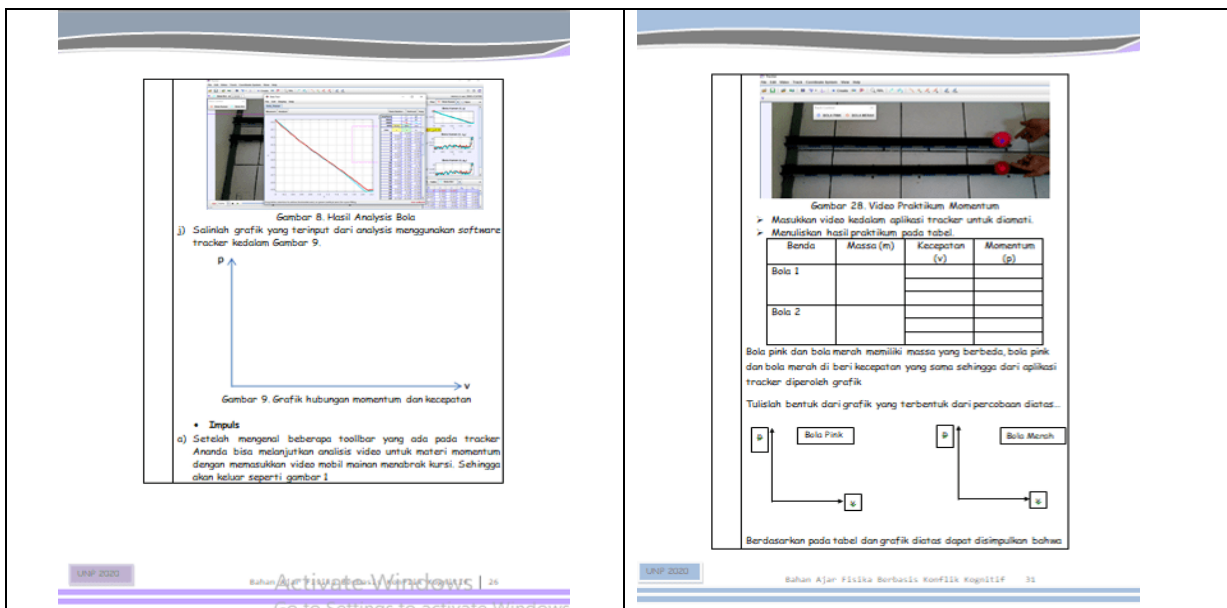
Ayo lakukan eksperimen sederhana untuk menjawab rasa keingintahuanmu..!

Lembar Kerja Siswa (LKS)

Pastikan alat dan bahan dilengkapi untuk merekam video yang dianalisis serta ikut langkah berikut.

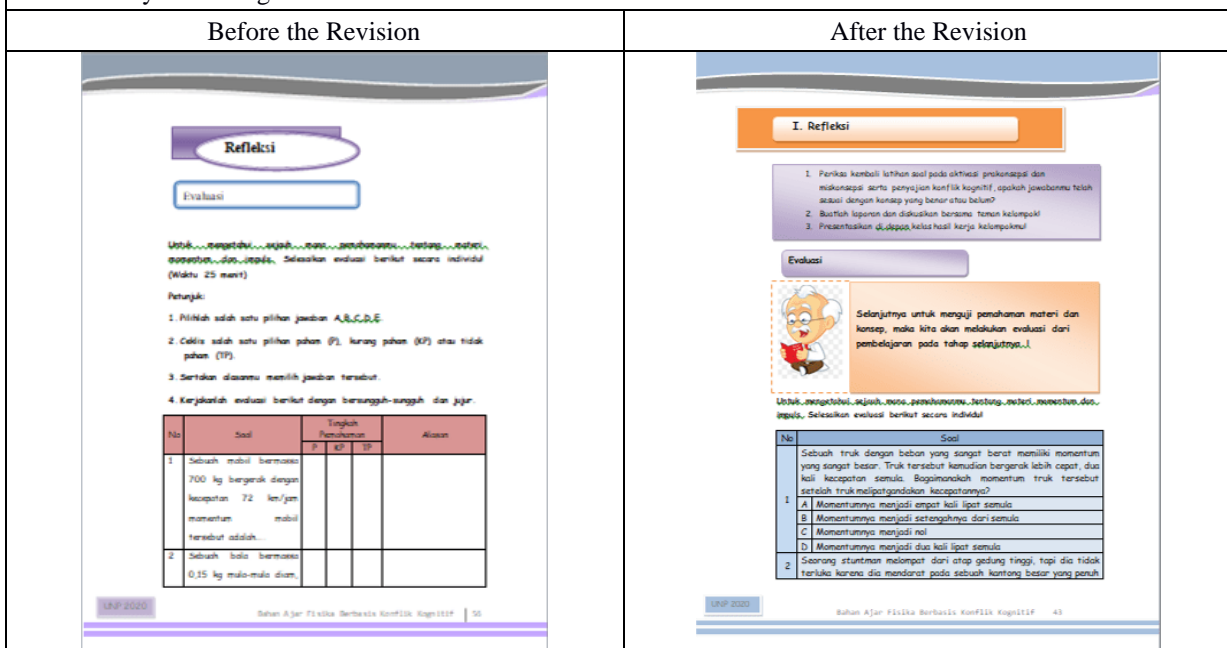
No	Eksperimen Sederhana Momentum dan Impuls
1	<p style="text-align: center;">Membuktikan Momentum dan Impuls</p> <p style="text-align: center;">Eksperimen Momentum dan Impuls</p> <ul style="list-style-type: none"> • Momentum Alat dan bahan praktikum <ol style="list-style-type: none"> 1. Bola 2 buah 2. Penimbang/Neraca 3. Penggaris 4. Tempat lintasan bola Langkah Kerja <ol style="list-style-type: none"> 1. Buatlah kelompok belajar 4-5 orang 2. Lakukanlah percobaan dengan bekerja sama dan jujur 3. Batalkan prosedur di bawah ini dengan teliti 4. Prosedur Praktikum <ul style="list-style-type: none"> ➢ Timbang massa kedua bola menggunakan neraca ➢ Hitung panjang ubin keramik dalam satu petak ➢ Letakkan bola pada tempat lintasan bola ➢ Beri gaya kepada masing-masing bola secara bersamaan agar bergerak ➢ Rekam praktikum di atas dan pastikan kamera tidak bergerak

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In the 3rd syntax, expert advice is to add Tracker data, namely time and position data. So, the output is velocity, not momentum. The revision made was the experiment using 2 balls with different masses, and equipped with tables and graphs.

E. Fourth Syntax Design: Reflection



In the 4th syntax design, expert advice is that this teaching material has not guided students well in finding concepts. Revisions made to make questions related to the concept then provide calculation questions.

After revisions to the prototype and teaching materials were declared valid by experts, then a one to one evaluation practicality test was carried out on three students who had high, medium, and low ability levels at SHS B. The results of one to one evaluation are in Figure 3.

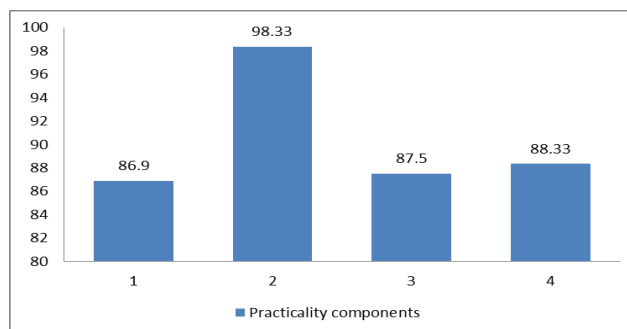


Fig. 3. Average Practicality Results Through One to One Evaluation

Based on Figure 3, the average score for each aspect of practicality assessment on teaching materials is between 86.9 and 98.33. Based on these values, it can be argued that overall the cognitive conflict-based impulse momentum teaching materials are valid in terms of (1) ease of use, (2) attractiveness, (3) efficiency, and (4) benefits. The average practicality of teaching materials is 90.27 which is in very valid criteria.

B. Discussion

Interview activities with physics teachers at SHS A, SHS B and SHS C. SHS A is senior high school with high-level students' abilities, SHS B is senior high school with moderate-level students' abilities and SHS C is senior high school with moderate to low-level students' abilities. The results of the interviews obtained were (1) the learning model used was not fully in accordance with the 2013 curriculum. (2) the teaching materials used had not used a model that could improve concept understanding and remediate student misconceptions. (3) Experimental activities on momentum and impulse materials in labor are rarely implemented due to tool limitations. In the physics learning process that does not involve students actively in finding concepts [12], the use of learning media that has not achieved the learning objectives [13] results in students preferring to memorize formulas rather than understanding concepts [14], so that their understanding of concepts decreases and experiences misconceptions [12].

Misconceptions are found in mechanical materials. One of them is impulse momentum material. Analysis conducted on 9 journals about impulse momentum found that many students experienced misconceptions. This is due to the ineffective implementation of the 2013 curriculum which causes errors in the learning process [7]. Previous research found that the lack of student activity was due to the conventional learning methods used [15]. Student learning outcomes depend on the learning model used.

The solution of the above problem is to develop teaching materials to overcome and remediate misconceptions. cognitive conflict learning can overcome the problem of misconceptions in physics learning that occurs in schools [16]. Teaching material designed based on cognitive conflict model integrate real experiment video analysis. The cognitive conflict-based learning model consists of 4 syntax. Experiment activities are found in the 3rd syntax. Experiments integrate real experiment video analysis. This is in line with the research of Mufit, et al [6] which uses video analysis of real experiments in practical experiments to improve student's conceptual understanding. Especially in this pandemic period, learning is carried out online and laboratories are rarely used, so a suitable solution is to use experimental activities [17].

The advantage of using real experiment video analysis is suitable for use in momentum and impulse materials. The material of momentum and impulses is related to the motion of an object that is difficult to observe with the naked eye. Real experiment video analysis makes it easy for students to observe the movement of an object. Real experiment video analysis is a practical way of understanding the process of movement of objects, there is a choice of representations of the experiment data that you want to analyze, and make physics lessons more interesting [9]. This is in line with previous research that developed cognitive conflict-based e-book that integrates video analysis of real experiments that can improve student's conceptual understanding of motion material, as an online learning facility [18]. Interesting pictures and video as well as virtual laboratories, sparking curiosity, and leading students to find new ideas or ideas, especially the physics concept of force [19].

At the Develop / Prototyping Phase, cognitive conflict-based teaching materials have been designed integrating real experimental video analysis to improve students' concept understanding. Then conducted self evaluation on teaching materials by researchers. The results of self evaluation are in a very valid category. This is because it corresponds to Ministry of National Education 2010 namely title, competency standards and learning competencies, supporting information, materials in learning, practice and assessment [20], the syntax order of the CCBL model is appropriate[5], the experiment using real experimental video analysis was appropriate, the

language rules were appropriate and the graphics were appropriate. So the results of self-evaluation can determine the validation process of teaching materials based on cognitive conflict [21].

Validation on teaching materials was conducted by 3 experts consisting of three lecturers of Physics. Validation results are used as guidelines in revising the teaching materials and determining the feasibility of the teaching materials that have been made. The component of the feasibility of the content of the teaching material consists of (1) the description of the indicators in the teaching materials is in accordance with base competence 3.10 & 4.10, (2) The learning objectives of the teaching materials are in accordance with the indicators, (3) 4) The physics symbol used is correct, (5) The physics equation used is correct, (6) The physics term used is correct, (7) The image presented is in accordance with the material, (8) The phenomenon of physics is in accordance with the material, (9) The material presented does not cause multiple interpretations from students, (10) Images quoted from other people's work include references/sources, (11) Cognitive conflict-based teaching materials contain cognitive conflict syntax, namely activation of initial knowledge of misconceptions, presentation of cognitive conflict, discovery of concepts & equations and reflection, (12) Teaching materials made to integrate the real experiment video analysis correctly. So, it is concluded that the teaching materials on the feasibility of the content are valid. Accordance to the research of Lutfi, et.al [8] who obtained teaching materials with the category valid because the material presented is in accordance with the 2013 curriculum, the physics symbols used are correct, the material presented does not cause multiple interpretations, the teaching material contains cognitive conflict syntax.

The presentation assessment component uses the following eight indicators; 1) Systematic teaching materials are presented in accordance with the Ministry of Education 2008, consists of the titles, learning instructions, competencies to be achieve, supporting information, tasks and steps of work and assessment, 2) Presentation of the stage of 'preconception and misconception activation' in teaching materials can reveal knowledge students have initial, 3) Presentation of the stage of 'presenting cognitive conflict' in teaching materials can trigger students to think deeply, 4) Presentation of the stage of 'finding concepts and equations' in teaching materials leads students to find concepts & equations, 5) Presentation of the 'reflection' stage in teaching materials it can reveal the progress of student understanding, 6) The numbering of images is presented in order, 7) The naming of images is presented appropriately, 8) The presentation of teaching materials that is made allows interaction between teachers and students. According to Hanum, et.al [22]. The suitability of the presentation in teaching materials is very important, because the presentation developed in teaching materials can attract students 'interest in learning and increase students' curiosity in studying physics.

The language assessment component has eight indicators as follows 1) Language used in accordance with the student's level of thinking, 2) The language used in teaching materials has a value of decency (ethical), 3) The language used in the teaching material has a beauty value so that students enjoy reading it (aesthetic), 4) The language used is communicative and informative so that the message conveyed is easy to understand (educative), 5) The language used does not mean double, 6) The terms used are in accordance with the agreed technical terms of science, 7) The language used is appropriate good and correct Indonesian grammar rules, 8) The spelling used refers to general guidelines for Indonesian spelling. The language component is valid according to the reading rules according to general guidelines for Indonesian spelling because the information presented in the book chapter model is clear and the language used in the book chapter model is effective in accordance with the Indonesian language rules [23].

The graphic assessment component uses the following six indicators 1) The arrangement of the cover of the teaching material is shown to be attractive, 2) The font used is correct, 3) The font size can be read clearly, 4) The size of the title of the teaching material is more proportional to the size of the content of the teaching material, 5) The cover color arrangement and design are correct, 6) The cover illustration describes the contents of the teaching material. Graphic feasibility is very valid. This is in line with Yunita and Hakim [24] which states that the illustration becomes attractive with the right layout. This opinion has similarities with Fadhilah, et al [25] which states that the use of appropriate fonts, layouts, illustrations makes the teaching materials used more attractive to read.

Cognitive Conflict-based Teaching Materials on Momentum and Impulse Materials to improve students' concept understanding have very valid level to validity. The results of the validation of teaching materials were obtained from the suggestions of experts for revision. Suggestions are given in the form of improving consistent sentences of assignments in concept discovery, presenting material coherently, improving picture sentences, making corrections to sentences for the same thing in writing in the form of teaching materials, repeating the head of the table automatically and completing the summary on teaching materials. The advice from these experts is used to improve the feasibility of the teaching materials that are made.

The practicality test of teaching materials according to students in the one to one stage was carried out at SHS B to three students who had high, medium, and low ability levels. The practicality test results were obtained from the analysis of the practicality test sheet instruments according to the students. In the instrument the practicality test sheet according to students consists of four components, namely: 1) ease of use, 2) attractiveness, 3) efficiency, and 4) benefit. Field tests are conducted to determine the feasibility of reading materials using student response questionnaires and comment/suggestion sheets. Based on the trials conducted, it was found that the average student response to reading material was 82.73% with the very high category. After conducting trials in the main field, [26]. According to research by Hanum, et.al [22] Regarding the learning of cognitive conflict models, it was found that the teaching materials they developed were also of practical value in accordance with the teaching materials that the researchers developed. According to Khairunnisa, et.al [27] namely the importance of attracting students' attention in the learning process. Instructional material indicators can be used to learn independently, namely by achieving an average value of 100 [25]. Thus, cognitive conflict based teaching materials on momentum and impulse material can be continued with practicality and effectiveness tests through small group evaluations and field tests, so that it can use by class X physics teachers to improve concept understand and remediate misconceptions on materials momentum and impulses.

IV. CONCLUSION

This research has produced teaching materials with characteristics composed of four syntax models of cognitive conflict-based learning (CCBL model), as follows: (1) activation of preconceptions and misconceptions, (2) presentation of cognitive conflict, (3) discovery of concepts and equations, and (4) reflection. In the third syntax, real experiment video analysis is integrated on momentum and impulses material. This teaching material is designed to overcome the problem of low conceptual understanding and misconceptions in momentum and impulses material. This teaching material has gone through a series of tests and revisions start from self-evaluation, expert review and one to one evaluation. Teaching materials on momentum and impulse are appropriate in terms of content validity, construct validity, language validity and face validity with very valid criteria. Teaching materials have practicality in aspects of ,convenience, benefits, tariffs power and efficiency in one to one evaluation with very practical criteria. Advice for further researchers in order to continue the development phase of the Plomp model, namely testing the practicality and effectiveness of teaching materials through small group evaluation and field test.

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