Analysis of students CRI (Certainty of Response Index) of genetic concept based two-tier diagnostic test online using I spring suite 8 for covid-19 learning

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Abstract. Technology-based learning in the covid-19 pandemic period faced many obstacles and challenges. Consequently, the learning design and strategy are expected to be effective, efficient and able to empower student competencies appropriately. One of the important points in learning during the Covid-19 epidemic was an effective learning evaluation. One of the effective learning evaluation in pandemic period is the online multiple-choice test. However, multiple-choice tests in the form of online quizzes also have some short ages, for example, it is quite difficult to capture the student's mastery concepts level in more depth and detail. Therefore an online multiple choice test evaluation form can be developed with a two-tier system, so that it can showed the level of students understanding and thinking further. Moreover, the certainty of response index also added to determine the level of student confidence in the answers given. The purpose of this study was to analyze the student's understanding with the Certainty of Response Index (CRI) on genetic material using two-tier online diagnostic test based on the I spring suite 8application. The method used is descriptive. The subjects were all 2018A IKIP Budi Utomo Malang students, with the total number of 18 students. The results showed that the CRI level of students tends to be low, the answers and reasons are not correct and related each other, so it seems that the students are answer randomly which unable to show logical reasons related to answers. Some factors that causing the low level of student understanding and CRI are the characteristics of genetic material that's abstract and difficult, the scope of the material are complex and complicated, the initial ability of students, and the use of learning resources that are not optimal.

1. Introduction

In the year 2019 has identified a new virus corona or severe acute respiratory syndrome corona virus 2 (SARS-CoV-2) is a virus that attacks the respiratory system [1]. This Virus has spread to all over the world which lead to the enactment of Social distancing or which means that individuals should keep a distance from one another [2]. Social distancing is causing some companies, schools and universities were closed and apply a WFH (Work From Home) and Distance Learning [3], [4]. A result of this pandemic covid-19 leads to the implementation of various policies to break the chain of spread of the virus covid-19 in Indonesia. One of the efforts made by the Indonesian government is applying the physical distancing that appeal to maintain the distance between the communities, away from the activity in all forms of the crowd, the society, and to avoid any meeting that involves many people.

Education field in Indonesia has become one of the areas affected by the presence of the pandemic covid-19. With the restrictions on interaction, the Indonesia Ministry of Education also issued the policy to close the school and replace the process of teaching and learning activities using the system in the network (online) or distance learning. Online learning as one of the learning solutions in the covid pandemic period, is considered to be the best way to break the chain of virus spread. College online provide distance learning where the lecture materials provided through the software would certainly make it easier for students to still get the lectures without face-to-face. This option should be taken to take preventive actions and effective mitigation over the outbreak that has now become a global pandemic [5].

*Because in fact the learning process is the communication process (process of delivering a message) which must be realized through the activities of the delivery and exchange of messages or information by lecturers and students. In the pandemic it clearly emerges the tendency of the utilization of learning software and application. Software is a program designed to create, reverse engineer, or develop a variety of things digitally. The ability to use diverse software absolutely owned by the lecturer and students of the present to be able to perform online learning and more easily adapt to advances in technology [5].One of the learning software is I-spring suite 8.*Ispring Suite 8 is one tool or software that can change the presentation file that is compatible with power point to be used in the form of flash. Excess application I spring is able to provide variations of forms of matter that are accompanied by scoring the end and comes with the record audio, record video, management presentations and flash[6]. I Spring Suite 8 is a software to make a media learning which is a presentation that can be used in the process of learning contains aspects of media in audio, visual, audio-visual, and various types of evaluation that has been provided. In addition, I Spring Suite 8 can convert the power-point file into a form of flash buttons so that the user can use it either directly for learning in the form of e-learning [7]

Furthermore, learning in the pandemic covid-19based online or distance learning face many obstacles and challenges. Some of these are the lack of the online learning system preparation in higher education, the lack of lecturer or professors preparation for online learning, professors tend to only give tasks so that the burden of the students task to become excess, the access of services and facilities to the lectures online is still not up. Another distance learning system problem as stated by Lazonder *et al*., (2008) is that distance learning also has constraints, these constraints result in the material received by students is not complete so that interfere with the learning process [4]. Furthermore, the low quality internet access signal causes the slowness in accessing the information. Students are sometimes left with information because the low quality signal. As a result they are late in collecting task given by the lecturer. Not to mention for teachers who check out many of the tasks that has been given to the students. The adoption of online learning also makes educators rethink back, of the model and learning methods that will be used and effective during the pandemic.

Therefore, the model and the learning methods expected to be effective, efficient and still able to empower student's competencies optimally. It is a challenge for lecturer in the scope of the college. One of the important points in learning in the epidemic covid-19 is the form of effective learning evaluation. One form of learning evaluation that is quite effective is a multiple choice test. However, multiple choice tests in the form of an online quiz also has some shortcomings for example is quite difficult to capture the level of student mastery concepts more in depth and detail. Therefore evaluation form multiple choice test online can be developed with a system of two-tier so that it can determine the level of understanding and level of thinking students furthermore. The results of a good test does not guarantee a student has understood the concept well. Misconception also feared can inhibit the formation of knowledge in the students cognitive structures. Therefore, misconceptions need to be detected to determine the material that is considered difficult by students so that the teacher can determine the learning remediation to be done. Necessary tools another test that can uncover students ' understanding of a concept [8].

According to Tamir, test two-tier diagnostic multiple choice materials effective diagnostic. Diagnostic tests two-tier multiple choice is one of the diagnostic tests which consist of two-levels. The first level consists of questions with three answer choices, whereas the second level consists of five selection of reasons which refers to the answers on the first level. These reasons consist of one right answer and destructor. Answers destructor is an explanation of the students obtained from the literature, interviews or open response[9]; [10].

Two-tier multiple choice has the advantage because in this test in addition to students doing grain tests that reveal the specific concepts the student must also disclose the reasons why to choose the answers. By revealing their reasons in answering each question, it will be known layout of the misconceptions that occur. In addition, the diagnostic test multiple-choice two levels are easily implemented and easy to provide ratings. Two-tier multiple choice questions consisted of the first tier which is a content-based question and the second tier which is a reasoning-based question. Greer (2001), Brown et al. (1997), Gibbs (1999), BIO (2010) stated as there is a very strong

relationship between assessment design and the effectiveness of student learning in the biological sciences.

Furthermore, the two-tier diagnostic multiple choice also be added with a Certainty Of Response Index or CRI method to determine the confidence level of students on the answers given. Method found by Saleem Hasan is used to identify the occurrence of misconceptions and can distinguish it with no idea of the concept and understand the concept. This method is a tool used to measure the confidence level/certainty of the respondents in answering each problem/question given. CRI is usually based on a scale and given along with each answer a question.

A method with a Certainty of Response Index (CRI) is the method used to measure the level of student confidence of the material that has been taught by the teacher. Certainty of Response Index (CRI) is a measure of the confidence level/certainty of the respondents in answering each of the questions given. In using the method of CRI is based on the scale and the opportunity to answer the questions. The scale of the CRI used are 0-5, and given simultaneously with any answers to questions. If the CRI is low indicates the incertitude of the students in answer to a question or it could be interpreted the presence of elements penebakan in answering questions. On the contrary, if a high CRI indicates the confidence of students in answering a good question. If the answers are answered correctly, the confidence level is high the truth the concept has been well tested. In the use of the method of CRI, the way to determine the ability of the students namely by giving a multiple choice test that is the understanding of the concept. Recent research about CRI had been done by Ulfah and Fitriyani, 2005; Waluyo, Muchyidin and Kusmanto, 2019; Liliawati and Ramalis, 2009.

CRI is often used in surveys, especially those that ask respondents to give a degree of certainty which he possessed of the ability to choose knowledge, concepts, or laws formed with a good in itself to determine the answer of a question (question).Based on the description above, the Purpose of this study is to analyze the understanding of students with Certainty Of Response Index (CRI) on the material of genetics using the diagnostic test online two-tier based application I spring suite 8.

2. Method

The method used in this research is descriptive method. The determination of the sample classes are conducted with a simple random sampling technique. Data obtained through the multiple choices test two tier + CRI. A test technique is carried out by administering a diagnostic test a two-tier multiple choice to the sample to uncover a concept that is owned by the students. Furthermore, the data the test results were analyzed based on the answers selected by the students per choice of answers. The type of student answers are then categorized in accordance with categories of misconceptions expressed Tuysuz. The categorization is based on the types of student answers at each level of the question. Answer-students ' answers can be categorized with the categories contained in Table 1 below [8].

Table 1. Answer Category For Two-Tier Question

Answer type	Note	Category
C-C (correct-correct)	Answering correctly the first and second question level	Good Understand
C-U (correct-uncorrect)	Answering correctly the first question dan answering uncorrectly the second level question	Misconception
U-C (uncorrect-correct)	Answering uncorrectly the first question level dan answering correctly the second level question	Guessing
U-U (uncorrect-uncorrect)	Answering uncorrectly the first and second question level	Not understand

Data collection tool used is a multiple choice test with two tier models. This test is used to identify and distinguish students who experience misconceptions, do not know the concept, and master the concepts well by using the technique of CRI. The number of questions (about) used is

20 about the material of genetics. The questions given are designed in such a way that this question is a qualitative standard (do not have a high level of difficulty). The data analysis technique used in this study is refers to the model of Miles and Huberman (2014); Ulfah and Fitriyani (2005), namely: (1) data reduction, (2) data presentation, (3) withdrawal of conclusion or verification.

To identify the occurrence of misconceptions, Hasan, Saleem. D. Bagayoko, D., and Kelley, E. L (1999) has developed a method of identification that is known with the term CRI (Certainty of Response Index), which is level of confidence or certainty of the respondents in answering each of the questions (question) is given. CRI is usually based on a scale which remains is given along with each answer a question. In this study used test students in the form of a multiple choice test accompanied by a technique CRI uses a scale of six (0-5) developed by Hasan, Saleem. D. Bagayoko, D., and Kelley, E. L., 1999; Ulfah and Fitriyani, 2005 the criteria in Table 2 below.

Table 2. Response Scale of Certainty of Response Index (CRI)

CRI	Criteria
0	(Totally Guessed Answer): If in answering questions 100% is guessed.
1	(Almost Gues): If in answering the question the percentage of the element of guess is between 75-99%.
2	(Not Sure): If in answering the question the percentage of the element of guess is between 50-74%
3	(Sure): If in answering questions about the percentage of elements guessed between 2549%.
4	(Almost certain): If in answering questions the percentage of elements guessed between 124%.
5	(Certain) If in answering questions there is no element of guessing at all (0%).

The use of the scale of the CRI is when students answer the questions given, where students were asked to give a value of 0-5 on each question answered. The results of the CRI are given by the students is processed and then combined the result with the provisions of the criteria understand the concept or don't understand the concept. Based on the table, according to Saleem Hasan (in Tayubi, 2005) the figure 0 indicates that the student does not know or does not understand the concept being taught, while the numbers 5 states that the students understand the concepts that have been taught and confident in answering each question. To scale the certainty of 0-2 indicates that the guessing answers made by the students to be an important role in answering questions not see the answer that's right or wrong. Scale 3-5 indicates that students have a high level of confidence in answering questions, in this level the student can answer the questions with the correct value and shows that students understand concepts taught, but if the wrong answers are misunderstanding of the concept.

Based on Table 1, there are 6 (0-5) CRI scales where 0 means that they do not understand the concept and 5 are true of the concept that respondents answered. If the confidence level is low (CRI value 0-2) states that the respondent answers it by guessing, regardless of the answer is right or wrong. This shows that respondents do not understand the concept. If the CRI value is high, and the answer is correct then it indicates that the respondent understands the concept (the answer is reasonable) If the CRI value is high, the answer is wrong then shows misconceptions. So, a student experiences misconceptions or does not understand the concept can be distinguished in a simple way that is by comparing the correct or not the answer to a problem with the high and low certainty of the answer index (CRI) given to the problem. Next, Table 2 describes the provisions for distinguishing between students who know concepts, misconceptions, and do not understand the concepts for individual and group respondents [12].

Techniques CRI not only can identify student misconceptions, but also can distinguish students who know the concept and students who don't know the concept, just by looking at the answers and the scale of assurance given students as shown in the Table 3 below shows the four possible combinations of answers (right or wrong) and CRI (high or low) to each respondent individually in answering the questions (question). To a respondent and to such a question is given, answers are correct with the CRI indicates do not know the concept, and the correct answers with high CRI show mastery of concepts high. Wrong answers with the CRI indicates do not know the concept, while wrong answers with high CRI indicates the occurrence of misconceptions.

Table 3. Provisions To Distinguish Between Know Concept, Misconception and Don't Know The Concept For Respondents

Answer Criteria	Low CRI (0-2)	High CRI (3-5)
Correct answer	The answer is correct but low CRI means not knowing the concept (lucky guess)	Right answer and high CRI means mastering the concept well.
Wrong answer	The wrong answers and low CRI means not knowing the concept.	The wrong answer but high CRI means a misconception.

(Hasan, Saleem., D. Bagayoko, D., and Kelley, E. L, 1999:296)

If the level of confidence or degree of certainty is low (CRI 0-2), then this illustrates that the percentage of guesses made by the students in determining the answers is still very high, namely between 50% to 100%. Without looking at the answers and the reasons given are right or wrong, the value of the CRI that is low indicates the presence of guessing elements that reflects that the student does not know the concept as the basis in determining the answers. If the level of confidence or degrees of certainty (high CRI 3-5), it indicates that the student has the level of confidence in choosing concepts that used as a reference to determine the answer and give a reason. In this state (CRI 3-5) 'students who obtain a answer with correct reasons, tend to indicate the level of confidence or degree of certainty of the truth concept with both. But if the answers and reasons obtained by the student is wrong, then it allows the existence of an error of conception in the knowledge about a material that he has and can be an indicator of the occurrence of misconceptions. Provisions such as this, show that the CRI requested when used in conjunction with the answer and the reason for such a question, allow us to distinguish between understanding concepts, misconceptions, and do not understand the concept. From the tabulation of each student's data by referring to a combination of the right and wrong answers and based on the high and low CRI scores, then the diagnosis data are grouped into three groups: students who understand the material, misconceptions and do not understand.

3. Result and Discussion

As has been stated previously, that the CRI is a measure of the degree of certainty of the respondents in answering each question. This index is in general classified as a type of Likert scale. In particular, for each question in the test form a multiple choice for example, respondents were asked to do the following: (a) choose an answer that is considered correct of the alternative options that are available, (b) provide CRI, between 0 - 5, for each answer chosen. CRI 0 asked if the answer selected results of the guesses, whereas the CRI of 5 asked if the answers have been selected on the basis of knowledge and skills which she believed the truth.

Table 4. The Correct And Incorrect Responses As Given

Question	First Tier		Second Tier		Total Correct
	Corret	Incorret	Correct	Incorrect	
1	7	11	6	12	13
2	2	16	7	11	9
3	7	11	1	17	8
4	1	17	0	18	1
5	8	10	4	14	12
6	6	12	5	13	11
7	6	12	4	14	10
8	5	13	4	14	9
9	0	18	0	18	0
10	3	15	12	6	15

4a. Where is location of the gene for eye color?
a. In all cells
b. In the cells of the iris of the eye
c. In sperm cells

4b. Which of the following statements is the reason for that answers?
a. The gene is only found in the tissue in which the gene is expressed
b. The X and Y chromosomes, which are contained in the sperm cells carry all the genes
c. All genes contained in all the cells
d. Different parts of the body have the specific gene
e. Part of the iris of the eye responsible for eye color

4c. How sureare you in the answer and the reason?
a. Very confident/understand
b. Almost sure/understand
c. sure
d. Not sure
e. Most answers guessed
f. The overall answer guessed

Figure 1. The Example of Two Tier Multiple Choice Test with CRI

Table 5. Persentage of Students Who Have Good Understand, Misconception, Guessing and Not Understand The Concept With Two Tier Question

Question Number	Presentage			
	Good Understand	Misconception	Guessing	Not Understand
1	33,33	5,56	0,00	61,11
2	5,56	5,56	33,33	55,56
3	5,56	33,33	0,00	61,11
4	0,00	5,56	0,00	94,44
5	22,22	22,22	0,00	77,78
6	16,67	16,67	11,11	55,56
7	22,22	11,11	0,00	66,67
8	0,00	27,78	22,22	50,00
9	0,00	0,00	0,00	100,00
10	16,67	0,00	50,00	33,33

Two-tier multiple choice has advantages compared with the form of another question. Excess of two-tier multiple choice compared with multiple choice conventional one is to reduce the error in measurement, by using multiple choice conventional with five answer choices have the opportunity to answer correctly by way of a guess is 20% whereas if you use test two-tier multiple choice a chance to answer right by the way guess is 4% [9]. Moreover, by using diagnostic tests, two-tier multiple choice teacher will be easier in doing the scoring [9]. The same thing is expressed by Tan and Treagust (1999), who stated that a diagnostic test a two-tier multiple choice more easily implemented and given a score compared with another diagnostic tool, so as to give more benefits for teachers in the classroom [10].

Tsai and Chou (2002) pointed that two-tier test helped teachers teach and students learn better. Chen and Lin (2003) found that the two-tier multiple choice test provided a reliable and valid pencil-and-paper, easy-to-score instruments for science teachers and/or researcher to better evaluate students' idea. When we compare a two-tier test with a multiple choice test, the two-tier test was more effective to determine the students' alternative conceptions on a subject and to reveal whether meaningful learning occurs or not (Treagust, 1995). Being as easy as the evaluation of

conventional multiple choice test, and the same time, student knows why he is giving particular answer to the question could make the two-tier test much more effective than the other tests (Peterson and Treagust, 1989; Tüysüz, 2009).

Table 6. The Value of Students CRI in Every Number Of Question

Students Name	CRI Index per Number										Mean
	1	2	3	4	5	6	7	8	9	10	
1	4	4	2	2	2	4	4	4	4	4	3,40
2	3	3	3	2	0	3	3	1	3	3	2,40
3	5	4	5	5	2	3	1	1	5	2	3,30
4	3	3	3	3	3	3	3	3	3	3	3,00
5	3	3	0	3	3	3	0	3	3	3	2,40
6	3	3	2	3	2	2	2	2	3	2	2,40
7	3	3	2	3	2	3	4	2	4	5	3,10
8	4	3	2	3	3	3	2	2	3	2	2,70
9	5	5	4	4	4	3	5	3	4	5	4,20
10	3	4	1	3	2	3	3	2	3	5	2,90
11	4	4	3	3	1	2	2	1	1	2	2,30
12	3	3	3	2	4	1	3	3	3	3	2,80
13	3	5	2	5	4	2	3	2	3	2	3,10
14	2	1	2	1	1	2	2	1	2	4	1,80
15	3	3	3	3	3	3	3	3	3	3	3,00
16	0	1	0	0	0	1	1	0	1	0	0,40
17	3	3	2	2	2	2	2	2	3	2	2,30
18	4	3	3	4	1	1	3	1	5	4	2,90
Mean	3,22	3,22	2,33	2,83	2,17	2,44	2,56	2,00	3,11	3,00	

Table 6. showed that in average the CRI Index between 2-3. This mean that the CRI students tend to be in low average. Just question number 1, 2, 9, 10 that have CRI more than 3 as qualified high. From 18 students just only one students that get 4,20 in CRI Index, meanwhile the others almost have under value of 3. Certainty Of Response Index (CRI) is a technique for measuring the misconceptions of someone with how to measure the level of confidence or certainty of a person answering each of the questions given. Method CRI developed by Saleem Hasan. CRI is often used in surveys especially those that ask respondent to provide the degree of certainty he had of his ability to choose and build knowledge, concepts, or laws formed with a good in itself to determine the answer of a question [13].

Overall, the data results of the test using the technique of CRI shows that misconceptions almost happen on any given problem, but of the 20 questions given there are one questions that have low misconceptions. Based on the results of the analysis of the data processing test by using the Certainty of Response Index (CRI) to produce three groups of students, i.e. students who know the concepts, Misconceptions and do Not Know the concept with the scale of the CRI that is different. The following Table 5 related to the percentage of students who Know Concepts, Misconceptions, and do Not Know the Concept of every problem experienced by students.

Table 7. Persentage of Students Who Know The Concept, Misconception and Not Know The Concept with CRI Question

Question Number	Presentage		
	Mastering Concept	Misconseption	Not Knowing Concept
1	27,78	61,11	11,11
2	5,56	83,33	11,11

Question Number	Presentage		
	Mastering Concept	Misconseption	Not Knowing Concept
3	5,56	38,89	55,56
4	0,00	66,67	33,33
5	22,22	16,67	61,11
6	16,67	38,89	44,44
7	16,67	38,89	44,44
8	0,00	33,33	66,67
9	0,00	83,33	16,67
10	16,67	44,44	38,89

From Table 7. the percentage of students who have misconception almost high in every number of question. If table 3 is expressed in the form of graphs that illustrate the percentage of students misconceptions, know the concept, and do not know the concept of each concept, it will be obtained a result like figure 2. From figure 2 it can be seen that the percentage of the number of students who have misconceptions and do not know the concept very much than know the concept, this happens to all the matter/concepts.

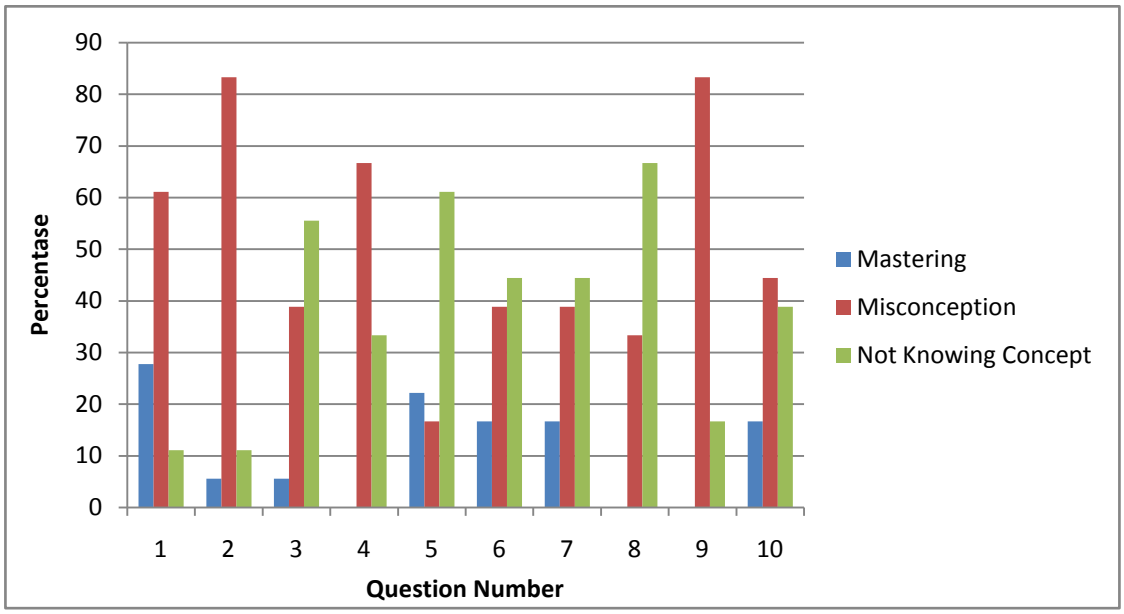

Figure 1.The Grapich of The Students Percentage on Misconceptions, Know The Concept, and Do Not Know The Concept

The scale of this is basically to give the value of level of confidence or trust that owned by the students in answering the questions. Figure 0 shows the level of confidence which is owned by the students is very low, the students answer the question with how to guess. This indicates that the students do not know at all about the concept-the concept being asked. While figure 5 shows the confidence level of students in answering questions is very high. They answer questions with knowledge or concepts completely without any element of conjecture at all [13].

A variety of student misconceptions that occur in the genetic material as described above have a cause that is different. The following described various causes of the occurrence of misconceptions in students: 1. Reasoning that is incomplete or wrong, Students had the reasoning wrong because the information or the data obtained the student is not whole or wrong, that lead to reasoning that is not complete. Here there is a change from the true meaning. 2. The intuition that one of the Students revealed their ideas about a concept spontaneously before learn it first. He tends to follow his emotions. Misconceptions caused by this intuition is wrong as this happened on the concept of multiplication and to understand the meaning of the word “of”. Students using only its own logic to

complete the multiplication operation, while to understand the meaning of the word "of" students still look with confidence. 3. Preconception initial Concept can lead to misconceptions. The initial concept which is understood since in school before make encountered an error. Because they believe that what is done is true, then this will be done with full confidence even though in fact what he did was wrong. Preconception wrong this happened on the concept of changing the shape of the fractional as well as on the simplification of the shape of the mixture fraction. Students believe that the change of ordinary fractions into mixed fractions, where the integer and the numerator the same-the same is obtained from the results of the reduction in both the numbers that shaped ordinary fractions such as simplifying the fractions of the mixture which should only fractions are usually simplified. 4. Ability Students Low ability students dominate the cause of the occurrence of misconceptions. With low ability, resulting in the wrong answer. Misconceptions caused by the low ability students like this happens almost on every concept of fractions. Students often find difficulty in understanding the concept of right, as well as on the concept of division [11].

This Certainty of Response Index method is a method introduced by Hasan et al [14] which is used to measure misconceptions. With the CRI method, respondents are asked to provide a level of certainty of their own ability by associating the level of confidence with knowledge, concepts, or the law. This CRI method asks the respondent to answer questions accompanied by giving the degree or scale of the respondent's confidence in answering the question. So this method can describe students' beliefs about the truth of alternative answers that are responded to [12].

According to Comins [15], students' incomplete reasoning is caused by incomplete information or data, as a result, students draw conclusions incorrectly and this can lead to misconceptions among students. The explanation above proves that effective diagnosis interviews are used to support the CRI method in analyzing misconceptions that occur in students

4. Conclusions

The results showed that the CRI level of students tends to be low, the answers and reasons are not correct and related each other, so it seems that the students are answer randomly which unable to show logical reasons related to answers. Some factors that causing the low level of student understanding and CRI are the characteristics of genetic material that's abstract and difficult, the scope of the material are complex and complicated, the initial ability of students, and the use of learning resources that are not optimal. The results of the research and discussion showed that The results showed that (1) the lacked of learning media as a reference for students in genetic subjects,(2) the learning process still used simple power point and discussions (2) lecturers needed appropriate genetic learning media to improve students understanding (3) students needed appropriate genetic learning media based on Improve learning models, (4) most students supported the development of appropriate genetic learning media.

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