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Analyzing K-11 Students' Boiling Conceptions with BFT-Test using Rasch Model: A Case Study in the COVID-19 Pandemic

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Abstract: During the COVID-19 pandemic, students tend to have limitations that can cause them to experience misconception of teachers' concepts in an online setting. This becomes an insufficient basis for students to construct knowledge. Students can properly use one concept in a particular context and experience misconceptions on the same concept but in different contexts. This study aims to determine students' misconceptions about the concept of boiling, the percentage of misconceptions on each indicator of the boiling concept, and the causes of misconceptions in eleventh-grade (K-11) natural science students in one of the state high schools in Bandung Barat Regency. This study involved 92 students as samples in the study. The instrument used to analyze the concept of boiling misconceptions is the instrument was named BFT-Test (Boiling concept Four-tier). The misconceptions analysis of buffer solutions using the BFT-Test instrument showed that misconceptions occurred by 60 %, scientific conceptions by 13 %, and lack of knowledge by 27 %. Most misconceptions occur in analyzing the effects of pressure at the boiling point, which is 65 %. Based on this research results, the teachers are expected in the online learning process during the COVID-19 pandemic to link the material taught with concepts that exist in students' daily lives so that students easily capture the material and students remember the concepts in each given material.

INTRODUCTION

At present, there is little or no literature on COVID-19 (Coronavirus Disease 2019) about educational studies. The only available literature is directly related to medical studies (Combs et al., 2020; Moradian et al., 2020; Rogers et al., 2020). Because studies in education rarely include the effects of disease on providing adequate education for students worldwide. The rapid spread of COVID-19 has made every sector of human life feel its effects immediately.

Since the Corona Virus Disease 2019 (COVID-19) outbreak, many changes have taken place in various world activities (Peters et al., 2020; Rastogi et al., 2020; Shadmi et al., 2020; Welfens, 2020). That happened because of the physical distancing policy implemented in various countries, including Indonesia, to reduce the spread of COVID 19 (Aldila et al., 2020). Teaching and learning activities in schools have turned into learning activities at home. In Indonesia, the home study policy took effect in mid-March (Abidah et al., 2020). This causes some material in each subject, especially in physics subjects, to be studied at home without face to face. This means that

school teachers in most public and private schools after conducting learning and assessment using a digital platform on the half-semester in odd semester of the 2020 academic year.

Students based on age, gender, and ability tend to bring misconceptions from personal experiences and social interaction results. Misconceptions can occur due to limitations in observations and experiences in the everyday environment (Antink-Meyer & Meyer, 2016; Gougis et al., 2017; Markauskaite et al., 2020). During the COVID-19 pandemic, students tend to have these limitations, which can cause students to misunderstand concepts given by teachers online. Most of the online learning provided by teachers during the COVID-19 pandemic used the google classroom platform. It sometimes also gave assignments via the WhatsApp media, and in this case, it could lead to misconceptions about the concepts being learned. Misconceptions can also be obtained from different experiences and sources of inaccurate information. This becomes a bad basis for students in constructing knowledge. Students can properly use one concept in a particular context and experience misconceptions on the same concept but in different contexts. They need help precisely and as early as possible in order to overcome the misconception (Bohlin et al., 2017; Kahn & Zeidler, 2019; Stein & Galili, 2015).

During face-to-face learning at school, many students do not understand the teacher's material (Ichsan et al., 2020). Moreover, if learning is moved to the home, students may not understand the teacher's material online. This could have happened due to a lack of student focus or the teacher's learning model, which was still less effective (Irwandani & Rofiah, 2015; Supriatna et al., 2019). Because learning is done online at home, the assessment is also done online.

Misconceptions can be identified through various techniques, such as concept maps, prediction-observation-explanation (Diani et al., 2018; Samsudin et al., 2017), interviews, open-ended questions, multiple-choice questions, and multilevel tests (two-tier, three-tier, and four-tier) (Gurel et al., 2015). One technique that can be used to uncover misconceptions experienced by students is to use diagnostic tests. A diagnostic test is a test conducted to determine the weaknesses of students so that based on the results of these tests can be done appropriate handling (Shen et al., 2017). The diagnostic test results can provide an overview of concepts that have been understood and not understood by students. Teachers can use this diagnostic test as a reference in designing learning that can improve students' understanding of concepts (Husnah & Samsudin, 2019). Various forms of diagnostic tests have been developed by experts, one of which is the four-tier diagnostic test (Kiray & Simsek, 2020).

Not all misconceptions are misconceptions, but some cases of mistakes cannot be called misconceptions. Students may answer incorrectly because they do not understand the concept or do not know the concept. Thus, a four-tier diagnostic test is used to distinguish students who experience misconceptions from those who do not understand the concept of boiling. The concept contains many phenomena that make students confused and misconceptions of existing phenomena.

Misconception, according to Heyd-Metzuyanim & Schwarz (2017), is interpreted as prejudice or understanding of a concept that is strongly believed but a concept that is believed to be incompatible with scientific concepts of experts. It is believed that most of the misconceptions come from everyday experiences. The causes of misconceptions can come from themselves or how teachers teach at school, teaching materials, or teaching media.

One technique for diagnosing students' misconceptions is the diagnostic misconception test. According to Xiong & Suen (2018), diagnostic test, is a test conducted to determine the weaknesses of students so that based on the results of these tests, proper handling can be done. One of the tests for the misconception is the four-tier test. The four-tier test is the development of a three-tier test combined with the Confidence Rating on the reason for the answer so that the level of confidence of the answer and the reason for the answer is more accurate. The four-tier test is the development of a three-level test combined with a Confidence Rating for the answers so that the answers' confidence level and the reasons for the answers are more accurate.

After conducting a brief survey related to the digital platform used by teachers (Irwandani et al., 2017), several platforms can be utilized for 21st-century learning, especially for conducting assessments, including 1) Moodle (Gamage et al., 2019; López et al., 2016); 2) Google Classroom, Google Drive, Google Docs, Google Form (Gray, 2019; Leary et al., 2016); 3) Edmodo (Çobanoğlu, 2018), and so on. One of the websites that can be used is Google Form.

Google Form is one of Google's services to manage event registration, opinion polls, making quizzes, and doing quizzes online (Peacock & Grande, 2016). The other benefits of Google Form can create quizzes that require multiple choice answers and descriptions. The appearance of Google Form is also more exciting and easily distributed to respondents in the form of a link to access it. In this study, researchers used the Google Form platform because it makes it easier to work on students' questions than using other platforms. The Google-Form platform is also following the existing platform on Google, commonly used by teachers during online learning. Therefore, this Google Form can be used for assessments about the ability to think creatively on boiling discussion because the concept contains many phenomena. With Google Form, students can quickly answer questions related to drawing phenomena and designs (Muir, 2014).

In order to apply learning models that were applied effectively during the COVID-19 pandemic, researchers conducted case studies to see students' conceptions. In this case study, the researcher focused on the concept of boiling.

Data obtained from students' answers were analyzed using the Rasch Model. The Rasch Model not only measures the number of correct answers obtained by students, but at the same time also calculates the odds ratio probability for each item worked on (Judd et al., 2016). The Rasch Model will create a hierarchical relationship between the student (person) and the item (item) used. Because the same interval scale is produced with the same unit of logit for person and item, these two things can be compared directly which results in information about the test conducted and the ability of students to take the test (Fahmina et al., 2019). The advantage of the Rasch Model is the ability to identify wrong answers, identify incorrect judgments, and predict missing data based on systematic response patterns (Fiedler et al., 2017). This study aims to determine the students' misconceptions about the concept of boiling, the percentage of misconceptions on each indicator of the boiling concept, and the causes of the misconceptions that occur in students.

METHOD

The method used in this study is a single case study, specifically an embedded design. This design is not limited to one type of analysis, such as quantitative or qualitative, but allows for the diversity of methods useful in sub-units (Siniauskaya et al., 2016). The research was conducted during the COVID-19 pandemic, which is around the

second week of April. Research schools are selected based on the school and students' quality: not too low and not too high, so the results can be used as illustrations and give a general impression. This research was conducted by taking data by giving four-tier diagnostic test questions on the concept of boiling. Due to the COVID-19 pandemic, this test was administered using a digital platform (Google Form) with a time limit of 15 minutes. Tests are given to students who have learned the concepts being tested. Then the results are processed statistically and then analyzed. The circulate phase was carried out to test the use of four-tier tests developed in diagnosing the conception of eleven high school students at one of the public high schools in Bandung, West Java. To categorize students' conception, guidelines are used to classify students in the categories of Scientific Conception (SC), Misconceptions (M), and Lack of Knowledge (LK). Meanwhile, the research procedures conducted by researchers during the COVID-19 pandemic are shown in Figure 1.

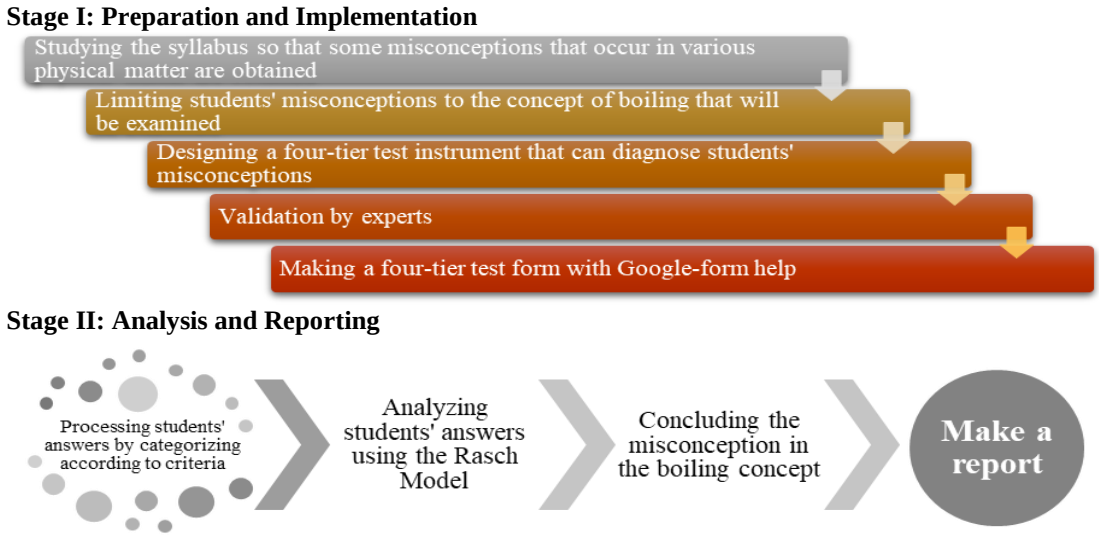


Figure 1. The Research Procedures

The number of respondents in this study was 92 of XI (K-11) students of Natural Sciences in one of the state high schools in West Bandung regency in the age range of 16-17. Students who were respondents were students who had learned the concept of boiling before. The students are also equipped with handbooks and technological devices such as cell phones, computers, and other tools to support them during learning.

The test instrument was named BFT-Test (Boiling concept Four-tier). This test is a four-tier diagnostic test consisting of 3 questions. The number 2.1 reflected the item or question number one for the first-tier in the form of questions, number 2.2 reflected the item number one for the second-tier in the form of students' level of confidence in answer to problem 2.1, while 2.3 occurs to the item or question number one for the third-tier in the form the choice of reasons for students' answers to questions 2.1, the last 2.4 points to the item or question number one for the fourth-tier in the form of students' confidence in the answers to questions 2.3.

The test instrument contains 3 question indicators in the form of a four-tier diagnostic test. Each question answered correctly is given a value of 1. This score can be calculated using the Rasch model for the validity of the test instrument. The instrument has a reliability value of 0.71 after testing with previous tests. That is, the items on the test instrument used can be said to be

reliable. Moreover, instruments have a 'very good' measure of unidimensionality (validity), where the raw variance index is explained by measurements above 40 % (Sumintono & Widhiarso, 2014), as shown in Figure 3.

Question Number	Misconception	Question Indicator	Question	Answer Key
2	Pressure does not affect the boiling temperature of the liquid	Analyzing the effect of pressure on the boiling point	One day, Ilham went to climb a mountain. At that time, Ilham wanted to make tea, to make it, inspiration had to boil water until it boiled. What is the boiling point of the water? A. < 100°C B. 100°C C. > 100°C My level of confidence in answering questions is ... A. Sure B. Not Sure The reason I chose that answer ... A. The boiling point does not depend on the pressure of a plateau. B. The lower the pressure, the lower the boiling point. C. The higher the pressure, the lower the boiling point. D. ... My level of confidence in answering questions is ... A. Sure B. Not Sure	Answer: A Reason: B

Figure 2. A Sample of Rubrics for the Conception Test on BFT-Test

```
INPUT: 92 Person  3 Item  REPORTED: 92 Person  3 Item  3 CATS     WINSTEPS 4.4.7
-------------------------------------------------------------------------------

    Table of STANDARDIZED RESIDUAL variance in Eigenvalue units = Item information units
                                        Eigenvalue   Observed   Expected
Total raw variance in observations   =       6.1794 100.0%          100.0%
  Raw variance explained by measures =       3.1794  51.5%           50.0%
    Raw variance explained by persons =      3.1057  50.3%           48.9%
    Raw Variance explained by items  =       .0738   1.2%            1.2%
  Raw unexplained variance (total)   =       3.0000  48.5% 100.0%   50.0%
    Unexplned variance in 1st contrast =     1.8321  29.6%  61.1%
    Unexplned variance in 2nd contrast =     1.1593  18.8%  38.6%
    Unexplned variance in 3rd contrast =      .0079    .1%    .3%
    Unexplned variance in 4th contrast =      .0005    .0%    .0%
    Unexplned variance in 5th contrast =      .0002    .0%    .0%
```

Figure 3. The Result of Unidimensionality (Validity) using the Rasch Model

```
     SUMMARY OF 92 MEASURED (EXTREME AND NON-EXTREME) Person
-------------------------------------------------------------------------------
|          TOTAL                          MODEL          INFIT        OUTFIT    |
|          SCORE     COUNT     MEASURE    S.E.      MNSQ   ZSTD   MNSQ   ZSTD |
|-----------------------------------------------------------------------------|
| MEAN       5.6       3.0        -.73    1.64                                 |
|  SEM        .2        .0         .31     .04                                 |
| P.SD       1.5        .0        2.99     .39                                 |
| S.SD       1.5        .0        3.01     .39                                 |
| MAX.       9.0       3.0        5.59    2.06                                 |
| MIN.       3.0       3.0       -5.60    1.25                                 |
|-----------------------------------------------------------------------------|
| REAL RMSE   1.86 TRUE SD    2.35  SEPARATION  1.27  Person RELIABILITY  .62 |
|MODEL RMSE   1.68 TRUE SD    2.48  SEPARATION  1.47  Person RELIABILITY  .68 |
| S.E. OF Person MEAN = .31                                                   |
-------------------------------------------------------------------------------
Person RAW SCORE-TO-MEASURE CORRELATION = .99
CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = .72 SEM = .78

     SUMMARY OF 3 MEASURED (NON-EXTREME) Item
-------------------------------------------------------------------------------
|          TOTAL                          MODEL          INFIT        OUTFIT    |
|          SCORE     COUNT     MEASURE    S.E.      MNSQ   ZSTD   MNSQ   ZSTD |
|-----------------------------------------------------------------------------|
| MEAN     171.7      92.0         .00     .28       .96   -.30    .79   -.97 |
|  SEM        5.0       .0         .39     .00       .20   1.30    .18    .88 |
| P.SD        7.0       .0         .56     .00       .28   1.84    .25   1.24 |
| S.SD        8.6       .0         .68     .01       .35   2.25    .31   1.52 |
| MAX.      181.0      92.0         .61     .29      1.32   1.93   1.07    .33 |
| MIN.      164.0      92.0        -.73     .28       .62  -2.57    .45  -2.64 |
|-----------------------------------------------------------------------------|
| REAL RMSE    .30 TRUE SD     .47  SEPARATION  1.58  Item   RELIABILITY  .71 |
|MODEL RMSE    .28 TRUE SD     .48  SEPARATION  1.69  Item   RELIABILITY  .74 |
| S.E. OF Item MEAN = .39                                                     |
-------------------------------------------------------------------------------
```

Figure 4. Reliability Estimation Using Rasch Analysis

The BFT-Test (Boiling concept Four-tier) is used to identify students' conceptions of moderate difficulties. A test containing three items has a good reliability coefficient of 0.72, meaning that the interaction between the item questions with the respondent as a whole can be categorized as "good." The students' reliability coefficient in conducting the test was 0.62, while the reliability coefficient of the items in the developed test was 0.71. From student reliability data and item reliability, it can be concluded that the consistency of answers from students is weak. However, the quality of item items in this instrument can be categorized as "good." The reliability estimates analyzed using Rasch Analysis are presented in Figure 4.

Based on Figure 4, there are two scores: the separation of items and people's separation. The score of separation of people is equal to 1.27, while item separation is 1.58. The separation score shows the quality of the instruments used by researchers and respondents in this study. The greater the separation score, the better the instrument's quality in identifying the respondent group and the item group (based on the level of difficulty) will be.

This BFT test is given to students who use the Google Form help in the Indonesian language format (for English translation shown in Figure 2) because students cannot take the test at school. Examples of questions given in the Google Form can be seen in Figure 5.

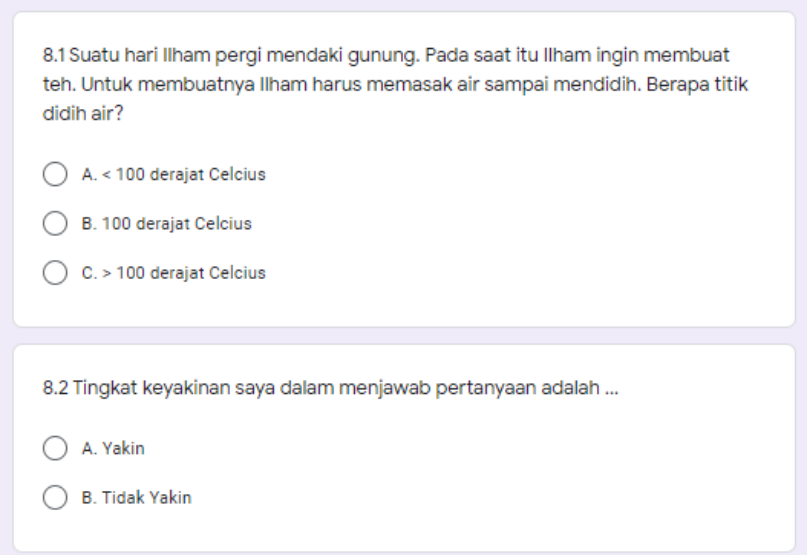


Figure 5. Examples of Questions Given in the Google Form

After the BFT-Test is given to students through the Google Form platform, the results are processed statistically and then analyzed. Before the data were analyzed using the Rasch Model, student answer data were first grouped according to each conception category's criteria. The students' conception categories from the four-level diagnostic test results are explained in Table 1.

Table 1. The Categories of Students' Conceptions

Tier 1	Tier 2	Tier 3	Tier 4	Conception Category
True (T)	Sure (S)	True (T)	Sure (S)	Scientific Conception (SC)
True (T)	Sure (S)	True (T)	Not Sure (NS)	Lack of Knowledge (LK)
True (T)	Not Sure (NS)	True (T)	Sure (S)	Lack of Knowledge (LK)
True (T)	Not Sure (NS)	True (T)	Not Sure (NS)	Lack of Knowledge (LK)
True (T)	Sure (S)	False (F)	Sure (S)	Misconception (M)

Tier 1	Tier 2	Tier 3	Tier 4	Conception Category
True (T)	Sure (S)	False (F)	Not Sure (NS)	Lack of Knowledge (LK)
True (T)	Not Sure (NS)	False (F)	Sure (S)	Lack of Knowledge (LK)
True (T)	Not Sure (NS)	False (F)	Not Sure (NS)	Lack of Knowledge (LK)
False (F)	Sure (S)	True (T)	Sure (S)	Misconception (MC)
False (F)	Sure (S)	True (T)	Not Sure (NS)	Lack of Knowledge (LK)
False (F)	Not Sure (NS)	True (T)	Sure (S)	Lack of Knowledge (LK)
False (F)	Not Sure (NS)	True (T)	Not Sure (NS)	Lack of Knowledge (LK)
False (F)	Sure (S)	False (F)	Sure (S)	Misconception (M)
False (F)	Sure (S)	False (F)	Not Sure (NS)	Lack of Knowledge (LK)
False (F)	Not Sure (NS)	False (F)	Sure (S)	Lack of Knowledge (LK)
False (F)	Not Sure (NS)	False (F)	Not Sure (NS)	Lack of Knowledge (LK)

RESULT AND DISCUSSION

Analysis of Students' Misconceptions and Conceptions Categories

Based on research, information on the students' conception category on the concept of boiling has been obtained. Student conception categories are identified by analyzing student responses at each tier. The following graph of the percentage of students' conceptions in the boiling concept is shown in Figure 6.

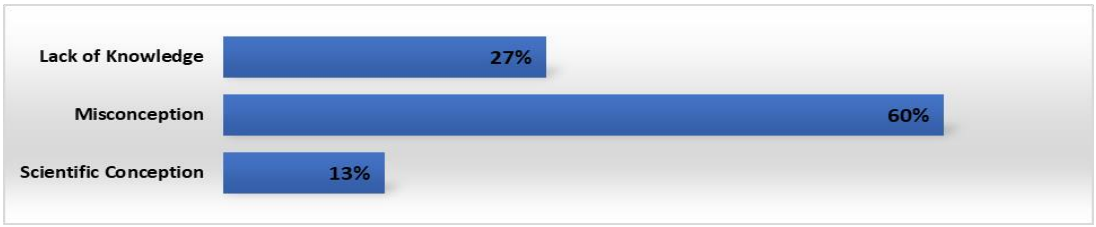


Figure 6. Percentage of Students' Conceptions in the Boiling Concept

Based on Figure 6, the percentage of each conception category is 60 % of students experience misconceptions, 13 % of students are included in the category of Scientific Conception, and 27 % of students fall into the category of lack of knowledge, which means some students are not sure of the answer or reason to answer the answer. To see the percentage of students' specific conception categories for each question can be seen in Figure 7.

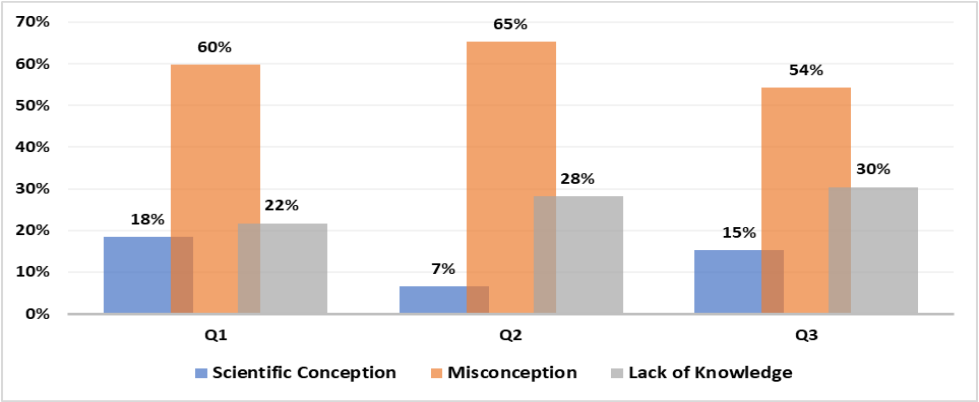


Figure 7. The Percentage of Students' Conception Categories for Each Question

Based on the students' conception of each question, the value with the greatest chance of experiencing misconception with a percentage of 65 % is found in number 2 with the Q2 code. The indicator of problem number 2 is analyzing the effects of pressure at the boiling point.

There are many misconceptions about the problem because many students think that pressure does not affect the

liquid's boiling temperature. Such students' assumptions, due to wrong thinking because students consider mountains to have high pressure so that the boiling point of water is low, following research (Kirbulut & Beeth, 2013), which states that students assume the higher an area, the lower the boiling point of water.

Question number 1 found a misconception with a percentage above 50 %, which is 60 % in the indicator determining water's boiling point. Students assume that the boiling point of water is always 100^0 C. Supposedly, the boiling point of water is affected by ambient atmospheric pressure. This is consistent with the research (Kim & Park, 2018), which states that atmospheric pressure is ignored by students when determining the boiling point of water.

Question number 3 found a misconception with a percentage of 54 % on the indicator predicting the temperature of boiling water continuously. Many students still think that the boiling point of water decreases over time because it is not affected by pressure. The boiling point should always be stable and cannot be changed. This is consistent with the research (Hokayem & Schwarz, 2014), which states that students cannot continuously predict boiling water temperature. Based on the analysis of students' misconceptions related to boiling, students have a misconception of several indicators, as shown in Table 2.

Table 2. Students' Misconceptions Related to the Concept of Boiling

Indicator	Misconception
Determine the boiling water.	The student assumed the boiling point of water is affected by ambient atmospheric pressure.
Analyzing the effect of pressure on the boiling point.	Students consider mountains to have high pressure so that the boiling point of water is low.
Predict the temperature of boiling water continuously.	Students still think that the boiling point of water decreases over time because it is not affected by pressure.

Analysis of Respondents (Students) Using Rasch Analysis

Achievement of students' conceptions on boiling concepts was analyzed using the Rasch model through the Wright Map. Wright Map can help analyze the distribution of each student's ability to his conception based on the logit scale. The distribution of student ability distribution can be seen in Figure 8.

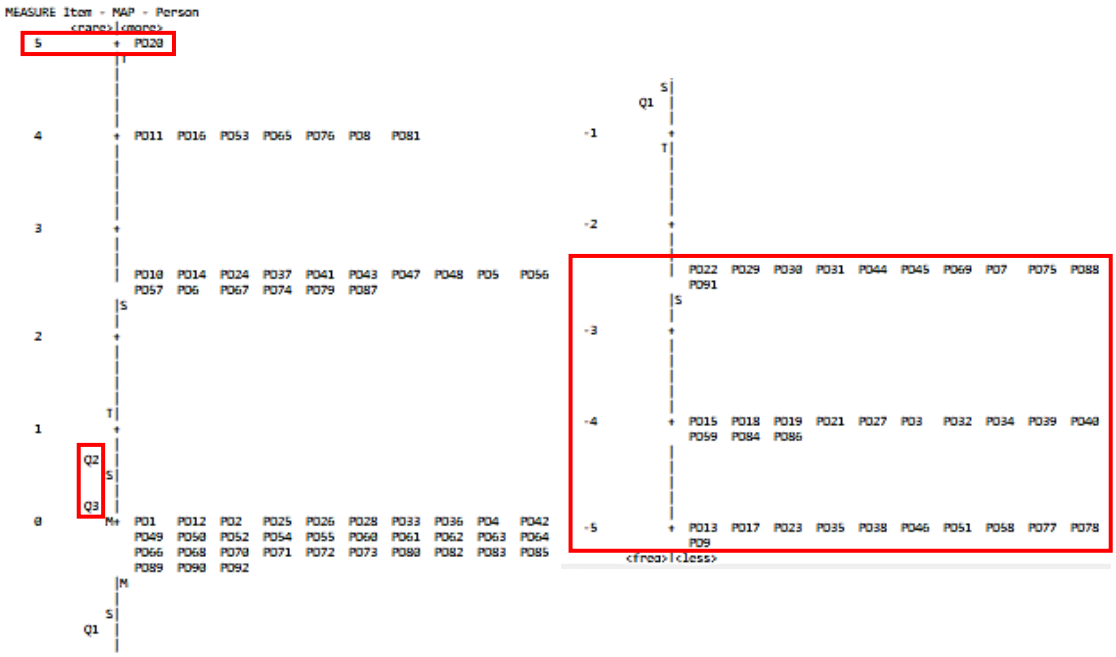


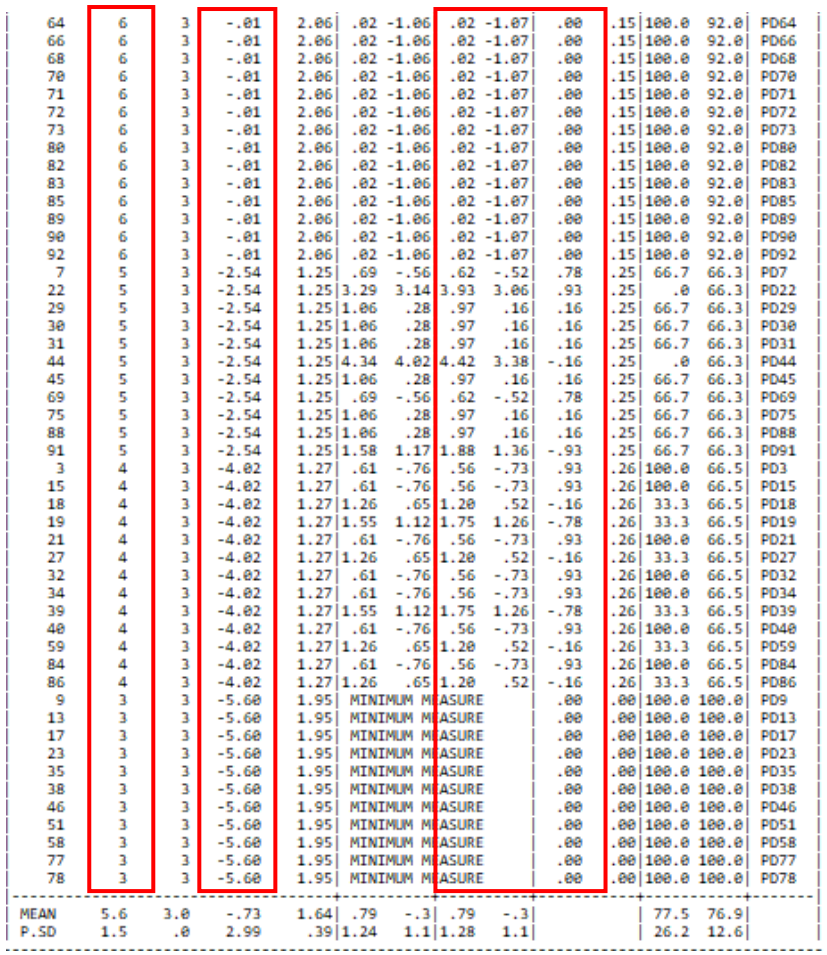
Figure 8. The Distribution of Students' Ability

Figure 8 illustrates the distribution of abilities of 92 students and the distribution of difficulty levels with the same scale. They have seen a student with very high ability, namely students with the PD20 code. The logit score of this student is +5 logit. These students are also outside the limits of the two Standard Deviations (SD) marked with T. This shows that these students have high intelligence that is different (outliers) from the group of students tested. Students who have the lowest ability are students with a logit value less than -1 logit. This is consistent with the statement (Bond & Fox, 2007) that candidates with higher ranks present a more convincing construct than those who rank lower. It is seen that students cannot answer questions with a low level of difficulty (Q1).

Figure 8 also shows that questions with Q2 and Q3 codes have a higher level of difficulty than questions with Q1 codes. This can be seen from the logit value indicated by the logit +1 logit value. This problem shows that students can do less correctly than Q1. Questions with code Q1 have a low level of difficulty: having a logit value below 0 logits, and almost most students can likely do this problem correctly. From these results, it can be seen that there are no outlier problems.

In addition to measuring individual abilities more precisely, the Rasch model can also be known for the accuracy of the ability with the response patterns given. In this aspect, the teacher can find out earlier information from the results of tests conducted, where this formative test will provide valuable information to improve teaching and help students. Detection can be done to identify students' misconceptions on certain subjects, which can be known from their statistical fit information and unusual response patterns. The results of the analysis of the level of students' ability in Figure 9.

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PTMEASUR-AL CORR.	PTMEASUR-AL EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	Person
20	9	3	5.59	1.94	MAXIMUM MEASURE				.00	.00	100.0	100.0	PD20
8	8	3	4.02	1.26	1.07	.31	.98	.17	.16	.24	66.7	66.6	PD8
11	8	3	4.02	1.26	.70	-.57	.63	-.53	.78	.24	66.7	66.6	PD11
16	8	3	4.02	1.26	1.07	.31	.98	.17	.16	.24	66.7	66.6	PD16
53	8	3	4.02	1.26	.70	-.57	.63	-.53	.78	.24	66.7	66.6	PD53
65	8	3	4.02	1.26	1.59	1.24	1.93	1.45	-.93	.24	66.7	66.6	PD65
76	8	3	4.02	1.26	.70	-.57	.63	-.53	.78	.24	66.7	66.6	PD76
81	8	3	4.02	1.26	1.07	.31	.98	.17	.16	.24	66.7	66.6	PD81
5	7	3	2.55	1.26	4.05	3.61	4.21	3.30	.16	.26	.0	66.3	PD5
6	7	3	2.55	1.26	.60	-.74	.55	-.71	.93	.26	66.7	66.3	PD6
10	7	3	2.55	1.26	.60	-.74	.55	-.71	.93	.26	66.7	66.3	PD10
14	7	3	2.55	1.26	.60	-.74	.55	-.71	.93	.26	66.7	66.3	PD14
24	7	3	2.55	1.26	1.24	.60	1.19	.50	-.16	.26	66.7	66.3	PD24
37	7	3	2.55	1.26	1.24	.60	1.19	.50	-.16	.26	66.7	66.3	PD37
41	7	3	2.55	1.26	.60	-.74	.55	-.71	.93	.26	66.7	66.3	PD41
43	7	3	2.55	1.26	1.24	.60	1.19	.50	-.16	.26	66.7	66.3	PD43
47	7	3	2.55	1.26	.60	-.74	.55	-.71	.93	.26	66.7	66.3	PD47
48	7	3	2.55	1.26	1.24	.60	1.19	.50	-.16	.26	66.7	66.3	PD48
56	7	3	2.55	1.26	.60	-.74	.55	-.71	.93	.26	66.7	66.3	PD56
57	7	3	2.55	1.26	1.24	.60	1.19	.50	-.16	.26	66.7	66.3	PD57
67	7	3	2.55	1.26	.60	-.74	.55	-.71	.93	.26	66.7	66.3	PD67
74	7	3	2.55	1.26	1.24	.60	1.19	.50	-.16	.26	66.7	66.3	PD74
79	7	3	2.55	1.26	.60	-.74	.55	-.71	.93	.26	66.7	66.3	PD79
87	7	3	2.55	1.26	1.24	.60	1.19	.50	-.16	.26	66.7	66.3	PD87
1	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD1
2	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD2
4	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD4
12	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD12
25	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD25
26	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD26
28	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD28
33	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD33
36	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD36
42	6	3	-.01	2.06	9.06	2.78	9.21	2.81	-.63	.15	33.3	92.0	PD42
49	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD49
50	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD50
52	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD52
54	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD54
55	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD55
60	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD60
61	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD61
62	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD62
63	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD63



64	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD64
66	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD66
68	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD68
70	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD70
71	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD71
72	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD72
73	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD73
80	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD80
82	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD82
83	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD83
85	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD85
89	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD89
90	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD90
92	6	3	-.01	2.06	.02	-1.06	.02	-1.07	.00	.15	100.0	92.0	PD92
7	5	3	-2.54	1.25	.69	-.56	.62	-.52	.78	.25	66.7	66.3	PD7
22	5	3	-2.54	1.25	3.29	3.14	3.93	3.06	.93	.25	.0	66.3	PD22
29	5	3	-2.54	1.25	1.06	.28	.97	.16	.16	.25	66.7	66.3	PD29
30	5	3	-2.54	1.25	1.06	.28	.97	.16	.16	.25	66.7	66.3	PD30
31	5	3	-2.54	1.25	1.06	.28	.97	.16	.16	.25	66.7	66.3	PD31
44	5	3	-2.54	1.25	4.34	4.02	4.42	3.38	-.16	.25	.0	66.3	PD44
45	5	3	-2.54	1.25	1.06	.28	.97	.16	.16	.25	66.7	66.3	PD45
69	5	3	-2.54	1.25	.69	-.56	.62	-.52	.78	.25	66.7	66.3	PD69
75	5	3	-2.54	1.25	1.06	.28	.97	.16	.16	.25	66.7	66.3	PD75
88	5	3	-2.54	1.25	1.06	.28	.97	.16	.16	.25	66.7	66.3	PD88
91	5	3	-2.54	1.25	1.58	1.17	1.88	1.36	-.93	.25	66.7	66.3	PD91
3	4	3	-4.02	1.27	.61	-.76	.56	-.73	.93	.26	100.0	66.5	PD3
15	4	3	-4.02	1.27	.61	-.76	.56	-.73	.93	.26	100.0	66.5	PD15
18	4	3	-4.02	1.27	1.26	.65	1.20	.52	-.16	.26	33.3	66.5	PD18
19	4	3	-4.02	1.27	1.55	1.12	1.75	1.26	-.78	.26	33.3	66.5	PD19
21	4	3	-4.02	1.27	.61	-.76	.56	-.73	.93	.26	100.0	66.5	PD21
27	4	3	-4.02	1.27	1.26	.65	1.20	.52	-.16	.26	33.3	66.5	PD27
32	4	3	-4.02	1.27	.61	-.76	.56	-.73	.93	.26	100.0	66.5	PD32
34	4	3	-4.02	1.27	.61	-.76	.56	-.73	.93	.26	100.0	66.5	PD34
39	4	3	-4.02	1.27	1.55	1.12	1.75	1.26	-.78	.26	33.3	66.5	PD39
40	4	3	-4.02	1.27	.61	-.76	.56	-.73	.93	.26	100.0	66.5	PD40
59	4	3	-4.02	1.27	1.26	.65	1.20	.52	-.16	.26	33.3	66.5	PD59
84	4	3	-4.02	1.27	.61	-.76	.56	-.73	.93	.26	100.0	66.5	PD84
86	4	3	-4.02	1.27	1.26	.65	1.20	.52	-.16	.26	33.3	66.5	PD86
9	3	3	-5.60	1.95	MINIMUM MEASURE				.00	.00	100.0	100.0	PD9
13	3	3	-5.60	1.95	MINIMUM MEASURE				.00	.00	100.0	100.0	PD13
17	3	3	-5.60	1.95	MINIMUM MEASURE				.00	.00	100.0	100.0	PD17
23	3	3	-5.60	1.95	MINIMUM MEASURE				.00	.00	100.0	100.0	PD23
35	3	3	-5.60	1.95	MINIMUM MEASURE				.00	.00	100.0	100.0	PD35
38	3	3	-5.60	1.95	MINIMUM MEASURE				.00	.00	100.0	100.0	PD38
46	3	3	-5.60	1.95	MINIMUM MEASURE				.00	.00	100.0	100.0	PD46
51	3	3	-5.60	1.95	MINIMUM MEASURE				.00	.00	100.0	100.0	PD51
58	3	3	-5.60	1.95	MINIMUM MEASURE				.00	.00	100.0	100.0	PD58
77	3	3	-5.60	1.95	MINIMUM MEASURE				.00	.00	100.0	100.0	PD77
78	3	3	-5.60	1.95	MINIMUM MEASURE				.00	.00	100.0	100.0	PD78
MEAN	5.6	3.0	-.73	1.64	.79	-.3	.79	-.3			77.5	76.9	
P.SD	1.5	.0	2.99	.39	1.24	1.1	1.28	1.1			26.2	12.6	

Figure 9. The Results of Students' Ability Level Analysis

Figure 9 tries to determine whether the respondent or student has a different response pattern based on his ability. The results can be seen by examining the criteria used by MNSQ (0.5 <MNSQ> 1.5), ZSTD (-2.0 <ZSTD> 2.0), and the norm of 0.4 < Pt Measure Corr < 0.85 (Boone et al., 2014). Students who have the highest level of quality learning tools are PD20, but their responses do not match the researcher's criteria. Because, when viewed from the total score, the student has a perfect score. Significant differences in these students can sometimes become impurities in the research data. Although students with the code PD8, PD11, PD16, PD53, PD65, PD76, and PD81 do not have perfect scores, they meet the data criteria. It can be seen from the value of the logit, which is +4.02.

The BFT-Test cannot only be used to diagnose students experiencing misconceptions. It can also diagnose other categories of students' conceptions. The study results can be used as a reference for researchers and teachers to make improvements in learning from home online during the COVID-19 pandemic, especially in boiling concepts. Researchers and teachers can find out which parts are detected are students' misconceptions. Thus, researchers and teachers can plan to learn better during the COVID-19 pandemic to deal with students' misconceptions.

CONCLUSION

Based on the results of data analysis and discussion, it can be concluded that there are scientific conceptions, a lack of knowledge, and experiencing misconceptions about boiling concepts.

The percentage of students with scientific conceptions was 13 %, lack of knowledge was 27 %, and students who experienced misconceptions were 60 %. The percentage of these misconceptions can be categorized in the level of misconception. Based on the results and discussion, there are several suggestions proposed, among others: (1) students should need to multiply read references from various books, the internet, and search for material through other media and emphasize mastery of concepts to avoid misconceptions; (2) teachers are expected in the online learning process during the COVID-19 pandemic to link the material taught with concepts that exist in students' daily lives so that students easily capture the material and students easily remember the concepts in each given material; (3) as a development for research, further research can be done related to the analysis of misconceptions about the causes and types of misconceptions experienced by students.

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