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Identifying Javanese Students' Conceptions on Fluid Pressure with Wright Map Analysis of Rasch

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ABSTRACT
This research aims to identify the conception of Central Javanese students on fluid pressure. The survey was conducted in Central Java involving 515 participants (eight grade students about 14 years old) consisting of 177 males and 338 females. The instrument consists of six questions in a four-tier format about fluid pressure and is distributed via Microsoft Form. The analysis was carried out with Rasch analysis and percentages with six categories of conceptions: CU (Conceptual Understanding); PP (Partial Plus); PM (Partial Minus); NU (No Understanding); MC (Misconception); and NC (No Coding). The Rasch analysis shows the Cronbach alpha is 0.68 (Enough) and the distribution of students' conceptions of fluid pressure forms a normal curve. Meanwhile, bias was not found for gender problems in answering the questions. The percentage of the result are: CU (17%), PP (4%), PM (39%), NU (13%), MC (27%), and NC (0%). This indicates that students' conceptions are still dominated by PM and MC categories. Students in the PM category have good characteristics but lack self-confidence. While the MC category is an unexpected result because students are confident in their answers that are wrong or not in accordance with scientific conceptions. Thus, further action is needed to overcome students' misconceptions.

Keywords: *students' conceptions, fluid pressure, rasch analysis*

INTRODUCTION

Concepts can be expressed as ideas or ideas, knowledge, and abstractions which can be non-physical physical objects which are symbolized in an abstract way so that humans can communicate with each other (e.g. Aminudin et al., 2019; Permana et al., 2021; Samsudin et al., 2017). It means, the concept in general is an abstraction that describes the general characteristics of a group of objects, events, or other phenomena. Thus, it can be concluded that the concept is an idea or idea that is symbolized in general. Concepts in physics are usually expressed in symbolic language. The symbols used are manipulations of one or more natural science process reasoning which cannot be expressed in everyday language. Symbol is the name of a concept related to other symbols, thus allowing for an orderly way of thinking. In physics, students are required to understand existing concepts. Understanding the concept will help students understand and solve questions, or solve the problems they face in life. In this case, students' understanding of a concept or material in learning is referred to as conception.

The view of a concept can be called a concept (Gumilar, 2016). Conception relates to the experience of each individual so that there will be different conceptions for each student for the same concept. The ideas that students have are usually obtained from the learning process of the surrounding environment in both formal and informal education based on their daily experiences (e.g. Kaltakci-Gurel et al., 2017; Liu & Fang, 2016; Lotter & Miller, 2017). However, students sometimes have different conceptions from scientific views.

Conception or conceptual understanding of physics that students have does not only involve the knowledge learned in the classroom, but also through observations in their daily lives (e.g. Fratiwi et al., 2020; Permana et al., 2021; Samsudin, et al., 2021). Prior understanding shows an important part of the information it brings to the classroom, whether it conforms to scientific conceptions or not. If the understanding is in accordance with the expert's conception, then there will be no problems when learning in class. However, if it is not appropriate, then the student may experience misconceptions or do not understand the concept (Haryono et al., 2021; Koto & Gusma, 2021).

Misconceptions, alternative conceptions, students' ideas, and mental models are terms that describe the differences between ideas brought by students and concepts in scientific theory (Kaltakci-Gurel et al., 2017). Misconceptions are obstacles to understanding a phenomenon based on scientific conceptions due to conflicting beliefs but apparently supported by reasonable arguments. Based on the process of daily observation since childhood and increasing experience there will be times when the concepts learned are assimilated with everyday habits.

Misconception occurs when students assume their understanding is certain, even though it is not in accordance with scientific conceptions (e.g. Adimayuda et al., 2020; Candra et al., 2022; Nurjani et al., 2020). Misconceptions that occur in students do not only occur due to internal factors of students but also external factors. Most of the misconceptions are believed to originate from everyday experiences. The misconceptions can be caused by a lack of knowledge about concepts, textbooks, confusion, or language and excessive generalizations. In this case, it is necessary to identify specifically the conceptions possessed by students, so that the anticipation given can be adjusted to the existing problems. Misconceptions can happen to anyone and any concept, one of which is the concept of fluid. Some of these misconceptions are shown in Table 1.

Table 1. Examples of Misconceptions on Fluid Concepts

No	Misconception	Source
1.	Misconceptions about Archimedes' concept: Students think that a nail sinks in water due to its density. The density of the ferns is greater than the density of the water, so the nails sink.	(Diani et al., 2018)
2.	Misconceptions about Archimedes' concept: Students think that a ship floats in seawater due to its volume. The volume of the ship is smaller than the volume of sea water so the ship can float.	(Cahyani et al., 2019; Diani et al., 2018)
3.	Misconceptions about the concept of hydrostatic pressure: Students assume that large hydrostatic pressure is affected by its cross-sectional area	(Saputra et al., 2019)
4.	Misconceptions about Pascal's Law: Students assume that the pressure exerted on a larger cross-section is different from that applied to a smaller cross-section	(Cahyani et al., 2019)

The examples of misconceptions in Table 1 show that there are problems in students' understanding of fluid concepts in general. The concept of fluid has several discussions, one of which is fluid pressure. The concept of pressure generally has a relationship between force and area. Meanwhile, the fluid equations for two closed vessels are interconnected, the resulting equation is shown in Equation 1 (Jousten et al., 2017).

$$P_1 = P_2 \rightarrow \frac{F_1}{A_1} = \frac{F_2}{A_2} \quad (1)$$

Note: P = Pressure
F = Force
A = Area

However, when Equation 1 is implemented in everyday life, sometimes students are still confused in answering it. Moreover, if there is a combination with other equations in the fluid, and it is associated with existing phenomena. Although Equation 1 is a general pressure equation, its implementation varies widely. This pressure concept can be implemented for all types of substances, including solids, liquids, gases, and plasma. Of course, variations in Equation 1 will be adjusted depending on the case. For example, the pressure in a solid will only be affected by the cross-sectional area (A), and the applied force (F). Meanwhile, in plasma or gaseous substances, it will be related to temperature (T), volume (V), number of moles of particles (n), and ideal gas conditions (R). However, gas can also be implemented in the concept of fluids such as liquids. However, from a conceptual point of view, the position of fluid pressure can be identified as a whole as shown in Figure 1.

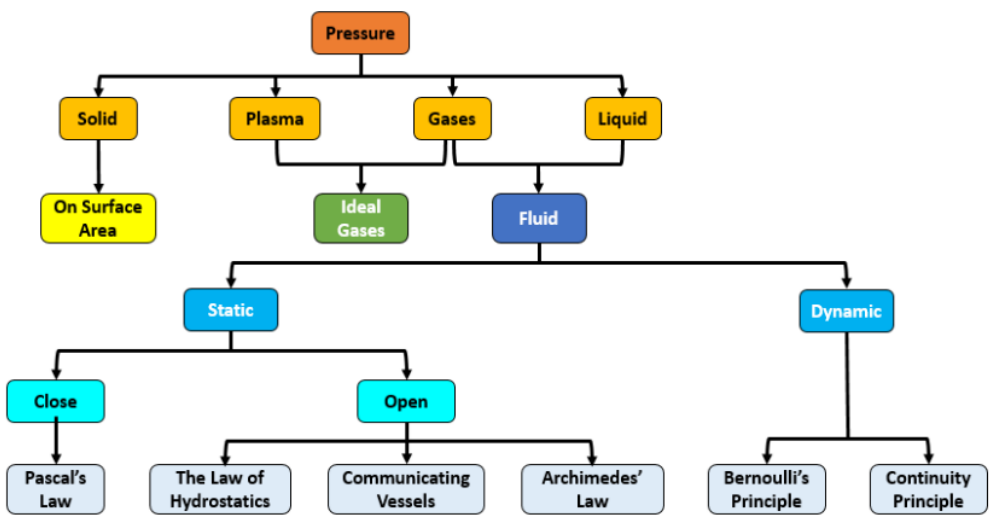


Figure 1. Concept Mapping of Pressure

Based on Figure 1, the focus of this study will onl 3 be limited to pressure on the fluid concept. Thus, we intend to conduct research to identify the conceptions of Central Javanese students on the concept of fluid pressure. This is done because Indonesia has a very large area, and it is our hope that in the future can identify students' conceptions of fluid pressure in other regions.

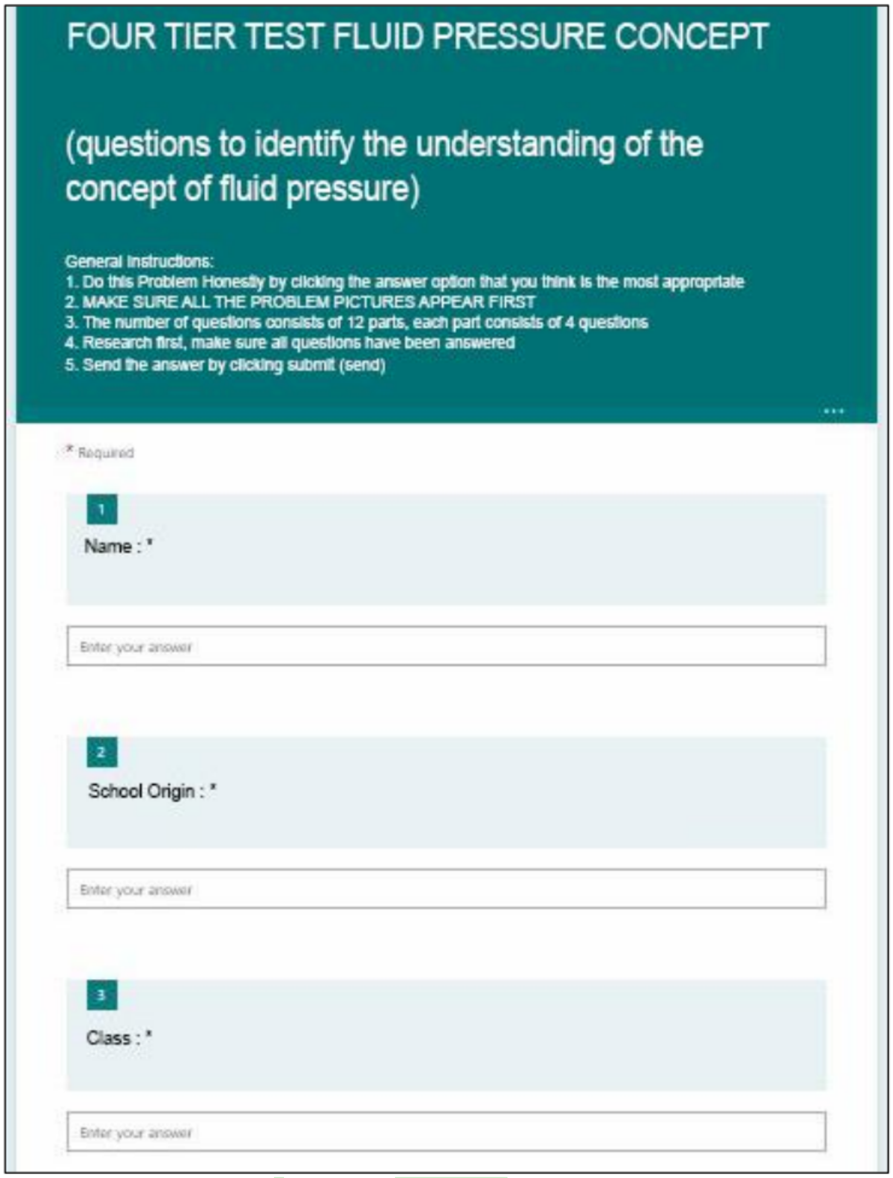
METHODOLOGY

The survey method was used in this research to broadly identify the conceptions of Central Java students about the concept of fluid pressure. In general, survey research is carried out using a fairly large sample of the population that has been selected (Samsudin, 2021). Meanwhile, the survey design used in this study is a type of cross-sectional surveys. This type of cross-sectional survey collects information from a sample that has been drawn from a predetermined population at one time (Fraenkel & Wallen, 2009). The implication of this type of survey is that in this study, the population has been determined, namely in Central Java, and the data collection was carried out at one time. Thus, the concept of fluid pressure can be known from the number of samples or participants used.

This research involved 515 participants (eight grade students about 14 years old) consisting of 177 Male and 338 Female, or in Javanese be called *Mbak* for Female, and *Mas* for Male. All participants are from Central Java with the capital city of Semarang as shown in Figure 2.

Figure 2. Area of Central Java

The instrument consists of six questions in a four-tier format about fluid pressure and is distributed via Microsoft Form. Instruments in the four-tier format have been developed and are believed to be able to identify students' conceptions (e.g. Adimayuda et al., 2020; Fratiwi et al., 2020; Samsudin, Afif, et al., 2021). The format consists of: Tier 1: Contains questions about the concept; Tier 2: Contains questions about the confidence level at Tier 1; Tier 3: Contains the reason for the answer to Tier 1, and; Tier 4: Contains questions about the confidence level at Tier 3. An example of the instrument used can be seen in Figure 3.


FOUR TIER TEST FLUID PRESSURE CONCEPT

(questions to identify the understanding of the concept of fluid pressure)

General Instructions:
1. Do this Problem Honestly by clicking the answer option that you think is the most appropriate
2. MAKE SURE ALL THE PROBLEM PICTURES APPEAR FIRST
3. The number of questions consists of 12 parts, each part consists of 4 questions
4. Research first, make sure all questions have been answered
5. Send the answer by clicking submit (send)

* Required

1 Name : *

Enter your answer

2 School Origin : *

Enter your answer

3 Class : *

Enter your answer

Figure 3. Display of Instruments on Microsoft Form

Data analysis in this research used Rasch analysis with WINSTEPS Version 4.4.5 software, with Summary Statistics (to see the reliability value), Variable (Wright) maps (to identify the distribution of students' conceptions), and Item: DIF, between/within. Previously, the data were included in six categories of conceptions: CU (Conceptual Understanding); PP (Partial Plus); PM (Partial Minus); NU (No Understanding); MC (Misconception); and NC (No Coding). Meanwhile, the scores for each category of conception referring to the study (Samsudin, Aminudin, et al., 2021)(Aminudin et al., 2019) can be seen in Table 2.

Table 2. Score of Conceptions Categories

Tier	Category of Conceptions																
	CU	**PP**			**PM**								**MC**		**NU**		**NC**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
1	T	T	T	T	T	T	T	T	F	F	F	F	F	F	F	F	NF
2	S	U	S	U	S	U	S	U	S	U	S	U	S	U	S	U	
3	T	T	T	T	F	F	F	F	T	T	T	T	F	F	F	F	
4	S	S	U	U	S	S	U	U	S	S	U	U	S	S	U	U	
Score	4	3	3	3	1	1	1	1	1	1	1	1	0	0	0	0	(empty)

*T: True, F: False, S: Sure, N: Not sure, NF: No Fill

Based on Table 2, CU is a conception category in which the answers given are all correct with their level of confidence. Meanwhile, PP is a conception category where the answers given are correct in terms of concepts, but students lack confidence in answering them. For the PM category, the answers given were partially correct or partially incorrect, but the level of confidence was not reviewed because conceptually the answers were not completely correct. Meanwhile, the MC category is a student who answers incorrectly, but is sure of the answer. For NU, it's the same as MC, it's just that they are still unsure about answering it. Finally, the NC category, where there are parts that students don't answer or double in answering. For the percentage of each conception's categories, Equation 2 is used to determine the tendency of the students' conceptions.

$$\% = \frac{\text{Total students for each category}}{\text{Total students}} \times 100 \quad (2)$$

RESULTS AND DISCUSSION

Based on the conception categories in Table 2, the results obtained regarding Javanese students' conceptions on fluid pressure can be seen in Table 3.

Table 3. Frequency Distribution of Student Answers

Category of Conceptions	Question Number											
	1		2		3		4		5		6	
	f	%	f	%	f	%	f	%	f	%	f	%
SU	182	35	55	11	130	25	75	15	62	12	31	6
PP	28	5	11	2	20	4	41	8	10	2	15	3
PN	244	47	203	39	196	38	228	44	94	18	228	44
NU	27	5	71	14	57	11	73	14	88	17	84	16
MC	34	7	175	34	112	22	98	19	261	51	157	30
NC	0	0	0	0	0	0	0	0	0	0	0	0

f = frequency

The frequency in Table 3 shows the number of students who are in the predetermined conception category. Furthermore, each person will be given a score according to the scoring in Table 2, and the results will be analyzed using Rasch analysis.

Based on the scores that have been analyzed, moreover we identified the instrument in terms of its reliability. The Rasch analysis shows the combined results of the person and item reliability in the form of Cronbach Alpha, from the Summary Statistics output as shown in Figure 4.

```
INPUT: 515 Person  6 Item  REPORTED: 515 Person  6 Item  5 CATS   WINSTEPS 4.4.5
--------------------------------------------------------------------------------
      SUMMARY OF 512 MEASURED (NON-EXTREME) Person
-------------------------------------------------------------------------------
|          TOTAL                         MODEL         INFIT          OUTFIT    |
|          SCORE      COUNT     MEASURE   S.E.      MNSQ   ZSTD   MNSQ   ZSTD   |
|-------------------------------------------------------------------------------|
| MEAN      10.5       6.0        -.08     .47      1.02   -.02   1.02    .00   |
|  SEM        .2        .0         .04     .00       .03    .05    .03    .05   |
| P.SD       4.3        .0         .96     .11       .66   1.11    .70   1.08   |
| S.SD       4.3        .0         .96     .11       .66   1.11    .70   1.08   |
| MAX.      22.0       6.0        2.01    1.08      3.84   2.93   3.75   3.06   |
| MIN.       1.0       6.0       -3.59     .37       .07  -2.54    .06  -2.43   |
|-------------------------------------------------------------------------------|
| REAL RMSE    .55 TRUE SD     .78  SEPARATION  1.44  Person RELIABILITY  .67   |
|MODEL RMSE    .48 TRUE SD     .82  SEPARATION  1.71  Person RELIABILITY  .74   |
| S.E. OF Person MEAN = .04                                                     |
-------------------------------------------------------------------------------
  MAXIMUM EXTREME SCORE:      3 Person .6%

     SUMMARY OF 515 MEASURED (EXTREME AND NON-EXTREME) Person
-------------------------------------------------------------------------------
|          TOTAL                         MODEL         INFIT          OUTFIT    |
|          SCORE      COUNT     MEASURE   S.E.      MNSQ   ZSTD   MNSQ   ZSTD   |
|-------------------------------------------------------------------------------|
| MEAN      10.5       6.0        -.06     .48                                  |
|  SEM        .2        .0         .04     .01                                  |
| P.SD       4.4        .0         .99     .14                                  |
| S.SD       4.4        .0         .99     .14                                  |
| MAX.      24.0       6.0        3.19    1.48                                  |
| MIN.       1.0       6.0       -3.59     .37                                  |
|-------------------------------------------------------------------------------|
| REAL RMSE    .56 TRUE SD     .81  SEPARATION  1.46  Person RELIABILITY  .68   |
|MODEL RMSE    .49 TRUE SD     .85  SEPARATION  1.72  Person RELIABILITY  .75   |
| S.E. OF Person MEAN = .04                                                     |
-------------------------------------------------------------------------------
Person RAW SCORE-TO-MEASURE CORRELATION = .96
CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = .68  SEM = 2.49

     SUMMARY OF 6 MEASURED (NON-EXTREME) Item
-------------------------------------------------------------------------------
|          TOTAL                         MODEL         INFIT          OUTFIT    |
|          SCORE      COUNT     MEASURE   S.E.      MNSQ   ZSTD   MNSQ   ZSTD   |
|-------------------------------------------------------------------------------|
| MEAN     905.2     515.0         .00     .05      1.01   -.05   1.02    .26   |
|  SEM      91.2        .0         .20     .00       .05    .81    .03    .45   |
| P.SD     204.0        .0         .44     .00       .10   1.81    .07   1.01   |
| S.SD     223.5        .0         .48     .00       .11   1.98    .08   1.11   |
| MAX.    1279.0     515.0         .45     .05      1.16   2.14   1.09   1.22   |
| MIN.     706.0     515.0        -.78     .04       .81  -3.76    .87  -1.93   |
|-------------------------------------------------------------------------------|
| REAL RMSE    .05 TRUE SD     .44  SEPARATION  8.87  Item   RELIABILITY  .99   |
|MODEL RMSE    .05 TRUE SD     .44  SEPARATION  9.08  Item   RELIABILITY  .99   |
| S.E. OF Item MEAN = .20                                                       |
-------------------------------------------------------------------------------
```

Figure 4. The output of Summary Statistics

There are two Person Reliability values shown in Figure 4, namely, Real and Model. However, what is used is the Real value (blue box) of 0.68 because it is the lower limit value of the results obtained (Boone et al., 2014). Meanwhile, the model value is the upper limit value calculated from the system. Likewise, for the Item Reliability value, which is used is the Real value (green box) of 0.99. This value shows the quality of the instrument which is very good in measuring student conceptions. The combination of the two results in a Cronbach Alpha value (yellow box) of 0.68. A general reliability value that is closer to 1 indicates a more internally consistent measure (e.g. Adimayuda et al., 2020; Aminudin et al., 2019; Boone et al., 2014). Thus, the interaction between participants and the questions has consistency which is sufficiently analyzed further.

The thing to note is that in the Person section, there are NON-EXTREME and EXTREME AND NON-EXTREME sections (purple boxes). Meanwhile, in the Items section there are only NON-EXTREME (pink boxes). For NON-EXTREME, it means that the score used is a score without extreme scores, such as a person who answered all correctly or all who answered incorrectly. Meanwhile, for EXTREME AND NON-EXTREME, all scores on person are used without exception. And in this study, the scores used are EXTREME AND NON-EXTREME scores.

As for the level of validity, several tests were carried out, namely from constructs and items. For construct validity can be seen in Figure 5.

```
INPUT: 515 Person  6 Item  REPORTED: 515 Person  6 Item  5 CATS   WINSTEPS 4.4.5
--------------------------------------------------------------------------------

     Table of STANDARDIZED RESIDUAL variance in Eigenvalue units = Item information units
                                           Eigenvalue   Observed   Expected
Total raw variance in observations     =      10.9475 100.0%         100.0%
  Raw variance explained by measures   =       4.9475  45.2%          45.0%
    Raw variance explained by persons  =       1.6255  14.8%          14.8%
    Raw Variance explained by items    =       3.3220  30.3%          30.2%
  Raw unexplained variance (total)     =       6.0000  54.8% 100.0%   55.0%
    Unexplned variance in 1st contrast =       1.3005  11.9%  21.7%
    Unexplned variance in 2nd contrast =       1.2939  11.8%  21.6%
    Unexplned variance in 3rd contrast =       1.1314  10.3%  18.9%
```

Figure 5. Construct Validity

Construct validity test is intended to identify items in measuring person's ability. Identification was carried out in the "raw variance" section, where what was identified was "raw variance explained by measures", with an accepted value of >20%. While the value obtained is 45.2% (box orange). For the other parts is "unexplained variance", where only the first part is identified, namely the 1st contrast, with an accepted value of <15%. The value obtained is 11.9%. However, for other contrasts the value is also <15%. Based on this value, it can be identified that in terms of the construct it is valid.

Further analysis is the validity for each item. The measurement of item validity test was seen based on the logarithm odd unit (logit) value on the outfit mean square (MNSQ), outfit Z-standard (ZSTD), and point-measure correlation (PTMEASURE-AL COOR). Sequentially, the values received for each category are: 1) MNSQ (0.5 - 1.5); 2) ZSTD (-2.0 - +2.0), and; 3) PTMEASURE-AL COOR (0.4 – 0.85 (not negative)). The values obtained can be seen in Figure 6.

```
INPUT: 515 Person  6 Item  REPORTED: 515 Person  6 Item  5 CATS   WINSTEPS 4.4.5
--------------------------------------------------------------------------------
Person: REAL SEP.: 1.46  REL.: .68 ... Item: REAL SEP.: 8.87  REL.: .99

        Item STATISTICS:  MISFIT ORDER

-------------------------------------------------------------------------------------
|ENTRY   TOTAL  TOTAL           MODEL|   INFIT  |  OUTFIT  |PTMEASUR-AL|EXACT  MATCH|      |
|NUMBER  SCORE  COUNT  MEASURE  S.E. |MNSQ  ZSTD|MNSQ  ZSTD|CORR.  EXP.| OBS%  EXP%| Item |
|------------------------------------+----------+----------+-----------+-----------+------|
|     5    706    515      .45    .05|1.16  2.14|1.05   .68|A .57   .57| 50.6  48.6| Q5   |
|     6    713    515      .43    .05|1.06   .87|1.09  1.22|B .50   .57| 46.7  48.5| Q6   |
|     3   1043    515     -.32    .04|1.02   .41|1.04   .55|C .63   .62| 38.5  37.4| Q3   |
|     4    905    515     -.03    .05|1.01   .16|1.04   .66|c .61   .60| 40.0  41.9| Q4   |
|     2    785    515      .25    .05| .99  -.10|1.03   .37|b .57   .58| 47.3  45.9| Q2   |
|     1   1279    515     -.78    .04| .81 -3.76| .87 -1.93|a .67   .64| 34.2  33.9| Q1   |
|------------------------------------+----------+----------+-----------+-----------+------|
| MEAN   905.2  515.0      .00    .05|1.01    .0|1.02    .3|           | 42.9  42.7|      |
| P.SD   204.0     .0      .44    .00| .10   1.8| .07   1.0|           |  5.7   5.6|      |
-------------------------------------------------------------------------------------
```

Figure 6. Item Validity

Based on Figure 6, the conclusions for each question item can be seen in Table 4.

Table 4. Frequency Distribution of Student Answers

Question Number	Out Fit					
	MNSQ		ZSTD		PT-MC	
	Score	Decision	Score	Decision	Score	Decision
1	0.87	Accepted	-1.93	Accepted	0.67	Accepted
2	1.03	Accepted	0.37	Accepted	0.57	Accepted
3	1.04	Accepted	0.55	Accepted	0.63	Accepted

Question Number	Out Fit					
	MNSQ		ZSTD		PT-MC	
	Score	Decision	Score	Decision	Score	Decision
4	1.04	Accepted	0.66	Accepted	0.61	Accepted
5	1.05	Accepted	0.68	Accepted	0.57	Accepted
6	1.09	Accepted	1.22	Accepted	0.50	Accepted

Table 4 shows the validity for each item, and the result is that all items are accepted. Further analysis was carried out to see the distribution of the Central Javanese students when answering questions about fluid pressure. The results can be seen in Figure 7.

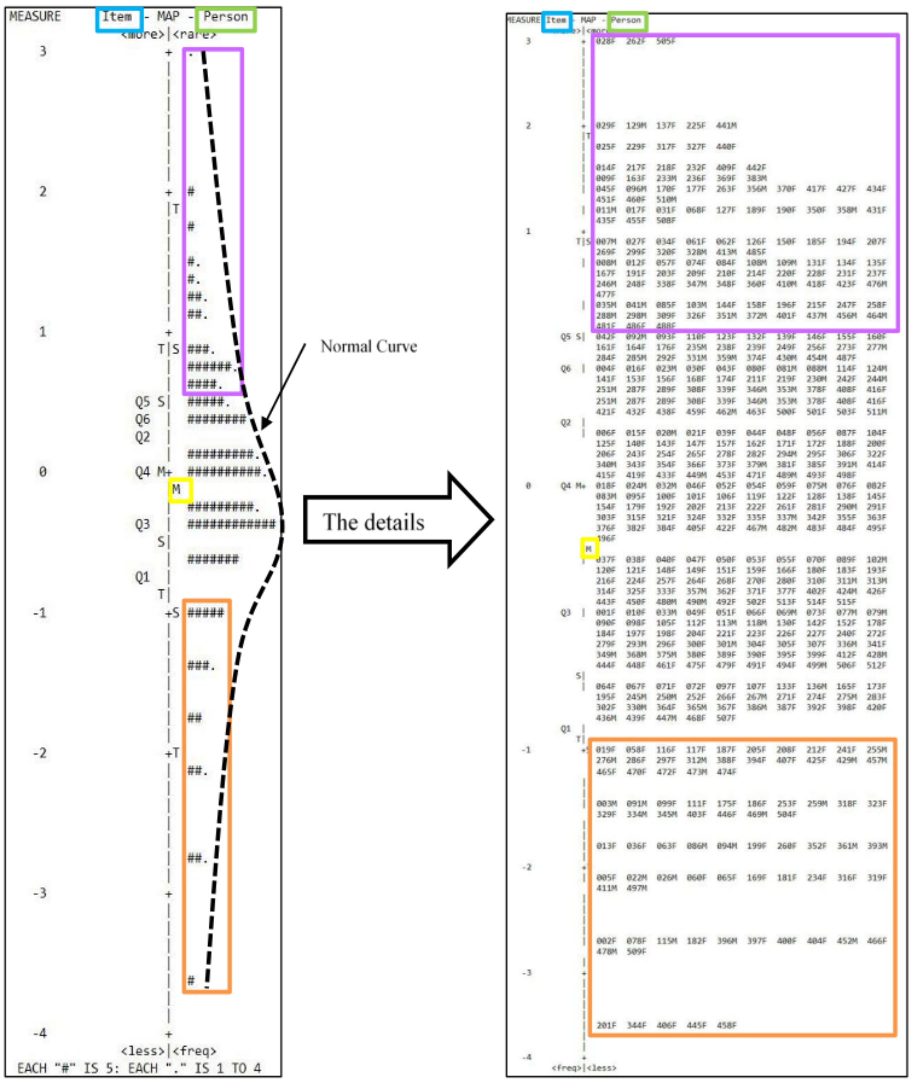


Image 7. The output of Variable (Wright) maps

Figure 7 shows a further interaction between Item (blue box) and Person (green box). The Item section contains the Q (Question) code followed by a number as a sequence of questions. Whereas Person contains the number as the sequence followed by the code M (Male) and F (Female). It can be seen that the distribution of students 'answers in answering questions forms a normal curve, where the students' answers are mostly around the median (yellow box). Meanwhile, the purple box shows students who actually have the ability to answer all the questions, and the orange box shows the ability of students who actually do not have the ability to answer the questions. The output of Variable (Wright) maps can map and show the potential of the person in answering items (Lestari & Samsudin, 2020; Ringo et al., 2021; Sumintono, 2018). Meanwhile, to determine the existence of gender bias from the questions used, the output of Item: DIF, between/within is presented in Figure 8.

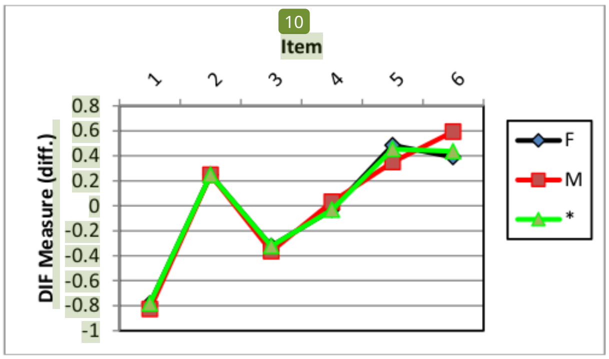


Figure 8. Percentage of Each Central Javanese Student Conception Category

Differential Item Functioning (DIF) is the difference in the probability of correctly answering the items from two different groups (Alavi & Bordbar, 2016; Strobl et al., 2015). The DIF Measure (diff.) in Figure 8 shows the difficulty level of the question. The higher the value, the more difficult the problem is and vice versa, with a black line for Female (F) and a red line for Male (M). For Item, contains the serial number of the questions given. It can be seen in Figure 8 that the difficulty level for each graph problem is increasing and this shows a positive trend for the instrument. Meanwhile, bias was not found for gender problems in answering the questions, because the F and M graphs were still around the green line (normal line). Gender analysis is one of the novelties in this study, where the analysis is carried out to the extent of gender bias. Moreover, it is very difficult to find surveys conducted on fluid concepts in Central Java.

To calculate the percentage of each student's conceptions, it can strengthen the results of the distribution of students' conceptions. The results obtained for the percentage of each category of conception can be seen in Figure 9.

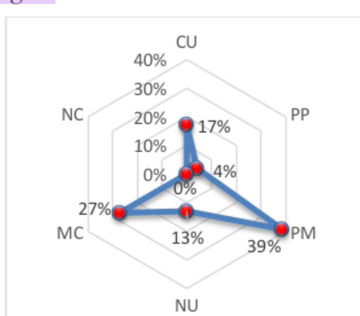


Figure 9. Percentage of Each Central Javanese Student Conception Category

Figure 9 shows the percentage for each category of Central Javanese student conceptions. The smallest to the largest percentages are: 1) 0% for the NC (No Coding); 2) 4% for the PP (Partial Plus); 3) 13% for the NU (No Understanding); 4) 17% for the CU (Conceptual Understanding); 5) 27% for the MC (Misconception), and; 6) 39% for the PM (Partial Minus). This shows that the misconception on the concept of fluid pressure is still relatively high compared to other categories, although the highest value is still held by the PM category. This result is in line with (Saputra et al., 2019) and (Wijaya et al., 2016) which states that the misconception of fluid pressure still occurs on students. Meanwhile, there needs to be clear action in the learning process, so that misconceptions can be suppressed or reduced. As for the categories of CU, PP, and PM, the result is 60%. If you look closely, the differences between CU, PP, and PM (Table 1) are only limited from the level of confidence, while in terms of the concept, they are correct. However, because the PM score is the highest, it shows that the students are not confident in their answer, even though it is correct. (Aminudin et al., 2019) stated that the level of self-confidence is very important in answering questions, so that in his research the level of confidence had a special assessment for further analysis.

CONCLUSION

In terms of the instrument, the instrument used is feasible to be used as a test tool, because it has been proven valid and reliable. As for the identification of Central Java students' conception of the concept of fluid pressure, the results varied. The lowest percentage is found in NC (No Coding) of 0% and the highest is PM (Partial Minus of 39%. However, more attention is focused on the MC (Misconception) category because the value is quite large, namely 27%. This shows that students Central Java still has a wrong conception of fluid pressure, thus, that serious handling is needed to reduce or eliminate misconceptions that occur because it can become an obstacle in the learning process and will indirectly affect other physics concepts. The suggestions that can be given as an alternative that can be done in dealing with misconceptions include: 1) The use of learning models that can apply conceptual change; 2) The use of technology-based media, either simulations or others, which can be used anywhere and anytime, and; 3) Selection of teaching materials according to student needs. We also recommend this instrument to be used as a tool to identify students' conceptions of fluid concepts.

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REFERENCES

Adimayuda, R., Aminudin, A. H., Kaniawati, I., Suhendi, E., & Samsudin, A. (2020). A multitier open-ended momentum and impulse (MOMI) instrument: Developing and assessing quality of conception of 11th grade sundanese students with rasch analysis. *International Journal of Scientific and Technology Research*, *9*(2), 4799–4804.

Alavi, S. M., & Bordbar, S. (2016). Differential Item Functioning Analysis of High-Stakes Test in Terms of Gender: A Rasch Model Approach. *Malaysian Online Journal of Educational Sciences*, *5*(1), 10–24.

Aminudin, A. H., Kaniawati, I., Suhendi, E., Samsudin, A., Coştu, B., & Adimayuda, R. (2019). Rasch Analysis of Multitier Open-ended Light-Wave Instrument (MOLWI): Developing and Assessing Second-Years Sundanese-Scholars Alternative Conceptions. *Journal for the Education of Gifted Young Scientists*, *7*(3), 607–629. https://doi.org/10.17478/jegys.574524

Boone, W. J., Staver, J. R., Yale, M. S., Boone, W. J., Staver, J. R., & Yale, M. S. (2014). Person Reliability, Item Reliability, and More. In *Rasch Analysis in the Human Sciences* (pp. 217–234). https://doi.org/10.1007/978-94-007-6857-4_10

Cahyani, H., Samsudin, A., Tarigan, D. E., Kaniawati, I., Suhendi, E., Suyana, I., Danawan, A., & Karena, A. (2019). Identifikasi miskonsepsi fluida statis pada siswa SMA menggunakan four-tier diagnostic test. *Prosiding Seminar Nasional Fisika 5.0*, *0*, 114–124.

Candra, N., Setiawan, E., & Ilahi, P. R. (2022). Identification of Misconceptions in Chemical Bonding Materials Using Three Tier Diagnostic Test. *Journal of Natural Science and Integration*, *5*(1), 77–89. https://doi.org/10.24014/jnsi.v5i1.16860

Diani, R., Latifah, S., Anggraeni, Y. M., & Fujiani, D. (2018). Physics Learning Based on Virtual Laboratory to Remediate Misconception in Fluid Material. *Tadris: Jurnal Keguruan Dan Ilmu Tarbiyah*, *3*(2), 167. https://doi.org/10.24042/tadris.v3i2.3321

Fraenkel, J. R., & Wallen, N. E. (2009). *How to Design and Evaluate Research in Education* (M. Ryan (ed.); Seventh). Beth Mejia.

Fratiwi, N. J., Samsudin, A., Ramalis, T. R., Saregar, A., Diani, R., Irwandani, Rasmitadila, & Ravanis, K. (2020). Developing memori on Newton's laws: For identifying students' mental models. *European Journal of Educational Research*, *9*(2), 699–708. https://doi.org/10.12973/eu-jer.9.2.699

Gumilar, S. (2016). Analisis Miskonsepsi Konsep Gaya Menggunakan Certainty of Respon Index (CRI). *Gravity*, *2*(1), 59–71. http://jurnal.untirta.ac.id/index.php/Gravity

Haryono, H. E., Aini, K. N., Samsudin, A., & Siahaan, P. (2021). Reducing the students' misconceptions on the theory of heat through cognitive conflict instruction (CCI). *AIP Conference Proceedings*, *2330*. https://doi.org/10.1063/5.0043400

Jousten, K., Hendricks, J., Barker, D., Douglas, K., Eckel, S., Egan, P., Fedchak, J., Flügge, J., Gaiser, C., Olson, D., Ricker, J., Rubin, T., Sabuga, W., Scherschligt, J., Schödel, R., Sterr, U., Stone, J., & Strouse, G. (2017). Perspectives for a new realization of the pascal by optical methods. *Metrologia*, *54*(6), S146–S161. https://doi.org/10.1088/1681-7575/aa8a4d

Kaltakci-Gurel, D., Eryilmaz, A., & McDermott, L. C. (2017). Development and application of a four-tier test to assess pre-service physics teachers' misconceptions about geometrical optics. *Research in Science and Technological Education*, *35*(2), 238–260. https://doi.org/10.1080/02635143.2017.1310094

Koto, I., & Gusma, S. E. (2021). Using certainty response index to differentiate lack of knowledge and misconception about basic electrical concepts. *Journal of Physics: Conference Series*, *1731*(1). https://doi.org/10.1088/1742-6596/1731/1/012070

Lestari, A. S., & Samsudin, A. (2020). Using rasch model analysis to analyze students' scientific literacy on heat and temperature. *PervasiveHealth: Pervasive Computing Technologies for Healthcare*, *1*, 619–626. https://doi.org/10.4108/eai.12-10-2019.2296483

Liu, G., & Fang, N. (2016). Student misconceptions about force and acceleration in physics and engineering mechanics education. *International Journal of Engineering Education*, *32*(1), 19–29.

Lotter, C. R., & Miller, C. (2017). Improving Inquiry Teaching through Reflection on Practice. *Research in Science Education*, *47*(4), 913–942. https://doi.org/10.1007/s11165-016-9533-y

Nurjani, D. M., Alpusari, M., Mahartika, I., Diniya, D., Ilhami, A., Permana, N. D. P., Alim, J. A., Sari, I. K., Mulyani, E. A., Putra, R. A., & Hermita, N. (2020). Identifying the Misconception of Sound Concepts among Grade v Students at SDN 192 Pekanbaru. *Journal of Physics:*

Conference Series, *1655*(1). https://doi.org/10.1088/1742-6596/1655/1/012074

Permana, N. D., Wibowo, F. C., Susilawati, Zarkasih, Z., Bakhtiar, N., Darman, D. R., & Siswanto, S. (2021). Development of a Basic Physics Practicum Guide that is Integrated with Qur'anic Verses for Prospective Natural Science Teachers. *AIP Conference Proceedings*. https://doi.org/10.1063/5.0037559

Ringo, S. ., Kuswanto, K., Samsudin, A., & Setiawan, A. (2021). Rural and urban students' attitudes toward physics: a comparative study using Rasch analysis. *Journal of Physics: Conference Series*, 0–6. https://doi.org/10.1088/1742-6596/1806/1/012009

Samsudin, A., Afif, N. F., Nugraha, M. G., Suhandi, A., Fratiwi, N. J., Aminudin, A. H., Adimayuda, R., Linuwih, S., & Costu, B. (2021). Reconstructing Students' Misconceptions on Work and Energy through the PDEODE*E Tasks with Think-Pair-Share. *Journal of Turkish Science Education*, *18*(1), 118–144. https://doi.org/10.36681/tused.2021.56

Samsudin, A., Aminudin, A. H., & Fratiwi, N. J. (2021). *Measuring students ' conceptions of light waves : A survey in Central Java Measuring students ' conceptions of light waves : A survey in Central Java*. https://doi.org/10.1088/1742-6596/1796/1/012124

Samsudin, A., Cahyani, P. B., Purwanto, Rusdiana, D., Efendi, R., Aminudin, A. H., & Coştu, B. (2021). Development of a multitier open-ended work and energy instrument (MOWEI) using Rasch analysis to identify students' misconceptions. *Cypriot Journal of Educational Sciences*, *16*(1), 16–31. https://doi.org/10.18844/cjes.v16i1.5504

Samsudin, A., Suhandi, A., Rusdiana, D., Kaniawati, I., & Coştu, B. (2017). Promoting conceptual understanding on magnetic field concept through interactive conceptual instruction (ICI) with PDEODE∗E tasks. *Advanced Science Letters*, *23*(2), 1205–1209. https://doi.org/10.1166/asl.2017.7539

Saputra, O., Setiawan, A., & Rusdiana, D. (2019). Identification of student misconception about static fluid. *Journal of Physics: Conference Series*, *1157*(3). https://doi.org/10.1088/1742-6596/1157/3/032069

Strobl, C., Kopf, J., & Zeileis, A. (2015). Rasch Trees: A New Method for Detecting Differential Item Functioning in the Rasch Model. *Psychometrika*, *80*(2), 289–316. https://doi.org/10.1007/s11336-013-9388-3

Sumintono, B. (2018). Rasch Model Measurements as Tools in Assesment for Learning. *1st International Conference on Education Innovation (ICEI 2017)*, 38–42. https://doi.org/10.2991/icei-17.2018.11

Wijaya, C. P., Supriyono Koes, H., & Muhardjito. (2016). The diagnosis of senior high school class X MIA B students misconceptions about hydrostatic pressure concept using three-tier. *Jurnal Pendidikan IPA Indonesia*, *5*(1), 14–21. https://doi.org/10.15294/jpii.v5i1.5784

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