Learning Difficulties and Students’ Ability Level During Pandemic Covid-19 on the Subject of Thermochemistry

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Abstract
This study aims to identify learning difficulties learning experienced by students on the subject thermochemistry in class XI IPA SMA Negeri 8 Palu during the Covid-19 pandemic for the 2021 / 2022 school year. The instruments used in this study are thermochemistry tests, questionnaires, and interviews. The results showed students’ difficulties in the subject thermochemistry in class XI IPA was 60 %, the highest difficulty of students is found in the thermochemistry test of calculating the heat of the type of compound, calculating enthalpy changes, and formulating steps and hypotheses of an experiment. The difficulty is indicated by the low level of student comprehension of 54 %, medium 43 %, and high 3 % with an average of 30%. Furthermore, the difficulty of students in participating in chemistry learning during the Covid-19 pandemic is technical difficulties with a percentage of 65.92 %, difficulties in implementing learning with a percentage of 65.44 %, and external difficulties (environment and parental) with a percentage of 52.92 %. Based on these results, the learning difficulties experienced by students during chemistry learning thermochemistry subjects during the Covid-19 pandemic include students often being constrained by signals and quotas to access materials on the internet and do not have student handbooks to study at home, difficulty understanding chemistry concepts because teacher explanations are elusive, students are not active in participating in learning because chemistry learning during the pandemic is not interesting, can’t afford chemistry books and quotas also parents don’t provide motivation and students are often lazy to do assignments because no one helps with doing. The result of this study indicates that the level of students’ difficulties learning about thermochemistry is a quite high category with a low level of student ability and students agree that it is difficult to study chemistry during the pandemic Covid-19.

Keywords: Learning difficulties, ability levels, thermochemistry

Introduction
The subject of chemistry is one of the subjects that most students find difficult to understand among high school students. Factors that cause chemistry subjects to be considered difficult include: (1) chemistry requires the ability to think abstractly for study materials such as chemical bonds, and atomic and molecular structures; (2) chemistry requires mastery of mathematics, for example in the study of thermochemistry. Reaction rate and stoichiometry; (3) studying chemistry requires a strong memory and a steady logic; (4) chemistry consists of abstract concepts where concepts are tiered, developing from simple to more complex concepts (Novia & Kusumo, 2013).

Sastrawijaya (1988) states that students’ inability to understand concepts is because students are unable to understand the previous concept underlying it. For example, students fail in understanding thermochemistry concepts because they don’t understand the concept of reaction equations and the concept of moles. The cause of the difficulties experienced by students in studying thermochemistry is that students do not understand the similarities between thermochemistry and the concept of moles. The contributing factors include students not being able to store information widely, lack of focus when the teacher explains, difficulty in understanding algorithmic material, need for tools for numeracy, and lack of laboratory tools causing students to fail to get accurate results (Aswita et al., 2017).

Thermochemistry material is one of the chemistry materials taught in class XI science which contains concepts about enthalpy changes, thermochemical equations, various enthalpy changes, enthalpy changes based on Hess’s law experiment, changes in enthalpy reaction formation, and bond energy data. In the concept of thermochemical equations and various enthalpy changes, students are required to understand the concept of reaction equations and be able to convert the magnitudes contained in the mole concept and operate mathematical formulas (Zakiyyah et al., 2018).
Based on these facts, problems arise from studying thermochemistry faced by students because in addition to rote concepts, students must also master carefully about a material and are often faced with certain formulas in solving problems, but often students use the wrong formula according to its designation. Thus, students’ lack of understanding of the concepts presented can make it difficult for students to do the questions. The learning difficulties can increase during the Corona Virus Disease 2019 (Covid-19).

In the learning process during the Covid-19 pandemic, learning activities are carried out online and/or offline. Online and offline learning requires teachers and students to have reciprocal interactions, teachers provide guidance and direction to students and condition students’ abilities so that students gain new experiences. During online and offline learning, teachers must think about how to deliver learning materials effectively and creatively without coming face to face with students, so that students do not feel bored. Teachers must also manage time efficiently and assign tasks to students that stimulate students to ask questions to teachers, their friends and relatives, and parents. The role of parents is very important in monitoring children’s activities and motivating them in the implementation of online learning and the task given by not delaying doing them (Dimyati & Mudjiono, 2013).

Research conducted by Isnaini (2020) states that student participation that is lacking during online learning is a problem shown by low student motivation and interest because online learning is considered less attractive. In line with this statement, Utami & Cahyono, (2020) explained that the problem difficulty often occurs through self-concept where students do not have the initiative to learn on their own, so they wait for instruction and still seem to learn as necessary.

Online system learning has an impact on students’ understanding, namely technical obstacles where conditions in their homes are less conducive and constraints on teaching methods materials (Juliati & Guspatni, 2021).

Based on the problems and facts that have been described, researchers intend to identify student learning difficulties on the subject of thermochemistry class XI SMA Negeri 8 Palu during the Covid-19 pandemics for the 2021/2022 school year.

Methods

The method used in this study is a quantitative descriptive method combined with a qualitative point of view. Quantitative descriptive research is used to describe, explain, or summarize various conditions or solutions according to events as they can be photographed, interviewed, observed, and can be expressed through document materials. Descriptive research is a study designed to obtain information about the human being, groups, or objects that are rationally described as a condition or relationship that exists, an opinion that is developing, an ongoing process, an effect or an effect that occurs that has been manifested or is ongoing while the research is being carried out (Furchan & Maimun, 2005).

In this study, the research used a measurement of the level of difficulty by using thermochemistry test questions and questionnaires and interview guidelines that have been validated by expert lectures. The population in this study was all students enrolled in the 2021/2022 school year. The sample in this study was all students of class XI SMA Negeri 8 Palu, which consisted of XI IPA 1 (n = 30) and XI IPA 2 (n = 31).

Sample technique

The samples in this study were selected using a nonprobability sampling technique, namely the samples were not randomly selected. The nonprobability sampling technique chosen is with a saturated sample (census), which is a method of drawing samples where all members of the population are samples. The samples in this study are all class XI IPA of SMA Negeri 8 Palu, totaling 61 students among them 22 male and 39 female students, who will be distributed thermochemistry test questions and chemistry learning difficulties questionnaires during the Covid-19 pandemic.

Research instruments

This study used instruments on thermochemistry test questions, questionnaires, and interview guidelines. The test questions consist of 15 multiple-choice questions representing thermochemistry material indicators and questionnaires with a Likert scale consisting of 25 statements regarding chemistry learning during the Covid-19 pandemic. Interview guidelines are designed to make it easier to dig up information on the difficulty of learning chemistry. Interviews were conducted with the chemistry teacher in class XI and 2 students, namely one female and one male student who were selected with low ability to strengthen the result of the research conducted, namely the result of the thermochemistry test.

Data analysis technique

The data analysis techniques in this study are as follows:

Data analysis of thermochemistry test result by calculating the percentage of difficulty of each questions item with the formula:

\[ P = \frac{s}{N} \times 100\% \]  

(Riduwan & Aidon, 2010)

Description:
P = difficulty percentage
s = number of students who answered incorrectly
N = total number of students

The next step is to analyze the level of students’ ability by grouping students into high, medium, and low categories (Arikunto, 2013). Analysis of student learning difficulty questionnaire data on the questionnaire method by decomposing quantitative
data into descriptive sentences that explain student difficulties based on indicators that have been compiled. To calculate the size of the index (%) questionnaire score with the formula:

\[ \frac{T}{Y} \times 100\% \]

(Sugiyono, 2017)

Description:

\( T = \text{total number of respondents who chose a particular answer} \)

\( Y = \text{highest score of Likert} \times \text{number of respondents} \)

The size of the percentage index is then interpreted based on the interval obtained (Sugiyono, 2017) the result of the analysis is described in descriptive sentences that explain what are the difficulties of students learning chemistry during the Covid-19 pandemic based on indicators of technical difficulties, difficulties in implementing learning and external difficulties.

**Results and Discussion**

**The level of difficulty in answering thermochemistry test questions**

Based on the result of the study, data on students’ difficulty in solving thermochemistry problems can be seen in Table 2. The table shows that the difficulty of students entering the category is quite high with a percentage of 60%. The results of the identification of student answer results have difficulty in answering questions at certain numbers that are highest in the questions of calculating enthalpy changes, calorific types of the compound, and formulating steps and hypotheses of an experiment.

The level of ability of students based on the results of thermochemistry tests can be seen in Table 1. From the test results obtained, only 2 students scored ≥ 73 and the remaining 59 students did not know thermochemistry material well. Students are called complete in learning if at least 85 % of students are complete (Trianto, 2009). The subject of thermochemistry is still very far from complete, low student ability is the cause of the learning difficulties that students experience in chemistry learning during the Covid-19 pandemic, especially the on the subject of thermochemistry.

The causes of difficulties traced based on the results of interviews with a chemistry teacher and 2 students with low abilities are male students and female students, respectively, showing that there are students difficulty remembering concepts or formulas to solve a problem from the material given, difficulty in mathematical calculation operations in formulas to solve a problem from the material given, and procedures for working on a chemical experiment. At the same time, students can also analyze various phenomena that occur during the experiment takes place, as there is a color change, a change in form, the onset of gases, the emergence of precipitate, and so on in the given impression (Saraswati & Mertayasa, 2020).

Based on the problems of these students in understanding the chemical concept, terms, and practices, will cause consistent errors if improvements are not made, so teachers need to overcome these situations by motivating students to learn independently and providing creative and effective learning to students even in the mids of the covid-19 pandemic.

**Identify chemistry learning difficulties during the covid-19 pandemic**

Based on several preliminary surveys that have been conducted regarding the implementation of online learning during the Covid-19 pandemic, there is a tendency for students who are faced with some difficulties, both technical and related to learning understanding (Özuidoğru, 2021).

The results of the identification based on the questionnaire on chemistry learning difficulties during the Covid-19 pandemic showed that 61.42 % of students agreed to have learning difficulties. The learning difficulties of class XI science students during online and offline learning are divided into three indicators of learning difficulties, namely technical difficulties, difficulties in implementing learning, and difficulties originating from outside students in the form of the environment around students, parents, and schools which can be seen in Table 3.

Students’ difficulty in learning chemistry during the Covid-19 pandemic is about technical issues. Technical difficulties are the most frequent difficulties and have an index of 65.92% that students agree to experience technical difficulties.
Student’s difficulties related to technical include difficulties due to being constrained by problematic signal aspects and often running out of quota (68.44%) and aspects of student inability to learn from home with a percentage of 61.57%, namely, students are not optimal in learning materials (78.27%).

Students said that learning chemistry during the pandemic online is difficult because it is constrained by signals and wastes internet quota and finds it difficult with the application used for online chemistry learning so students learn less optimally (Rasmitadila et al., 2020).

The challenge of online learning is the availability of Internet services. Some students access the internet using mobile cellular and some use WiFi. Students who use mobile cellular, experience their challenges namely obstacles in financing online learning. Students revealed that to take part in online learning, they have to spend quite a lot to buy internet quota (Sadikin & Hamidah, 2020).

Internal factors in the form of student learning motivation affect student learning difficulties. In addition, external factors related to the delivery of material by teachers also affect the level of difficulty of students in the implementation of learning (Isnaini, 2020). Based on Table 3 the indicator of student difficulty related to the implementation of the learning index is 65.44%. These difficulties include low motivation and students’ interest (65.54%), namely, students are not excited when learning chemistry during the Covid-19 pandemic because they are not interested (70.90%).

For students, online learning is no more interesting than face-to-face learning (Elfirdoussi et al., 2020). Teacher explanations when online are difficult to understand (75.81%), lack of participation during learning implementation (63.45%) namely students rarely take online learning (65.98%) and online learning makes students not independent in doing assignments (69.26%) also makes students are inactive in learning (68.44%), as well as giving assignments that are too many and difficult to do (68.30%).

The factors that affect student learning difficulties are internal factors including student attitudes, motivation, interest, and concentration of students, and external factors such as how to teach teachers and teacher assessment (Natasya et al., 2019).

Based on the interviews conducted, students admitted that the teacher’s explanations were difficult to understand because the teacher did not explain the material in detail due to limited time. Tasks that are many and difficult to do become a burden experienced by students so students often feel lazy and easily bored, even though student interest and motivation are the keys to the success of online learning (Siregar et al., 2021). In online learning, students must have an interest and motivation in themselves to be able to learn independently starting from managing study schedules and doing assignments (Kalman et al., 2020). Nevertheless, some argue that learning during the Covid-19 pandemic is easy and relaxing even though many students skip class and cheat on completing assignments.

Students are just used to studying at school and interacting directly with their teachers and classmates (Ranga, 2020). Learning by interacting directly face-to-face can make it easier for students to understand chemical material (Adnan & Anwar, 2020).

The average student only has a cellphone as a learning resource so learning is only carried out through the Whatsapp group (Kapasia et al., 2020). Inadequate student facilities and infrastructure affect the teacher’s delivery method in teaching. For example, not having a cellphone and internet quota hinders the subject matter from being delivered (Bahasoan et al., 2020). Online learning requires costs for the internet and facilities and infrastructure to support student learning (Favale et al., 2020).

Teacher factors related to method constraints are the lack of detailed and interactive material explanations and many materials that must be explained directly cannot be explained online. Online learning methods are considered not optimal enough to meet the learning styles of each student (Juliati & Guspatni, 2021). To overcome this, a teacher must find the right way to teach students online by reviewing the media and facilities owned by students (Suryaman et al., 2020).

During learning students need an environment that encourages enthusiasm, motivation, and direct tutoring (Siregar et al., 2021). If the environment does not support students during learning, they will experience difficulties in learning chemistry online or offline. Based on Table 3 the indicator of student difficulty external factors students agreed to have difficulty with an index of 52.92%.

Externals factors can affect students’ learning difficulties such as parents, home atmosphere, and economic conditions (Natasya et al., 2019). In the aspect of economic difficulties, students agreed that they could not afford to buy student handbooks as learning materials and quotas to access the internet (64.95%), parents of students did not provide motivation and no one could help complete tasks (51.42%).

The parents’ economy and the motivation of parents and the surrounding environment affect learning (Muklis et al., 2020). In addition to material support, students also need an environment that supports them so that they can motivate them to study well.

Isnaini (2020) based on the results of her research showed that students did not experience difficulties in the form of family environmental factors which were inversely proportional to the result that researchers found that 51.42% of students agreed that parents did not provide support and motivation. Even so, in the aspect of support from schools, students do not agree that chemistry learning during the Covid-19 pandemic,
homeroom teachers, and chemistry teachers do not provide motivation (42.41%). This means that during online and offline chemistry learning, the school, namely the homeroom teacher and chemistry teacher always provide support to students.

### Table 2. Data analysis of students’ difficulty in solving thermochemistry questions test

<table>
<thead>
<tr>
<th>No. Questions</th>
<th>$\sum S$</th>
<th>% Difficulties</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11</td>
<td>18</td>
<td>very low</td>
</tr>
<tr>
<td>2</td>
<td>56</td>
<td>92</td>
<td>very high</td>
</tr>
<tr>
<td>3</td>
<td>50</td>
<td>82</td>
<td>very high</td>
</tr>
<tr>
<td>4</td>
<td>49</td>
<td>80</td>
<td>high</td>
</tr>
<tr>
<td>5</td>
<td>57</td>
<td>93</td>
<td>very high</td>
</tr>
<tr>
<td>6</td>
<td>41</td>
<td>67</td>
<td>high</td>
</tr>
<tr>
<td>7</td>
<td>34</td>
<td>56</td>
<td>quite high</td>
</tr>
<tr>
<td>8</td>
<td>42</td>
<td>69</td>
<td>high</td>
</tr>
<tr>
<td>9</td>
<td>29</td>
<td>48</td>
<td>quite high</td>
</tr>
<tr>
<td>10</td>
<td>19</td>
<td>31</td>
<td>low</td>
</tr>
<tr>
<td>11</td>
<td>40</td>
<td>66</td>
<td>high</td>
</tr>
<tr>
<td>12</td>
<td>24</td>
<td>39</td>
<td>low</td>
</tr>
<tr>
<td>13</td>
<td>24</td>
<td>39</td>
<td>low</td>
</tr>
<tr>
<td>14</td>
<td>43</td>
<td>70</td>
<td>high</td>
</tr>
<tr>
<td>15</td>
<td>29</td>
<td>48</td>
<td>quite high</td>
</tr>
<tr>
<td>Average</td>
<td>60</td>
<td></td>
<td>quite high</td>
</tr>
</tbody>
</table>

### Table 3. Data analysis of students’ difficulties learning during the pandemic Covid-19

<table>
<thead>
<tr>
<th>Difficulty aspect</th>
<th>Index (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical difficulties</td>
<td>65.92</td>
</tr>
<tr>
<td>Difficulties in implementing learning</td>
<td>65.44</td>
</tr>
<tr>
<td>External difficulties</td>
<td>52.92</td>
</tr>
<tr>
<td>Average</td>
<td>61.42</td>
</tr>
</tbody>
</table>

### Conclusions

Based on the result and discussion of student difficulties in learning chemistry on the subject of thermochemistry during the Covid-19 pandemic, it can be concluded that the difficulty of class XI science students of SMA Negeri 8 Palu in learning chemistry online and offline thermochemistry materials with a percentage 60% of categories is quite high with a low average level of student understanding. The difficulty of students in answering thermochemistry questions is highest in questions number 2 and 5 respectively with percentages of 92% and 93%, namely calculating the heat of the type of compound and calculating enthalpy changes. The student’s difficulties that are most often experienced by students are technical difficulties 65.92% and difficulties in implementing learning 65.44%. This research which discusses the difficulties of learning chemistry is expected to contribute ideas for improving the implementation of chemistry learning in the future.

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### References


