

# Case-based learning

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**Abstract:** Case-based learning (CBL) is a learning method in which students analyse real-life scenarios to develop problem-solving and critical thinking skills. This method is used in the bachelor's program in Food Science, Technology, and Sustainability, in the module food technology - dairy and plant food (MATV3004). The cases are related to production of bread and camembert. Students form groups, investigate assigned cases, and engage in practical sessions to create the product and solve different hypothesis. A study was conducted to evaluate students' opinion of CBL, involving group interviews and a survey. Interviews showed different experiences: while some students thought practical work deepened understanding, other felt traditional reading was more effective. The survey showed positive results overall, with significant differences between cases. The case on Camembert was rated higher for understanding learning material and industry relevance, but bread provided more confidence for real-world application. However, CBL was less effective in preparing students for exams, which focused more on knowledge recall. The study highlights differences between group and individual opinions, suggesting that quieter students may not voice their concerns in group settings. To increase the effectiveness of CBL, it is recommended that students think of their own analyses and receive feedback at an earlier stage rather than at the end.

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Keywords: Case-based learning, industry relevance, group settings, critical thinking skills, supervision

# 1 Introduction

Case based learning (CBL) is a learning method whereby students learn by solving a case with the help of supervisors (Das et al., 2021). It originated at Harvard Business School and is widely used in medical schools. Nowadays, it is a method that can be found almost everywhere. CBL utilises a case to teach students. To be effective, it is important that the case is based on real-life scenarios, meets the learning objectives, stimulates interest and have general applicability (Thistlethwaite, et al., 2012). In CBL, small groups of students analyse the case, think about the problem and possible solutions. Next, data is collected from literature and practical experience. The results of the case are then shared with the rest of the class, potentially leading to new ideas that can be discussed further (Williams, 2004).

Supervisors play an important role in CBL. They will guide the discussions between students, ensuring that the students think of solutions in the right direction and find the right answers. To achieve this the supervisors, answer and ask questions and redirect them back to the topic if students stray too much from it (McLean, 2016).

In the module Food technology, MATV3004, which is part of the bachelor's degree program Food Science, Technology and Sustainability, students learn about dairy and plant food technology. The students form self-selected groups and are assigned two cases, one about bread and one about Camembert. Each case has a hypothesis that the students are required to research. Students are also asked to form group rules, to ensure the collaboration in the group is well (Aakre & Mørkve, 2021).

Through lectures and reading the material, students prepare for practical days, in which they will make the cheese and bread. In classic CBL, students are supposed to formulate their own hypotheses and find the appropriate analyses, but in this module, this was done by the supervisor. With the results of these days, they will make a presentation that is presented at the end of the semester.

CBL is a relatively new learning method for the students. The professors want to know what the student's perceptions of CBL are, whether they learn enough from it and whether there are any areas that can be improved further. So, the scope of my study, as an internship student fra VHL in the Nederland, was to investigate the effectiveness of CBL for MATV3004 students.

## 2 Methodology

### 2.1 Group interviews

To research the group experience in the middle of the project, six group interviews were conducted. Each group consisted of six students, whom all produced the bread and cheese together. The interview was performed after the second production day at which point the students had completed the preparation and the production of both products. The interviews were conducted in a small room and took approximately ten minutes. The interviews that were performed were semi structured, so if needed follow up questions could be asked. The interviews focused on the learning method and the experiences with

it during the project. Students were asked for permission to use their answers for the research beforehand.

## 2.2 Survey

Furthermore, a survey was conducted to collect the individual opinions of the students. This was done at the end of the module. At this moment all students participating in MATV3004 were present. The survey contained the following six sections: case bread, case camembert, presentation, group work, overall learning experience and guidance. The questions were ranking questions from Strongly disagree to Strongly agree (1-5). At the end of the survey there was room for other remarks that didn't come up during the survey. The survey was performed using Microsoft Forms. From the 36 participating students in the module, 33 completed the survey.

For data-analysis mean values of the questions were calculated. For both cases the same questions were asked. The results of these questions were compared using a paired sample t-test (significance level 95%). Chi square tests were performed to discover any differences between the groups.

# 3 Results

## 3.1 Interview

The interviews revealed that the various groups had different learning experiences. The majority appreciated the practical work to help them understand the process better and found it offered a more comprehensive understanding of the material than the traditional lectures.



*“I think it is hard to conceptualize the whole process of cheesemaking by watching the videos and a step-by-step guide. But now we have done it ourselves, and we got to understand the process more.”*

Picture 1: Students are measuring pH in the fresh camembert.

Other groups considered the production of both products to be unnecessary, because they learn more about the products by reading and remembering the material.

*“Sometimes it is just better to read about it and learn about it that way.”*

During the practical days, groups were required to split up to ensure both products were made within the allocated time. Some groups came to check in on each other while other didn't. The question regarding the sufficient knowledge at both subjects the reaction within and between groups differed. While one group member felt they lacked knowledge, another felt like they grasped the most important concepts.

*“I do feel like I'm missing out on some stuff here and there, but the supervisors said that everybody should work together on the cheese first. Then I feel like this may be important to have. So, if they know what is important in the future, they could call us, and it could be easier and better.”*

Some of the groups have will try to minimize these gaps of knowledge by talking to each other, watching the film they made and preparing for the presentation.

*“We have to make a presentation. I think we will learn more about both processes then as well and not only the part we worked on today and yesterday.”*

In contrast, another group thought the presentation wouldn't help in the learning process, while the focus lays on presenting the case to the class, rather than understanding the process themselves.

Out of both the subject's, students thought the production of the cheese was more important than the production of bread, while cheesemaking was a new process that they hadn't done before, and the majority of the students had made bread.

*“We tried to, as much as we could, to be in both places. Even though we divided into bread, we would still go back into the process lab and join the cheese group, and you guys came in. Most of us have been baking bread before, so we took that a little bit more lightly. And focused more on what we all need to know what we do in the cheesemaking process.”*

## 3.2 Survey

For both cases the same four questions were asked. The results are shown in Tabel 1. While all questions are answered rather positive there is a significant difference found between the cases concerning the learning material and the confidence in applying in real-life. One remark concerning the industry relevance of the bread case was that while the theory was appreciated, the student missed the real process that is also used in the factories. In contrast, students explained that the Camembert case was necessary to understand the theory behind the cheese better.

A comparison was made between groups was made for both the cases, and no significant difference was observed.

Tabel 1. Average scores responses on the questions about the cases.

	Bread	Camembert
The case helped me understand the learning material better	3,9	4,2
The case helped me understand the production process better	3,8	3,8
The case is industry related	3,9*	4,2*
I feel confident in applying the knowledge I learned in real-life situations	4,0*	3,7*

\* Significant difference between answers  $p < 0,05$

Five questions were asked about the overall learning experience. Results are shown in Figure 1. The average answer of CBL provided a better understanding than traditional lectures scored a 3,9, but the if it the cases helped prepare for the exam was scored with a 3. For the question about if the students preferred one or two cases the opinion of the students differed. One student explains that they wouldn't need the bread part and Camembert is enough work. Another student preferred two cases to do the laboratory days for, but preparing two presentation was too much work.

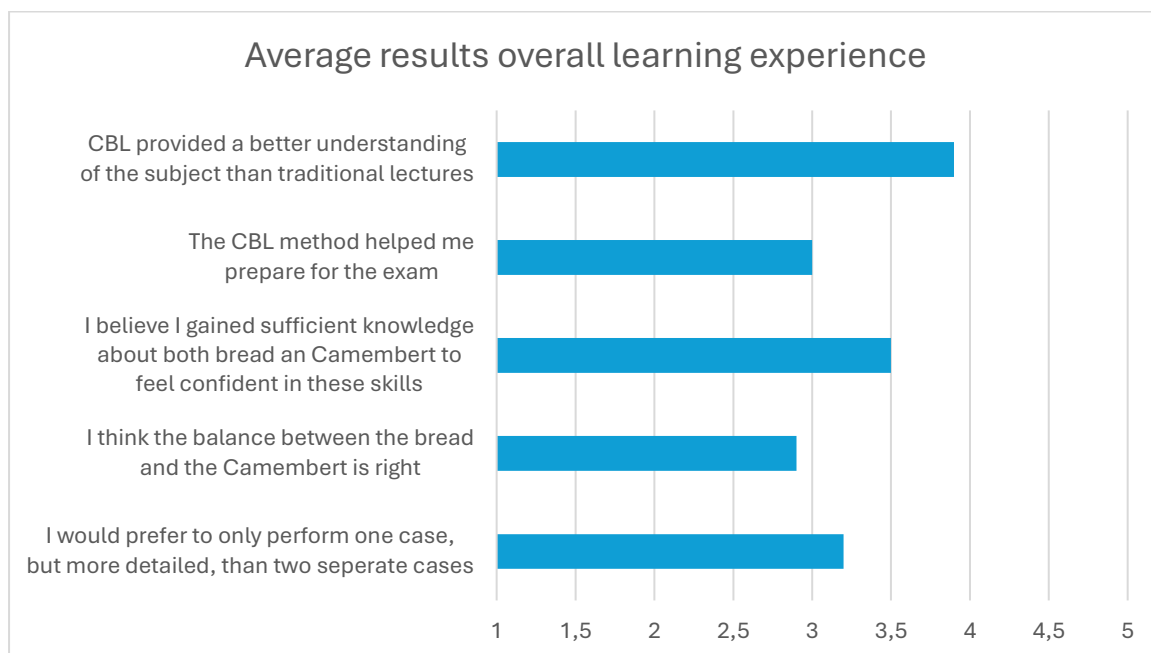


Figure 1. Average scores of five questions about the overall learning experience with scoring from strongly disagree (1) to strongly agree (5).

## 4 Discussion

### 4.1 Reflection on the survey

The survey results were considered positive overall. Two differences were found between the bread and Camembert cases. The difference in confidence to apply the knowledge was explained by the students' comments, indicating that bread is a more familiar process as they have made it before. This could also explain why they felt their understanding of Camembert was better through the case, as they only had theoretical knowledge prior. No significant differences were found between the groups, meaning that the different cases can be considered similar in terms of student workload.

Despite the student's perception that CBL gave them a better understanding of the subject, they felt that this method didn't help them prepare for the exam. The exam consists mainly of knowledge questions and some questions where they must apply their knowledge, suggesting that this is the reason why students feel that CBL doesn't help them prepare (Perez, et al., 2023). An additional comment from the professors regarding these results, is that the theory on bread and camembert is only a few lectures, so there are a lot to learn related to the cases. For the question if the students preferred one or two cases, the opinions differed, but the result leaned to one case. However, the comments made on this part was that the bread case was unnecessary, which can lead to students preferring the one case option. For the question if the students preferred one or two cases, the opinions differed, but the result leaned to one case. However, the comments made on this part was that the bread case was unnecessary, which can lead to students preferring the one case option.

#### 4.1.1 Comparison results group interviews and survey

During the group interviews there were little to no discussions about the answers. Students would rapidly agree with their peers, thus not forming their own opinions. That there are differences in the groups is evident from the survey results. On different questions, some students of in a group are very positive, while others are negative. The differences between group and individual results raise the question of whether the students who are too afraid to share differing opinions also aren't heard in discussions of the material. This can lead to insufficient exploration of the learning material.

A comparison of the results of the interview and the survey provides insight about the difference in opinion during the semester. Firstly, the knowledge can be addressed. During the interview, students indicated that they felt the lack of knowledge but believed that the preparation of the presentation would be effective in filling these gaps. The response of the survey also shows that this has indeed happened.

#### 4.1.2 Learning method

Another part that can be discussed is the similarities and differences between CBL and the method that is used in the module. Firstly, the case that is formulated follows the different criteria outlined in the literature (Perez, et al., 2023). Nevertheless, there are several differences that can be noted. In CBL, students are responsible for formulating

their own hypotheses and thinking of analyses that can answer the question in the case. However, in this module this was done by the supervisor. This affects the development of critical thinking skills and less engagement with the case, which can affect the learning effectiveness (Perez, et al., 2023).

Furthermore, in CBL feedback is used to generate new ideas that can be discussed further. By having the seminar at the end of the period it is possible that these are disregarded, as the students will no longer use it to complete their case.

## 5 Conclusion

This study investigated the effectiveness of CBL for MATV3004 students. The results showed that the students found it to be a valuable method and provided better understanding with an average score of 3.9 out of 5.

The method used isn't entirely CBL. To align better with the method, it is recommended to have students come up with their own analyses to train critical thinking skills.

## Thanks to

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Picture 1: Vilde Vegardsdatter Rognerud and Daniel Belaska Ustad