

The diversity of our students

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Rationale and aim of the project

Diversity is a topic of increasing relevance in our daily life: in the last years the #MeToo and Black Lives Matter movements lead the public to discuss social exclusion and discrimination. Diversity has been also a recurrent discussion point during the university pedagogical course. We discussed how the pandemic affected students in very different ways (Various authors, 2021), we learned how a diversified approach can address students with a different preparation or capability (presentation from Kim Splittorff), and we discussed several times the difficulty to teach in large classes with students with different background. In addition, in the pre-project we aimed to investigate how diverse are students' needs across groups and learning situations. We interviewed only four students, but it was very clear that unmet needs impacted their well-being and learning process.

When we think about diversity, we often think about their personal background (ethnicity, geographic origin, sex, age, residence, mother tongue, culture) of a person, but even in apparently homogenous class there is a diversity that is relevant for the learning process. Each student joins the class with his/her own prior educational experiences, levels of competency and preparedness, but also his/her ambitions and interest for the specific topic, thus affecting the learning outcome (Tinto & Cullen, 1973). In addition, each student has his/her own preferred learning style, i.e. how to fulfill academic tasks and to process information (Biggs et al., 1994): each student use preferentially an approach to solve problems, to study, to face exams and to collaborate with peers.

All these aspects that make our students diverse, contribute to students' integration and satisfaction at the university, so much to affect exams failure rates and drop-out from academy (Johannsen et al., 2015). According to Tinto's longitudinal model (Tinto & Cullen, 1973), students' satisfaction and integration at the university relies on social and academic integration. The social integration builds on the feeling of belonging to the social system of the university¹. The academic integration is based on students' academic performance (formal; the university provides feedback to the students with grades and exams) and the relevance that the discipline has for the students (informal; students can see or not their academic experience as a process of intellectual development). Thus, the diversity of our students might be key to understand their social and academic integration, and thus their learning process, and to help them to improve their learning outcome.

Preliminary data

The course in Fødevarer mikrobiologi (NFOB14028U) is part of the "Bachelordannelsen i fødevarer og ernæring", a collaboration between University of Copenhagen (KU) and Technical University of Denmark (DTU), and it is accessible to students from three specializations: Sundhed og ernæring; Kvalitet og teknologi; Fødevareingeniør. Last year it was attended by 70 students with a background in food engineering and biology. Of the 28 students that filled out the questionnaire on the course last year, seven declared that the level of the course was too high. Despite the majority of students are satisfied with the course, few comments reveal they felt unprepared:

- *"Jeg følte lidt vi manglede noget baggrundsviden omkring forskellige begreber der blev brugt gennem kurset. Måske det bare er mig. Men jeg har haft svært ved at finde rundt i selektive/ indikative principper, osv"*
- *"den del af kurset kunne måske ligge på et senere tidspunkt? når man derved ville have lidt mere viden på forhånd? her tænkes ift. cases"*
- *"Dog fandt jeg det lidt overvældende med alle de øvelser/cases/krydsord osv. der var at finde i de 3 uger her."*

The question is why these students felt unprepared? How they are different from the others? Since the level of the course is good for most of the

¹ The social integration is the aspect that the COVID pandemic put more at risk.

students, can we slightly modify our teaching in this course to meet also their diversity?

My proposal is:

- to verify how students perceive their diversity and if it affects their social integration
- to get an insight of the informal aspect of students' academic integration for this course
- to meet the students' diversity diversifying our teaching

The success of the intervention will be evaluated with the feedback on my teaching in the final questionnaire for the course and with the discussion of my teaching activities with my supervisors.

Students perceived diversity and their social integration

This year 87 students enrolled for the course, all from the University of Copenhagen. The students are free to choose their own colleagues to form 18 teams to work in the laboratory and to solve cases. For my intervention it would have been very interesting to have new mixed groups, but it has been decided not to add an additional stress factor to students in a period when they had to stand changes and restrictions because of the COVID19 pandemic.

I prepared a survey (Figure 1) to investigate: 1) if the students see themselves in homogenous (not diverse) or heterogeneous (diverse) groups, 2) if it was hard to work with that group, and 3) if the reason was because of the diversity/not diversity of their group. I chose to use many open questions to let the students open up and share freely what they perceive as diversity, and to provide their own perspective.

Seventeen students answered the survey: one from Biotechnology, three from Biology, thirteen from Food and Nutrition. A summary of the data is available as *Appendix A*, and I am offering here a comment.

Eight students answered they are in a homogeneous group (44%) and nine in a heterogeneous group (56%). When respondents answered they are in a heterogenous group, they revealed they think about different studies (*“different backgrounds”, “What we want to study in master”*), but also personality, origin and age (*“personalities”, “we are different types of persons”, “where we are from, age etc.”, “live different places in Dk”*). Likewise, respondents answering they are in a homogeneous group refer to their

Hello! Welcome to my questionnaire about diversity. My name is Michela Gambino and I work as assistant professor at KUJ. I am taking my pedagogical course and this questionnaire is part of my project where I investigate how students diversity can effect learning. The collected results will be kept confidential and anonymous. In the next questions I will ask a bit about you and how diverse is the team you worked with during this course.

What are you studying?

Why did you choose this university curriculum?

Let's talk about the team you are working with. Is your team

not diverse (homogeneous)

very diverse (heterogeneous)

In what it is not diverse/diverse?

Did others in your group study the same as you?

Working with others in your team was

very easy

easy

sometimes difficult

difficult

Why was it easy/hard with others in the team?

Did you have troubles understanding each other?

Did you learn something from others in your team that you did not know?

Do you want to add anything else?

[PREVIOUS](#)

[FINISH](#)

100%

Figure 1. Survey about students' diversity.

studies (“*We are all studying the same*” and “*we’re all biologists*”), but mostly about their gender, ethnicity and origin (“*Around the same age and all from Denmark, mostly girls*”; “*were all white and straight, vanilla*”, “*100% monoethnic - male, around same age with common interests*”, “*we are all “pure-breed” Danes, so not a lot of diversity going around*”).

Thirteen students are in a group where others studied the same. Most of the respondents say that working with that team was very easy (35%) or easy (53%), while only two of them answered that it was sometimes difficult (12%). Notably, the two respondents answering that it was sometimes difficult were in groups with students from Biology, and the different background and education made them feel uncomfortable in the discussion:

- “*Their background is Biology, so it comes easier for them, which can make me feel dumb sometimes or left behind*”
- “*The ones from biology are at a higher biology level than me, and therefore understand somethings easier/quicker, maybe because they already know it*”

This is reinforced by their answer to the following question, where one of them answered that sometimes is difficult to understand each other because “*Sometimes the biology students don’t mention something, because they presume that we know it because it is clear for them.*” Except for a respondent highlighting that it can be difficult to work together because “*not everybody puts in the same work*”, the other groups get on well because they know each other from before or from outside university, or simply because “*people are good at listening*”, “*people are open*” and “*we discuss easily and without interrupting each other*”.

Feeling comfortable is certainly important for the students to discuss, but one could argue that we learn more when we challenge ourselves. In addition, learning to work with people from different disciplines is considered an excellent skill, especially nowadays that the field of food and nutrition became so interdisciplinary. One of the reasons for having heterogeneous groups is that the students could learn from each other (Christensen, 2015). Eleven students answered that they learned something from others that they did know before and, among these, three specified that they learned a way of thinking or of working:

- “*I work best with others, talking about the topics makes my brain work best*”
- “*often, new aspects and ways of thinking*”

- *“I’m learning to slow down, and maybe read stuff more carefully, decreasing my error rate”*

Both in the heterogeneous and in the homogeneous groups, six students (75% of each group) answered they learned something from others, thus confirming the importance of team work, but not necessarily supporting the necessity of having heterogeneous groups. The additional explanations provided by three students suggest the diversity we are looking for when assembling the groups is not in their background, but in the way of working and of thinking. Unfortunately, this might be hard to establish and use to form teams for a course.

The informal aspect of students’ academic integration

The informal aspect of the academic integration is about how relevant students find the course for their intellectual development and future (Tinto & Cullen, 1973). To get an insight of the students’ interest in this course, in the survey described above, I asked why they chose this curriculum. Thirteen respondents find the course interesting (81%), and seven of them explained that they are truly passionate about food. The general interest of the students for the course is also something both I and the responsible of the course could notice after the first classes, since the students participate actively to the activities, for example by asking and answering questions. The general interest about the topic in the class is a great contribute from the students’ side to the success of the course. On the other side, the students answering the survey revealed they have very different motivations. Some aim to find a well-paid job, others dream to become enologists or microbiologists, and another one seems to work already in the brewing sector. To satisfy so many different expectations, the use of different teaching approaches and materials is recommended, in order to increase the probability that each student will find what works best for him/her (Fleming, 1995; Prithishkumar & Michael, 2014).

Meet diversity with diversity

In this course the students are exposed to seven different teachers at different stages of their career, from two departments at KU, thus proposing very

diverse ways of teaching and presenting data. Diversity in the teachers' gender could be instead improved (6 men and 1 woman), since we know professor gender has a powerful effect on female students' performance in science (for example, Carrell et al., 2009).

Our section is responsible for the teaching in three weeks when, in addition to classes, we have two fundamentally different activities: exercise in the laboratory and case solving. Classes, exercise in the laboratory and case solving are different not only from a planning and teaching perspective, but they also activate students in different ways. For this reason, I will briefly analyze these activities from the point of view of the student learning style by using the VARK model. VARK is the acronym of Visual, Aural, Read/write, and Kinesthetic, and it refers to four different modalities that each student use to learn (Fleming, 1995). Respectively, each student can prefer to learn by pictures, graphs and diagrams (Visual), by listening to a speech (Aural), by reading and writing a text (Read/write), or by using their senses, thus by doing things or by analogies with something they can experience with other senses (Kinesthetic).

Classes are classically based on speech, thus students preferring the aural approach are greatly favored, and, depending on how the presentation is prepared, the use of text or graphs and pictures will help the students working well with read/write or the visual information. For my class on *Campylobacter*, I prepared a presentation with more text and additional information for the students to study, and a cleaner and shorter version cutting most of the text for the in person class, but with more visual aids (Figure 2). Aiming to maintain students activation, during the class I talked with the students about barbecuing and ask them to raise hands to answer which kind of chicken they prefer (don't eat chicken/ organic and free range/ conventional): this could have been important for the students that like the kinesthetic approach to link the class with their own sensorial experience.

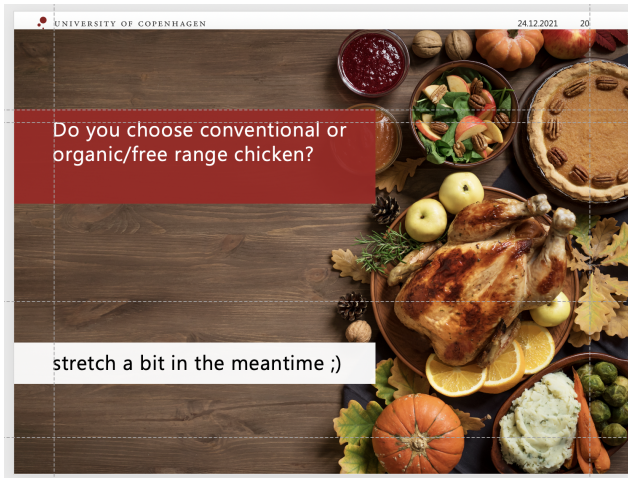


Figure 2. A slide of the *Campylobacter* class that might help establish a connection with students preferring the visual and kinesthetic approach.

Students with a preference for kinesthetic input will instead greatly appreciate the exercise in the laboratory, with the olfactory and tactile modalities deeply involved since they should analyze the food also by touching and smelling it, in addition to listen and talk to colleagues and supervisors.

The case solving is the most flexible activity in terms of planning. The students received in their material the description of eighteen foodborne outbreak cases. We asked them to identify the possible pathogen and food source for the outbreak and to propose solutions to avoid a similar case in the future. We discussed together the last four cases, unfortunately on Zoom for safety reasons. The case study session started with a group work in breakout rooms to discuss about the case, taking notes on a google document. In this phase, students were free to analyze and contribute to solve the case with the approach they preferred. After the discussion, they all came back to the main session, and I quickly read the case again. According to my plan (Figure 3), a representant from each team was supposed to make a sound every time that I read a hint, but the students felt too ashamed to do

it, a pity for those preferring the kinesthetic approach². Nevertheless, this helped them break the ice: they stopped me every time there was something noticeable to say and we started our discussion from their observations.

Plan for today – on Zoom

11:00 to 11:45 CASES 14, 15 and 16

- breakout rooms with your group
- 15 min to read and take notes on the google doc with your group – a text from me every 5 min

<https://docs.google.com/document/d/10zuiCB7xW6iHP2JVtHDdY2M546PtB33v6gggratFreAI/edit?usp=sharing>

- elect one representant from each group and find a sound ☺
- discussion to solve the cases – sound to answer and challenge another team

Figure 3. Plan for the case study.

The discussion on Zoom favors those students comfortable with aural information, but the use of metaphors and images can also help students preferring kinesthetic and visual aids. In the slide below, for example, I used a metaphor with pictures of chocolate and Nobel prize to explain what multivariable means (Figure 4). Hopefully, those students frequently using other senses to learn will remember the metaphor by associating it to the taste and the smell of chocolate.

The preference of one modality in a specific course or class does not exclude that others will be preferred in different situations, or that the best solution could be a combination of several modalities. The student preference for one modality should not be regarded as a fixed trait or characteristic, but rather a possibility for offering very diverse activities and being creative in our teaching tools.

² The following comment in the survey convinced me I should try this again: “I think your “sound game” for the cases would have worked great physical, but failed online”

Case 17

TABLE

Univariable and multivariable results of the Danish and Swedish case-control studies, adjusted for age and sex, sorted by most common exposure, Sweden* and Denmark*, March 2019

Food exposure	Denmark						Sweden					
	Cases exposed		Univariable ^a		Multivariable ^a		Cases exposed		Univariable ^a		Multivariable ^a	
	Proportion n/N	%	aOR	95% CI	aOR	95% CI	Proportion n/N	%	aOR	95% CI	aOR	95% CI

univariable vs multivariable: with multivariable, we account for confounding factors

aOR= adjusted odd ratio; not only descriptive, it controls for other predictor variables in a model, giving an idea of the dynamics between the predictors.

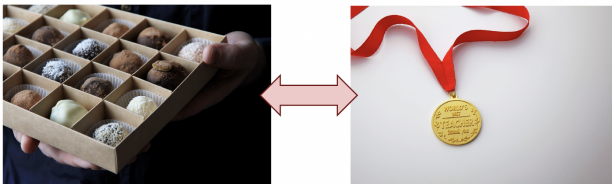


Figure 4. An association with chocolate might have helped students preferring kinesthetics or visual aids to learn about multivariables.

Conclusion and future plans

In this project, I aimed to investigate students’ diversity in the course of Fødevarer-mikrobiologi, because it might explain why few students felt unprepared for the exam the previous year.

I observed that students thought themselves as diverse in terms of studies, but also about personality, gender, ethnicity and age. The team work seemed to be important for their social integration within the small community of the course. Some recognized that a different background could sometimes create difficult dynamics in team works, but other groups highlighted that the gap created by diversity was easily solved if the peers were open to discussion. They confirmed the importance of team work to learn from each other, but the students do not necessarily appreciate the importance of working in groups heterogeneous in terms of studies, or personality/ gender/ ethnicity/ age. This is unfortunate, since collaborating with

experts from different disciplines and background is a valuable qualification for their career and life. On the other side, some students pointed out that they liked to learn new ways of thinking and working, so it might be proficient to form heterogeneous groups after a personality test result. Another possibility could be to modify the working groups after each module. After some weeks of work together, students could choose to form new groups, to merge two groups to establish new working dynamics, or to split groups to give more responsibility to each peer.

Regarding the informal aspect of students' academic integration, students regarded the course as relevant for their future and career. The motivations for their interest was nevertheless quite different. The use of diverse teaching activities and material could help meet this and other diversities, since it naturally offers a broad range of tools that students can use. The analysis of our activities with the VARK model highlights the strength of integrating the classes with the exercise in the laboratory and the case solving, thus offering information to the students in different forms to make it their own, depending on their VARK preferences. In addition, the team work in the exercise in the laboratory and in the case solving gave space and freedom to each students to adopt his/her preferred way of learning. A further improvement in this sense would require a preliminary evaluation of students preferences with the VARK models or a study process questionnaire (SPQ; Snelgrove, 2004) to tailor the course towards specific students' needs. Nevertheless, this might be unnecessary if we are able to offer diverse activities and flexibility for the students to adopt and learn in the way they naturally (and maybe unconsciously) prefer.

Finally, it worth highlighting that an additional effort from the teacher is needed with the online setup that limits the range of tools one can use to deliver information to the students. In this case, it is even more important to diversify our materials, suggesting podcast or videos or activities that the students can do by themselves. Providing the recording of the lectures can be also an important tool that they students can use to learn in the way that suits them best.

Further inputs are expected from the students evaluation of the course.

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A Summary of survey answers

Why did you choose this university curriculum?

- I am interested in how food contribute to global environmental issues, food waste
- I have a big interest in chemistry in food, I find it very relatable and I also enjoy cooking a lot, so knowing the chemistry behind is
- really cool
- found it interesting
- To become more qualified in the brewing industry
- i like food, and find production of food interesting
- Interest and its mandatory
- You will get a good pay when you get a job
- i like the STEM-field as a whole and this specific curriculum provided excellent job opportunities.
- dont know
- Because I want to become an enologist
- it sounded interesting and relevant, as I want to specialise in microbiology
- I want to work with food technology/safety
- Limited selection of courses, this courses was the most interesting choice
- Because it's compulsory for my study.
- Of interest
- Because it sounded interesting
- i moved to copenhagen and science had my interest

Let's talk about the team you are working with. Is your team

- not diverse (homogeneous): 44%
- very diverse (heterogeneous): 56%

In what it is not diverse/diverse?

- different backgrounds
- Around the same age and all from Denmark, mostly girls
- in gender, we are 5 girls around same age and so on
- personalities
- were all white and straight, vanilla
- We are all studying the same - only diversity is gender
- we are different types of persons
- We're all "pure-breed" danes, so not a lot of diversity going around.
- 100% homoethic - male, around same age with common interests.
- What we want to study in master, where we are from, age etc.
- we're all biologists
- different studies, live different places in Dk
- We have different Education backgrounds
- My group is a mix of different studies; fødevare og ernæring and biology.
- Lots of meanings and different perspectives
- I'm not sure that I understand this question?
- we are very different in working style and personalities

Did others in your group study the same as you?

- Yes: 70%

- No: 12%
- Not all: 18%*

Working with others in your team was

- very easy: 35%
- easy: 53%
- sometimes difficult: 12%
- difficult: 0%

Why was it easy/hard with others in the team?

- maybe disagreements
- We all have same ambition and are friends outside the uni
- People fit different roles naturally
- I've done it many times, and i knew the people on my team beforehand
- We have worked together before and know each other
- they are all nice people
- We've known each other for a while and get along really well, during schoolwork and personally
- same ambitions makes the work easier.
- Because not everybody puts in the same work, or participate all the time.
- I've studied with them before :)
- We discuss easily and without interrupting each other, worked with each other for a few weeks
- Their backgrounds is Biology, so it comes easier for them, which Can make me feel dumb sometimes or left behind
- The ones from biology are at a higher biology level than me, and therefore understand somethings easier/quicker, maybe because they already know it.
- We know each other and our values
- Because we all get along pretty well eventho we come from different educations
- people are open

Did you have troubles understanding each other?

- Yes: 0%
- No: 88%
- Sometimes: 12% *
- *Sometimes, but people are good at listening
- Sometimes the biology students don't mention something because they presume that we know it because it is clear for them.

Did you learn something from others in your team that you did not know?

No; I do not know: 25%

Yes; Other: 75%*

* i work best with others, talking about the topics makes my brain work best. so not directly
* often, new aspects and ways of thinking.

* i am learning to slow down, and maybe read stuff more carefully, decreasing my error rate

* Probably

* Sure, but I guess it wasn't because of them, but from the course - just at different paces.

*Hmm I don't know