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A comparison of various elements within the student active learning format

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Background

Student active learning (Danish: studenter aktiverende undervisning; SAU) is a teaching format where the students are in focus, where they will drive and form the lecture to a much larger extent then during "classical" lectures. Instead of a more passive acceptance of information the students will discuss among their peers, work in groups for shorter periods of time, and interact with the teacher in a dialogue to reach the subject information of the lecture; SAUs are student-cantered, rather than teacher-cantered and a large part is based on cooperation between peers (Michael, 2006; Springer et al., 1999; Wood, 2009).

The SAU format, or cooperative learning among students, has repeatedly shown to have a multitude of benefits as seen in an increase in test scores (Freeman et al., 2014; Johnson et al., 1998; Prince, 2004; Springer et al., 1999). Furthermore, these benefits seem to be robust to variations in instructor experience, student background, class size, and university ranking (Buck & Wage, 2005). Prince et al., summarizes it nicely when saying that "cooperation is more effective than competition for promoting a range of positive learning outcomes" (Prince, 2004).

Aim of study

In this study I set out to quantify what stimulates a student's interest/curiosity the most, and which part helps students to learn/memorize the most: in

teacher led lectures, in SAU lectures in general, and in my own SAU lectures.

With the strong evidence showing that the SAU format is a great way for students to learn, I was very excited to try it out in my own teaching and see how the students would receive it. I also wanted to test two exercises during the SAU lectures I had. The two exercises I wanted to compare were one led more by me (still heavily interacting with the students) that I refer to as "teacher-led", and secondly, one where the students were leading the teaching to a higher degree (peer-to-peer interactions), i.e., "student-led". The outcome that these would have on students' "curiosity" and "ability to memorize information" would be measured through a questionnaire.

Methodology

During the fall of 2021, I was responsible for a SAU group of 22 medical students for five SAU lectures, roughly 2 hours each, at the course of cellular- and tissue biology 'Medical cell and tissue biology' (for more information, see Appendix A), which is a bachelor course for second year medical students at the University of Copenhagen.

I wanted to hear from the students which learning format they preferred: "classical lectures" (plenum lectures) or SAU lectures, when it came to spark their interest/curiosity, and when it came for them to learn/memorize information. Furthermore, during my SAU lectures I wanted to see the effect of two different types of exercises within the SAU sessions, and their effect on the mentioned outcomes (interest/curiosity and learning/memorizing). The two exercises I want to compare were 1) led by me (interacting with the students), i.e., "teacher-led", or 2) where the students were leading the teaching (peer-to-peer interactions), i.e., "student-led". In the student-led exercises I, the teacher, only facilitate the forum/discussion and tried not to lead it as such.

For example, the *teacher-led exercises* consisted of me presenting the cell cycle on the white bord or teaching a topic using power-point slides. For these parts I interacted with the students more than I would in a "classic lecture", but I still made it more teacher-led compared to the second type of exercise (see below). The SAU format with interspersing group discussions was kept during this part.

For the *student-led exercises* I had the students, for example, draw cartoons of the various phases of the cell during mitosis, and then have them

going up to the whiteboard and present their drawings to the class, and their peers help them out if anything was missing or not clearly presented. I only facilitated the discussions, akin to a moderator or chair of a round table discussion at a conference.

The outcomes were measured through a questionnaire at the last lecture using the online platform SurveyXact (https://www.survey-xact.dk/). For the full questionnaire, please see appendix B. I wanted to focus the questions on which parts of learning motivated the students the most, i.e., made the students most "interested in the topic/curious and wanting to learn more" or "taught you the most/helped you to memorize facts".

Results

I had 10 students complete the questionnaire. I will focus on 3 questions and their answers, for full results, please see Appendix C. The first question relates to if the students would rate their experience higher from a "classic lecture" (plenum lecture) or a SAU lecture, related to sparked curiosity and/or ability to memorize information (**figure 1**). Strikingly, all students found the SAU lectures more helpful for both sparking interest and helping them to memorize facts then they found the "classical lectures". The students had several occasions with paired "classical lectures" and SAU sessions during the run of this course in cellular- and tissue biology.

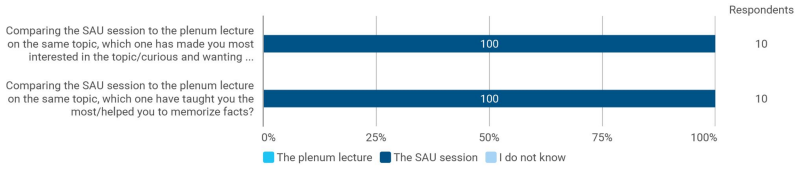

Figure 1. The SAU format is unanimously preferred among students, when compared to "classical lectures". In the top row of the figure, are the answers related to what made the student "most interested in the topic/curious and wanting to learn more", the plenum lectures or the SAU sessions. And in the bottom row is what the students answered what have "taught them the most/helped them learn facts", the plenum lectures or the SAU sessions. In both cases 100% of the students (n = 10) answered "the SAU sessions". Students could also choose "I don't know" (0%). "Classical lecture" = the plenum lecture.

Secondly, I asked the students if they would prefer a course format that employed both "classical lectures" and SAU lectures, "classical lectures" alone, or SAU lectures alone. Here the answers from the students were more evenly split at 60% and 40% between "plenum lectures and SAU sessions together" and "SAU sessions alone", respectively (**figure 2**). Interestingly, no students preferred a course with only "classical lectures".

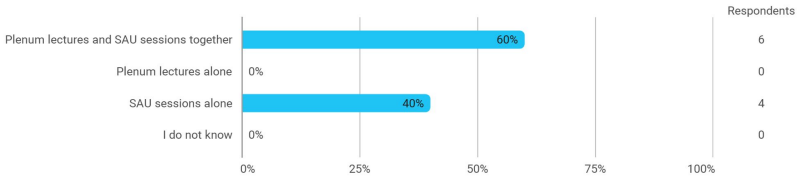

Figure 2. Students prefer SAU lectures in conjunction with plenum lectures, or alone, during the run of a course. If you had to choose, would you like the teaching with both plenum lectures and connected SAU sessions, or plenum lectures alone, or SAU sessions alone? Six out of ten students (60%) wanted a combination of plenum lectures and SAU sessions together, while the remaining four (40%) wanted SAU sessions alone. Students could also choose "Plenum lectures alone" (0%) or "I don't know" (0%).

Last question I would like to focus on, related to the structure of my own SAU lectures. For this question I asked if they preferred the "teacher-led", or the "student-led" elements of the SAU lectures I had taught. When it came to sparking their interest in a topic, 50% said teacher-led, 40% answered student-led (peer-to-peer interactive exercises) and 10% did not know. Seventy percentage of the students preferred the more peer-to-peer interactive exercises, over teacher-led exercises (30%), when it came to memorizing facts (**figure 3**).

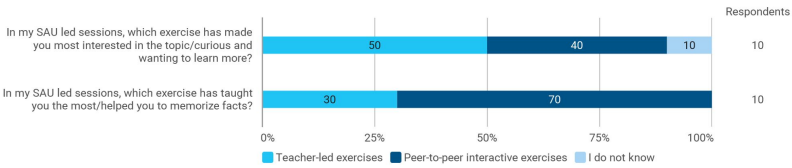

Figure 3. Students liked both the more teacher-led, as well as the more student-led exercises of my SAU sessions. When it came to which exercise form that sparked interest in the topic/made the students curious, 50% opted for the teacher-led ones, 40% answered the student-led ones (peer-to-peer) and 10% didn't know (upper panel). The students were leaning more to student-led exercises when it came to memorizing facts, 70% versus 30% for the teacher-led elements, and 0% did not know (bottom panel).

Discussion

As an experienced teacher stepping into my first SAU lectures, I hope that this short project will give some insight into my process for others in a similar situation, and hopefully it will be helpful. This was my first experience with the SAU lecture format and overall, it was a very positive experience with a lot of back-and-forth between me and the students as well as between the students. The feeling I had after the SAU lectures were that they had a very open and nice atmosphere to discuss the various topics and to facilitate learning. What my limited questionnaire had set out to measure was if the students would, in some form or shape, agree with this. A drawback of this study is of course the limited sample number of only ten participants for the questionnaire, and all from the same SAU group.

The students that answered my questionnaire seemed to agree, with an overall positive attitude to the SAU lectures, both mine and in general. It was even surprising that all students preferred the SAU lectures compared to "classical lectures"! It should be mentioned that these students are a good group to question about on their preference of SAU lectures compared to "classical lectures", since they have interwoven "classical lectures" and SAU lectures on the same topics all throughout this entire course. I.e., it means that they have a lot of both SAU sessions and "classical lectures" to compare to each other. Furthermore, even though some students wanted SAU sessions together with "classical lectures" through a course, some students would like only SAU sessions, and no student wanted only "classical lectures". These results speak strongly for SAU sessions when it comes to motivating students as well as to helping them learn and retain information.

Personally, I was very curious to understand more about how the students had responded to my own SAU teaching, and if they preferred the parts of the SAU sessions where I was more in charge, or those where the students took a bigger part of driving the lecture. Overall, there seemed to be a split in the students between the teacher-led and the student-led exercises of my SAU lectures. One thing that I did not query was if the students would prefer a mix of teacher-led and student-led exercises. However, I assume that is the case based on my first-hand experience with this SAU class, and it was also pointed out by one student in the free text of the questionnaire: "*I liked the combination of teacher-led and peer-to-peer exercises*".

In summary, I am really impressed with the overall positive feedback, and nice atmosphere for learning (and teaching) that SAU-based lectures provide. Indeed, cooperation does seem to be more effective than competition for promoting a range of positive learning outcomes.

Oh, and then there was this thing about 'name tags'

During discussion with my supervisors, the suggestion of giving the students name tags was proposed. At first, I was hesitant, but I also acknowledged the lack of personal touch when addressing my students. And since I was going to see them on several occasions, the investment in learning their names could very well "pay off". Providing the students small pieces of paper and pens to write their names on and place in front of them turned out to be a nice icebreaker on its own, and furthermore, I cannot overstate the benefit of addressing people by their own names! It truly transformed

the classroom and made the atmosphere a lot more familiar, which I believe helped the students to feel more comfortable to ask and answer questions. All these benefits were felt during my lectures, as well as evident by some of the free-text answers in the questionnaire:

> *"I think the learning enviorment* [sic] *is nice and it's stimulating the students to try and maybe make mistakes, which is good in my opinion."*
> *"Overall really good lectures! Empathic and enthusiastic teacher. Uplifting atmosphere."*
> *"I think it was great that we had name cards and I really appreciate that you took the time to learn our names, as none of our other SAU teachers did that."*

References

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A Course description

Kursus i medicinsk celle- og vævsbiologi, medicin (Course in Medical Cell and Tissue Biology, Medicine)

Udbydende institut: Institut for Cellulær og Molekylær Medicin

Udbydende fakultet: Det Sundhedsvidenskabelige Fakultet

Kursusansvarlige: Katerina Tritsaris

Bacheloruddannelsen i medicin – obligatorisk

Målbeskrivelser: Kurset baserer sig på grundlæggende elementer af biokemi, biofysik, celle og molekylærbiologi samt generel histologi med det formål at give en grundlæggende forståelse af cellers struktur og funktion samt organisering af celler i væv.

Efter endt kursus forventes den studerende at kunne:

Viden

- Beskrive og forstå proteiners struktur og funktion
- Beskrive og forstå struktur og funktion af intracellulære organeller, herunder membrantrafik
- Beskrive og forstå struktur og funktion af cellemembraner
- Beskrive og forstå ligevægtspotentialer og membranpotentialer
- Beskrive og forstå salt og vandtransport over biologiske membraner
- Beskrive og forstå organiseringen af cytoskelettet
- Beskrive og forstå genetisk information
- Beskrive og forstå DNA-replikation, transskription og translation, samt disse processers regulering
- Beskrive og forstå genteknologiske metoder
- Beskrive og forstå cellekommunikation og intracellulær signalering
- Beskrive og forstå cellecyklus, cellevækst og celledød
- Beskrive og forstå cancerbiologi og -udvikling, herunder cancercellens generelle karakteristika
- Beskrive og forstå specialiserede cellers struktur og funktion
- Beskrive og forstå organisering af celler og extracellulær matriks i væv.

Færdigheder

- Anvende grundlæggende vævslære til at diagnosticere de fire store vævsklasser ved virtuel mikroskopi
- Anvende grundlæggende principper i bioteknologiske metoder til at tolke videnskabelige forsøg.

Kompetencer

- Anvende opnået viden til at inddrage principper og forskningsresultater, analyseret med basale statistiske metoder, i medicinske sammenhænge og problemstillinger til selvstændig hypotese

B The full questionnaire

Hi, and thank you for your help!!!

I would like to know what stimulates a student's interest/curiosity the most, and which part helps students to learn/memorize the most; both in plenum lectures, SAU sessions in general, and in my own SAU sessions in particular.

Furthermore, I want to see the effect of two different types of exercises within the SAU sessions and their effect on the mentioned outcomes (interest/curiosity and learning/memorizing). The two exercises I want to compare are either 1) the ones led by me (interacting with the students), i.e., "*teacher-led*", or secondly 2) where the students are leading the teaching (peer-to-peer interactions), i.e., "*student-led*". In the student-led exercises I, the teacher, might only facilitate the forum/discussion and try not to lead it as much.

Below are 5 questions for you :)

PART I: LECTURES v. SAU SESSIONS

Comparing the SAU session to the plenum lecture on the same topic, which one has made you most interested in the topic/curious and wanting to learn more?

○ The plenum lecture ○ The SAU session ○ I do not know

Comparing the SAU session to the plenum lecture on the same topic, which one have taught you the most/helped you to memorize facts?

○ The plenum lecture ○ The SAU session ○ I do not know

If you had to choose, would you like the teaching with both plenum lectures and connected SAU sessions, or plenum lectures alone, or SAU sessions alone?

○ Plenum lectures and SAU sessions together ○ Plenum lectures alone ○ SAU sessions alone
○ I do not know

PART II: WITHIN THE SAU SESSIONS

For the next two questions (4 and 5), I want you to compare exercises we have done within my SAU sessions (Filip Mundt, block E). The ones that have been teacher-led (by me) or student-led (peer-to-peer interactions); regarding which ones have made you most interested/curious or taught/helped you memorize the most.

For guidance, here are examples of teacher-led exercises during our SAU sessions in Block E:

- Me writing a pathway on the whiteboard, asking (you) the students questions along the way
- Me showing a power-point slide and telling a story as well as asking questions

And here are examples of peer-to-peer interactive exercises during these SAU sessions:

- Group work where the students have to present a drawing and talk us all through it (e.g. stages of mitosis)
- Group work where the students have to guide me to fill in a signaling chart from, for example, Absalon

In my SAU led sessions, which exercise has made you most interested in the topic/curious and wanting to learn more?

Teacher-led exercises Peer-to-peer interactive exercises I do not know

In my SAU led sessions, which exercise has taught you the most/helped you to memorize facts?

Teacher-led exercises Peer-to-peer interactive exercises I do not know

What do you think that I can improve in my SAU sessions?

Is there anything in particular you liked about my SAU sessions?

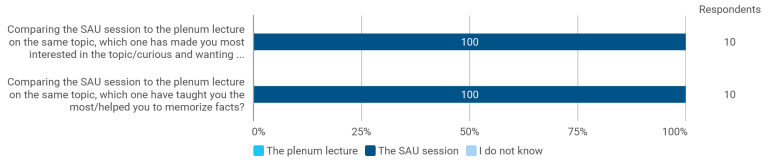
Additional comments

Previous

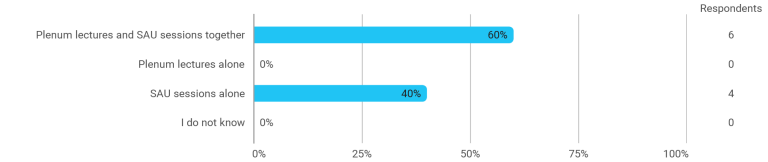
100%

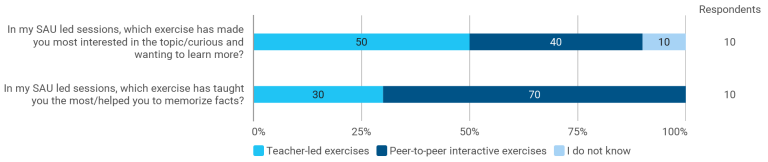
Finish

C Full results from the questionnaire



If you had to choose, would you like the teaching with both plenum lectures and connected SAU sessions, or plenum lectures alone, or SAU sessions alone?





What do you think that I can improve in my SAU sessions?

- I know it is your first time teaching SAU - and you are good at it!

  But I prefer to do all the questions instead of rep of the stuff we can read in the book
- I think it would benefit the students when there is a clear plan of what we are doing in each SAU. Just about the topics and what focus we have.
- Just small things:
  I feel comfortable with the teacher taking the lead on the structure of the lecture, example: Dont ask do you want a 10 or 15 min break? Just take the lead regarding structure as long as you are (as you already are) open for suggestions.
  Maybe take some time to look at the exams questions. It gives "ro i sjælen" when the teacher really knows what is coming.
  Maybe pause a bit when asking questions, so the slow thinkers can follow:)
- Don't question yourself so much, you are a brilliant teacher :-)

Is there anything in particular you liked about my SAU sessions?

- I liked how much peer-interaction there was, both in our peer-to-peer interactive exercises but also when you were leading the session, you asked a lot of questions and included us as much as possible, which greatly increased my understanding of the topics.
- When we were taught about replication
- Very good lessons! Energetic and engaging
- I think the learning enviorment is nice and it's stimulating the students to try and maybe make mistakes, which is good in my opinion.
- The drawings, that we made. It made it easier to memorize.
- Overall really good lectures! Empathic and enthusiastic teacher. Uplifting atmosphere.
- I liked the combination of teacher-led and peer-to-peer exercises

- I liked that your SAU sessions were very interactive and that you made us draw a lot.

Additional comments

- I think it was great that we had name cards and I really appreciate that you took the time to learn our names, as none of our other SAU teachers did that.
- Very good SAU.
- It was super nice having you as a SAU teacher

E-mail

Overall Status