	Title of your pedagogical development project
	Meeting Students Where They Are: Technology-Enhanced 'Teacher Feedback' to Address Student Learning
#	**Abstract (max. 200 words):** Write a summary of your pedagogical development project here.
	This pedagogical intervention explores the use of real-time student feedback to enhance learning in a quantitative methods course. Grounded in Self-Determination Theory and Vygotsky's Zone of Proximal Development (ZPD), the intervention aims to meets students at their current level of understanding to foster autonomy and competence. Using Mentimeter, students anonymously report challenging concepts, allowing the instructor to adapt teaching in real time and adjust future lessons. Results indicated that the intervention fostered psychological safety, increased participation, and helped normalize struggles with the material. Students appreciated the responsive teaching approach, though the intervention was more beneficial to less confident learners and less engaging for already advanced students. While it successfully supported relatedness, the intervention could be more focused on specific content to ensure consistent benefits across a heterogeneous student group.
¤	**Keywords (max. 5 keywords):** Write keywords that encapsulate your pedagogical development project.
	Adaptive teaching, Zone of Proximal Development (ZPD), Student feedback, technology enhanced participation
1	**Teaching or supervision context** Briefly describe your teaching/supervision context and practice that you want to focus on • Type(s) of teaching format(s) • Typical student characteristics and how many students • Level of education and ECTS • Your role and responsibility as a teacher/supervisor (do you teach alone or with others?) • The scope of your effort (are you aiming at a single lesson, a sequence of supervision meetings, an entire course, etc.)

	The context for the intervention project is a 10 ECTS course on quantitative methods taught to masters students in Education Science and Educational Sociology. The course is taught at two campi (Aarhus and Emdrup), there are approximately 150 students at each location. The course is made up of 8 three hour lectures where all students attend, and 4 three hour sessions of practical exercises, where students are divided into three classes. There is large heterogeneity between students, as some come from a background with a university bachelor (mainly Education Science) and others have a professional bachelor's degree (typically as either teacher or pre-school teachers). I am the course administrator and do the bulk of teaching, except for some practical exercises focused on learning how to use the statistical software used in the course. The intervention will be implemented into each session that I teach on the course (8 out of 12 sessions), with more time being devoted to the intervention in small class teaching.
2	**Aim of project** What is your pedagogical challenge(s)? Why have you decided to focus on this topic? It would be best if you were as concrete as possible e since this will make evaluating the results more accessible.
	The key pedagogical challenge relates to teaching quantitative methods to students from humanities or social sciences, particularly in fostering a sense of autonomy in their learning. Many students in the course have actively avoided mathematics-related subjects in the past, often due to a lack of confidence or even math anxiety. As a result, they may feel that they have little control over their ability to succeed in the course, leading to a passive, compliance-based approach to learning rather than an active engagement with the material. Furthermore, some students perceive quantitative methods as less relevant to their field, which reduces their motivation to engage. Addressing this challenge requires shifting the learning experience from one of external obligation to one of personal agency, allowing students to shape their learning by voicing their struggles and influencing how we work with the course material.
3	**Theoretical framework** Describe the underlying theory or model that aligns with the specific aspects of teaching and learning you are investigating.

	The intervention relies on two complementary theoretical perspectives: Self-Determination Theory (Deci & Ryan, 1985) and Vygotsky's concept of the Zone of Proximal Development (ZPD) (Vygotsky, 1978). While Self-Determination Theory emphasizes that individuals are most motivated when their psychological needs for autonomy, competence, and relatedness are met. This intervention focuses on all three aspects: first, the intervention aims to increase autonomy by giving students a sense that students have control over their learning and fostering competence by addressing difficulties. Second, relatedness can be understood as a prerequisite for the intervention to work, meaning the students need to feel safe enough to share their difficulties. ZPD describes the difference between what a learner can achieve independently and what they can accomplish with guidance from a more knowledgeable other (Vygotsky, 1978). ZPD provides a framework for understanding the importance of identifying where students are in their learning process and how instructional scaffolding can support students as they develop new skills and knowledge in quantitative methods. Quantitative methods is a relatively rigid course, compared to what this group of students are used to, which can easily lead to passive learning, where students memorize procedures without truly understanding their application - a form of disengagement or alienation from the course as understood through the lens of Mann (2001). Such disengagement may be especially common in subjects like quantitative methods, which can feel abstract, intimidating and something that is not valuable to students from humanities or social science programs but imposed on them. By incorporating student input, students gain greater autonomy to direct their learning, making the class more responsive to their needs. Because learning quantitative methods is cumulative, foundational concepts must be understood before more advanced ideas can be meaningfully grasped (Garfield et al., 2008), students' independent problem-solving ability is at first often below what is required to fully engage with the concepts. By providing structured support—through anonymous feedback mechanisms and adaptive teaching—this intervention aims to bridge the gap between students' current understanding and their potential learning outcomes. The use of live feedback via Mentimeter serves as a form of dynamic scaffolding. By allowing students to anonymously report which concepts they find challenging, the intervention creates an adaptive teaching environment where instruction is tailored to students' immediate needs. This aligns with the principles of ZPD, as the instructor can provide timely and targeted explanations that help students progress beyond what they could achieve independently. Moreover, the iterative nature of this process, where feedback informs subsequent lessons, ensures that scaffolding is gradually adjusted as students develop greater competence. Because results from the Mentimeter questions are visible to the students during the session, students are exposed to their peers' difficulties, which can help normalize struggles with quantitative methods and create a more supportive learning environment - enhancing their feeling of relatedness. The collective identification of challenging topics enables the teacher to focus on areas where guidance is most needed, ensuring that students receive support at the right level of difficulty.

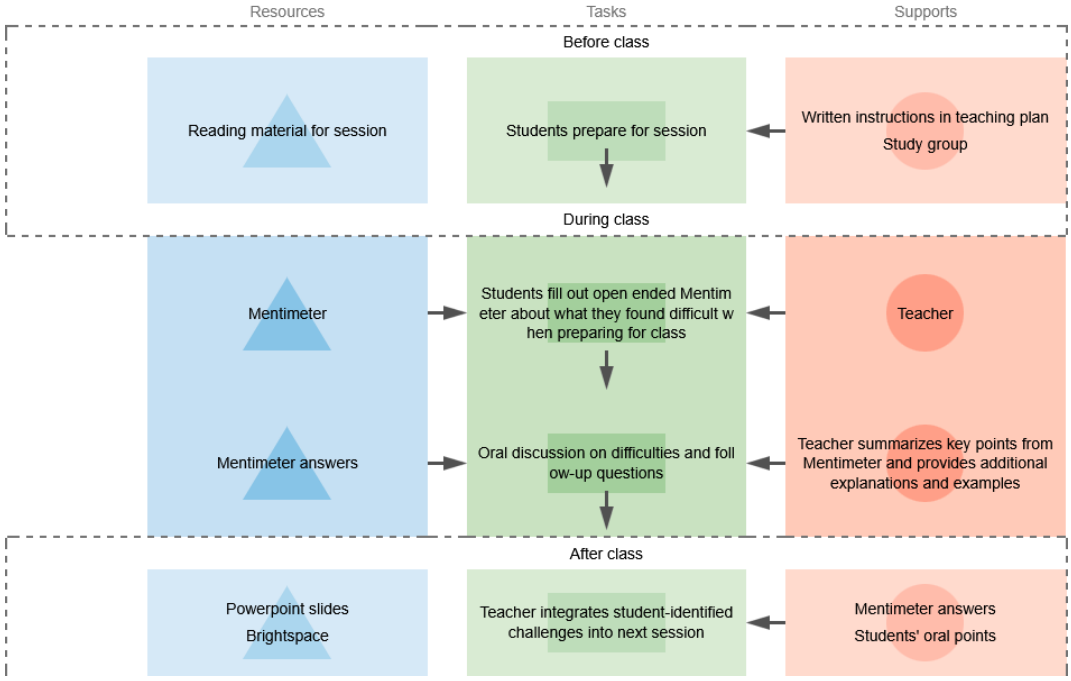
4	**Data collection** What kind of data and indicators have you collected to inform your learning design and to assess the impact of your design? Include input from your students, colleagues, supervisor, and professional opinion. For example, you may have conducted student interviews and surveys, looked into Brightspace statistics, made classroom observations, etc. NB: Describe what kind of data you intend to collect if you have not had the opportunity to test your design/intervention.
	Several types of data were collected to assess the impact of the intervention: *Interviews and observations* Interviews with a student taking the course and a co-teacher on the course were conducted to evaluate and inform the development of the intervention. Furthermore, I made observations of a teaching session on another course with the same students, to inform my own practice. Finally, the development project was discussed with my assistant professor supervisor. *Classroom Observations* During the implementation of the intervention, classroom observations were conducted to assess students' engagement with the feedback process and their willingness to articulate difficulties. Particular attention was paid to how students interacted with the Mentimeter tool, the nature of their responses, and their participation in subsequent discussions. *Formal Evaluations* As the course administrator, I was responsible for both the midway evaluation and the final evaluation of the course. The intervention was explicitly addressed in the oral evaluation sessions, where students were encouraged to reflect on its effectiveness. Additionally, three specific survey questions were incorporated into the quantitative portion of the evaluation to assess students' sense of whether they could influence the teaching content and whether the instructor successfully addressed their learning difficulties: (1) *The instructors had a sense of what I needed to have repeated,* (2) *The instructors adjusted the teaching to my academic level* (3) *I had the opportunity to have things I didn't understand explained in more detail during class.*

5	**Your learning design.** The content of this section is two-fold: **1.** Firstly, you should write an in-depth description of how you implemented your plans. The description should be so detailed that a fellow teacher could reproduce your teaching by reading your plan. Furthermore, explaining why you chose to do as you did is pivotal. For example, if you plan to implement peer feedback with rubrics, you need to argue why peer feedback is appropriate in your situation and the reasons for using rubrics the way you did. **2.** Provide a visual representation of your learning design and a detailed description of your student's learning process (both in and out of). Use the LDTool template to represent your learning design and the three components: task, resource, and support.
	The key idea of the intervention is to allow students to provide feedback on what they found difficult, thereby identifying their Zone of Proximal Development (ZPD) and ensuring that instruction is scaffolded appropriately. The intervention consists of the following steps (see figure 1): **Step 1: Feedback Collection** Using Mentimeter, students answer a short, anonymous question: - w*hich concept was the most difficult when preparing for today's session?* The anonymous format ensures psychological safety, encouraging honest responses without fear of judgment. Student answers become visible on the projector as they come in. Students can also vote on the answers they agree with, providing a sense of the most common challenges. This process helps determine the most common challenges, allowing the teacher to pinpoint where students are and what they need to work on. **Step 2: Adaptive Teaching Based on Feedback** I review the responses live and make on-the-spot adjustments to the session. For example: - Providing additional examples for a concept that many students found difficult. - Revisiting a prior explanation using a different teaching method (e.g., explaining a concept rather than relying on formulas). Talking about shared challenges also fosters oral discussions where students can further elaborate on difficulties and ask follow-up questions. This responsiveness should enhance autonomy by validating student concerns and adapting instruction to their needs, rather than rigidly sticking to a pre-planned lecture. Helping to respond to students' immediate challenges, ensures that instruction remains within their ZPD—neither too difficult to cause frustration nor too easy to disengage them.

Step 3: Integrating Student-Identified Challenges into Future Lectures

After the session, I review the collected feedback to identify gaps in understanding. These are then integrated when planning the next session. The next session begins with a brief revisit of the most commonly challenging topics, using alternative explanations. This additional step ensures that each time the intervention is made it has an impact beyond a single session, ideally making the overall course closer aligned with student ZPD. By structuring the intervention around students' ZPD, the project enhances autonomy by giving students greater choice and control over their learning experience. Rather than passively receiving instruction, students actively shape the direction of part of the lesson by identifying which concepts need further clarification (Bovill et al., 2011).

Figure 1. Depiction of intervention



6 Results

Evaluate your design and consider if the intervention achieved the pedagogical aim. Present your analyses and perspectives on the collected indicators and data. Highlight any unexpected findings or challenges you faced during the process.

From the very first session, the Mentimeter intervention seemed to lower the barrier for student participation. The anonymous format allowed students to share their struggles without fear of judgment and often sparked follow-up oral discussions that provided deeper insight into their difficulties. These discussions were generally more specific than the initial responses and allowed me to tailor explanations in real time. This shift in classroom dynamics suggested that the intervention not only encouraged more active participation but also fostered psychological safety. Observing the same students in another course during a session with student presentations, gave me additional insights into how to ensure a safe environment

as an instructor by using humor and keeping the atmosphere light, which also informed how I approached the intervention during class. Over time, students became increasingly comfortable expressing confusion and asking clarifying questions—even outside the Mentimeter prompts. This growing engagement indicated that the intervention supported relatedness and reduced anxiety. Compared to earlier iterations of the course, where students were more hesitant, this was a clear improvement in classroom culture.

Assessing actual learning gains remained a challenge, as student composition had changed, now including both Educational Sociology and Education Science students. Nevertheless, the intervention allowed me to better identify students' Zones of Proximal Development (ZPD) and offer more targeted support—especially in smaller sessions. While this should enhance learning, exam results were not yet available to confirm this.

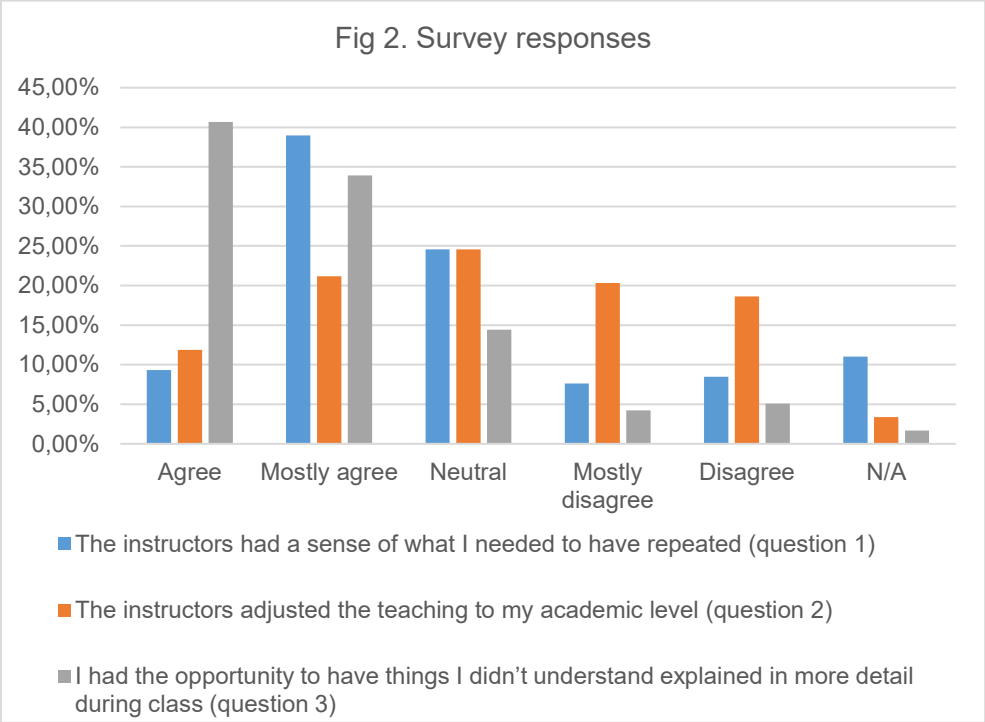
The midway and final evaluations, both took the form of an open oral discussion and showed that students appreciated being able to influence lecture focus and felt the course was more responsive to their needs. They noted that seeing peers' difficulties normalized their own, making it easier to ask questions. Students also noted that the intervention improved the classroom climate compared to other courses. However, many still found the subject difficult and felt it remained hard to master, suggesting the intervention didn't fully raise all students' perceived competence. A student interview confirmed this, with a motivated student reporting disengagement due to the course's difficulty.
Both oral evaluations was also based on open anonymous responses in Mentimeter. The general points from the written comments were:

- the open atmosphere made it easy to ask questions during sessions which was particularly valued, as this made the material more accessible and engaging
- The anonymous feedback mechanism was praised for creating a safe space for students to voice their difficulties.
- Seeing peers' struggles normalized their own challenges, making it easier to ask for help and engage with the material.
- The course was felt to be responsive to students' needs.

Students were generally reluctant to criticize the intervention, but it became apparent that those from Education Science, who typically found the course easier, engaged less—likely because they required less support. The diverse group meant that a single intervention couldn't meet all needs. A co-teacher echoed this, observing that while the intervention helped struggling students, it also consumed time that could have been used to challenge stronger students.

Survey responses (see Figure 2) reflected this complexity: most students felt instructors had a good sense of what to repeat, but fewer agreed that teaching was adjusted to their level. Most agreed they could get further clarification during class. These results suggest that Step 3—integrating feedback into future lessons—was less effective, but that the intervention succeeded in creating a safe space for asking questions. Students generally found the course challenging, which is reflected in question 2. The intervention may have slightly accommodated this,

however, students from this particular field of study typically feel challenged in quantitative methods.



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Reflections

Please reflect on what you have learned from your pedagogical development project and discuss the interplay between effort and impact. Summarize three key takeaways to guide your future teaching and benefit your colleagues. Additionally, reflect on your experiences and consider a different perspective on your students, teaching methodology, or your role as an educator.

Furthermore, explain how you will maintain the sustainability of your project and the equilibrium between the resources invested and the outcomes achieved.

From this project, I have learned:

1. Creating a space where students feel safe enough to voice confusion is foundational for fostering meaningful learning in courses where students often experience anxiety and disengagement.
2. Real-time, student-driven feedback mechanisms are useful for identifying common learning difficulties, but they need to be

complemented by more structured formats to keep discussions focused and pedagogically useful.

Although the intervention supported relatedness and opened up feedback, not all student input was equally relevant. Broad Mentimeter prompts (e.g., "What did you find difficult?") often yielded vague responses. In future iterations, I will pose more specific questions, possibly adding multiple prompts during class to target distinct topics. One student suggested this approach, which would provide more specific feedback on what they found difficult regarding the specific topic, which can the be addressed immediately. While Mentimeter promoted inclusive engagement through anonymity (Price & Kirkwood, 2011) , oral discussions were still dominated by a few students. This highlighted the need to manage classroom dialogue to ensure broad participation and prevent digressions.

When I had to cancel a lecture, I provided key points via video. Students appreciated being able to pause and revisit explanations. This response suggests that integrating flipped classroom elements (Akçayır & Akçayır, 2018) could be a valuable next step. Flipping key lectures could free up valuable classroom time for deeper engagement with difficult topics and more interactive exercises. Implementing flipped classroom in to the course can be seen as a radical expansion of the intervention that frees up time to address student's needs and give them more autonomy on what happens during class, ideally increasing enagement (Bryson & Hand, 2007) and active engagement with the content, which is Important for deep learning (Biggs & Tang, 2007) - increasing the potential for differentiating and offer more advanced exercises to high-achieving students.

Overall, the intervention fostered a more responsive and student-centered environment. It underscored the importance of adaptive teaching and relatedness, especially for students with math anxiety or limited prior experience. Yet, the diversity in students' backgrounds meant that a one-size-fits-all approach couldn't serve all learners equally well. Some students found the intervention less relevant, especially those already comfortable with the material.

Outside the intervention, the course could allow for greater differentiation could be to expand the options within exercises, offering a choice between more open-ended and more structured assignments. This would allow students to engage with the material at an appropriate level of difficulty for them, supporting both autonomy and competence development. To address this, the course should offer greater differentiation, such as providing exercises of varying difficulty, allowing students to engage at a level appropriate to their skills. Supporting students who find the material difficult remains a priority, as they often shape the

	overall classroom dynamic. Better support for them could also reduce frustration and disengagement across the board Moving forward, I will refine the intervention by sharpening feedback prompts, experimenting with flipped teaching formats, and continuing to foster a climate where all students feel safe to learn.
8	**References**
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