MARCIN FOJCIK

APPLICATION TO "MERITTERT UNDERVISER"

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The mind is not a vessel to be filled but a fire to be kindled.
Plutarch

Knowledge is constantly linked with action or operations, that is, with transformation.
Piaget

A wise man learns from experience and an even wiser man from the experience of others.
Plato

INTRODUCTION

I am very excited about the opportunity to apply for the "merittert underviser" position. I have worked for over 30 years at several universities in technical fields and have seen the trends there. I noticed that specific technical skills were often the most important for teachers and students alike while teaching and pedagogical skills, necessary in a teacher's job, were treated as less important. Pedagogical skills can't be seen at first glance and can't be easily measured or proven. It's like traveling to another continent when you discover an electrical outlet has a different, mismatched shape or voltage. And now what? We can't use electricity - so all electrical appliances are useless. This can cause disbelief. Everything that seemed the only proper thing turns out to be only one of the possibilities. This is often the case with pedagogy - for engineers. The engineer often acts according to the philosophy of science - logical empiricism. This is a philosophy from the previous century, basing science solely on empirical facts. Today, this approach is no longer valid. Science is defined by its methods, i.e., activity according to the scientific method recognized for the field. The methods proven in the work of an engineer, by their very nature, do not correspond to the methods in the work of an educator. An engineer knows what is happening, the technical condition and status of equipment, and how to respond to emergencies. An engineer as a teacher performs, on the surface, the same activities when teaching, but sometimes without understanding. The appearance of change, difference, a different approach, or expectation causes difficulties. Suddenly, there is a problem of misalignment and inability to act. Without pedagogical knowledge, educational practice drifts from one change to another. Teaching is then vulnerable to the influence of "other": social, political, and even economic forces. (Hejnicka-Bezwinska, 1996) It seems all you must do is read the theories, and you will be fine. Unfortunately, it is not so easy.

In my development, I have come a long way from a purely "technical" lecture to anonymous listeners to a holistic approach to the student as a person expecting to gain knowledge. I developed by thinking about what I was doing and what others were doing, especially why. I tried to compare different teaching aspects, find connecting elements, and update my knowledge and skills. Over time, I sometimes realized that the essential qualities of a teacher are openness, commitment, and motivation. As a teacher, I tried to combine a general overview of the subject with an understanding of technical concepts and details: known theory and up-to-date, research-based practical knowledge. The theory is not separate from practice (Robins et al., 2003). They are two parts of a "whole". Focusing on only one element leads to problems of lack of understanding or inadequacy. Both must see the bigger picture

and prepare students for new concepts. However, observing students and talking to them over time, I realized this was insufficient. Practicality cannot be the goal of learning; its essence is to explain. (Flis & Kapralski, 1990). It is not just about teaching but about showing interest and motivation. It's about correctly "reaching out" to students and encouraging them to develop. There is no one or right way to do this. Teachers should constantly think about their actions and how they affect students. Sometimes the effect will be visible, and sometimes it will not. I want to take this opportunity to share my actions, thoughts, and reflections on my actions and their reception by students and colleagues. For me, the opportunity to participate in the competition contributes to raising the status of teaching in higher education and can help in professional development.
The full description is divided into several parts, from a brief description of my history and pedagogical philosophy to the response to the given evaluation criteria.

MY HISTORY

While I was still a student majoring in automation, computer science, and electronics at the Silesian University of Technology, I often took part in trips to the Polish mountains, alone or with friends. After some time, I became interested in holiday trips as a chaperone of youth groups. Talking with the participants and learning about their views and opinions inspired me, so when I was in my 5th year of studies and the possibility of hiring the best students as academics appeared, I did not hesitate. I became one of those accepted. Reconciling studies and 100% work was not easy. How should I teach colleagues from the same year? It seemed to me that to avoid unfair evaluations, technical knowledge should be the main criterion. I also imitated the behavior and actions of other teachers. In addition, I enrolled in a pedagogical course. After graduation, I continued to work at the university. I got offers of additional work at an industrial automation company with colleagues from the university. In this way, I gained access to both scientific theory at the university and practical verification in an industrial setting. At the time, it seemed to me that this was all that was needed for teaching - learning the theory, applying it to industrial practice, and, after verification, passing on the knowledge to students. In retrospect, I see that my teaching was focused on the practical application of knowledge. The teacher was to show and explain, and the students were to understand and learn. The "best" students had many opportunities, but the "weaker" ones were left without help and often dropped out of college. It was common for 20-60% of students to drop out of college after the first year. This was known and accepted in academia as part of the competition and prestige of the university. After passing another pedagogy course, I wondered if what I was doing as a teacher was right.

After 12 years of working in Poland, I moved to Norway. There I started working at HiSF, then HVL, and obtained the position of førstelektor and dosent. I passed more pedagogical courses and participated in teaching projects, creation of subjects, modifications, coordination of lines, and work in committees. (MF_CV) I saw then that the Norwegian education system looks very different from the Polish one. In Norway, it seems focused on the students "most in need of help." Students who excel are considered able to cope, so there is no need to focus on them. Teaching is done collaboratively, cooperating with students, teachers, and administration. None of the pedagogical or didactic theories I knew explained this phenomenon. It was not explained until many years later while writing an article on the role of soft skills required in the Bologna process, that I became acquainted with Hofstede's cultural models. (Hofstede, 2009). Based on his long-term research, the author proposes behavior models for people from different countries. Five indicators were proposed: power distance, an individual or communal approach, masculine and feminine behavior, uncertainty avoidance, and short- or long-term goals. It is precisely masculine behavior (desire to compete, show off) that differs significantly between Poland and Norway (values of 86 and 8, respectively). It can be seen that we use similar symbols around the world, but their meaning in each culture may be different. McDonald's in America symbolizes ordinary, popular food, while McDonald's in Russia is a luxury item. It is the same artifact, but it is perceived differently. Knowledge of these phenomena helps explain and understand people's behavior. Things don't always fit exactly, but you can often better understand the behavior, needs, and expectations of others - including students and colleagues - as well as your own.

Experiences from two different teaching systems led to my interest in teaching. From a student working in the 5th year as a teacher to a dosent for the time being, I have taught more than 30 subjects. (MF_CV) In the beginning, without understanding the whole thing, over time, through mutual adjustment, gaining experience, collaborations, conversations, rehearsals, activities, etc. I have gained a broader and broader picture and understanding of what we do and what we do it for. If we don't know this, we will not achieve the goal. What is the purpose of teaching? What is the definition of teaching? Who is the teacher? What is important in the teaching process? An additional challenge was to be an engineer, a programming specialist, and precisely to combine the principles of my teaching field with the principles of didactics and pedagogy. There are strict rules in teaching technology. People are the source of errors. Devices must ALWAYS work correctly - any deviation is a defect. A device can be good (when it works) or broken (when it doesn't). In pedagogy, there are WAY different principles that cannot be compared and contradict technical principles. The human being is always at the center; it is the most important; different principles can lead to the same goal, but human action is not measurable and can change frequently.

From experience, I know that learning both systems' principles is not a challenge. Learning the definitions and theories of both pedagogical and technical is relatively easy. However, this is not all. The problem is to apply both systems in practice. The pedagogue is oriented towards the human being as the most essential element; everything is for the person. For the engineer, the person is the error-causing element, so his role must be minimized. For this reason, combining the two approaches is difficult. I know a lot of IT professionals who think they know the pedagogical principles and yet have problems using them. I often have issues with this myself, too. This phenomenon is also described in the literature. An OECD report (Vahrenhold et al., 2017) depicts that there were two countries in the EU, Poland and Norway, where there were no requirements for pedagogical skills to teach computer science. Industry professionals taught students and other teachers. This can also be seen in Boice (1992):

> "*it is common for university academics to have little or no formal preparation for their role as teachers*"

and Lortie (1975):

> "*preparation for teaching can be said to have completed as an 'apprenticeship of observation' during years as a student. It is like 'try by fire' in the lectures theater.*"

In retrospect, I see that my actions in Poland resulted from a misunderstanding of pedagogical methods AND a cultural mismatch. Today, knowing this, I try to behave differently. I can try to fit in more efficiently by understanding the principles of working in two systems. However, certain habits and habits are strong. Thus, in a previous application to "*merittert underviser*", I described my activities mainly in quantitative terms. I focused on measurable achievements for students and descriptions of actions rather than thoughts and personal reflections. I wrote "what" instead of "why". I hope I switched to better "pedagogical" thinking this time. Yet the specifics of teaching technology require a completely different approach. I can say, with some envy, that it is much easier for teachers of social subjects; they can use their natural thinking and behavior. Engineers are much less likely to specialize in pedagogy and didactics. An engineer often doesn't understand why he should do something that doesn't have a measurable effect. It isn't easy to behave technically measurable in content and pedagogically unmeasurable in form. It is much easier to confine oneself to one chosen pedagogical structure and repeat it repeatedly. This can be seen in the number of dosents in the technical sciences". However, I would like to see respect for the principles of one's scientific discipline apply in both directions. To achieve "*merittert*" status, a computer scientist must assimilate the concepts and principles of pedagogy. I would like to see people with both practical and professional knowledge of computer science involved in preparing the principles of teaching computer science.

What is teaching, and who is a teacher for me? One can refer to history, and yes, the well-known university models (Sajdak-Burska, 2013) show different approaches to teaching, from the individualistic (Humboldt model) to the centralized model (French model). In our time, the Bologna process has tried to structure teaching in Europe in terms of teaching content by introducing uniform ECTS scoring and in terms of needs: students at the center, focus on soft skills (Ash, 2008). It often turns out that this is not enough. Student at the center - yes, but what exactly does that mean? Soft skills - yes, but how do you teach it? It seems to me that what is expected is a committed teacher, motivating work and setting a personal example, combining theory and practice, being able to approach each student, understand and help, having contacts with administration, leaders, workplaces, scientists, and even politicians. The ideal. Unfortunately, there are no such people. So, what can be done? How do we describe an experienced teacher? HVL has prepared a description of the requirements to help limit and specify specific actions. The criteria given are open and overlapping. I find it difficult to separate, for example, the process of student learning from the scientific approach to teaching, so the answers to the criteria are scattered throughout the text.

CRITERION 1: EMPHASIZES THE PROCESS OF STUDENT LEARNING IN PLANNING, IMPLEMENTING, AND EVALUATING TEACHING

How did I develop myself? At the beginning of my career, I looked up to senior colleagues and tried to emulate them. Pedagogical courses provided me with the knowledge I found difficult to apply in practice. The literature often presents that a university teacher, as a researcher and a specialist in his field, may have problems teaching others what he knows (Kak, 2009). This may be due to a lack of knowledge, not paying enough attention to teaching methods, or a lack of personal development modernization. A teacher should be able to plan and situate his activities in a particular theory to implement them, manage problems that arise, and evaluate the students and himself. All activities leading to this are within the scope of the teacher.

Teaching someone cannot be guaranteed. Learning occurs in the student's head (Dewey, 1975), and the teacher's role is to assist. This can be done in many ways. Engineers would like specific instructions, and these educators try to systematize these activities. Thus, the teacher should demonstrate and implement a practical solution based on theory, show the interrelationship of elements, explore ways, show another way or path to a goal (Dall'Alba, 1991), or show changes, interest, provide explorations, show a big picture (Johnston, 1996). These are just examples of activities. One cannot assume a specific approach in advance and apply it to students "by force." The teacher should know many ways and be flexible. I believe that with such, I can better help students. It is not enough to "reach" most students and "lose" ONLY a few of them. The teacher's role is to present knowledge, assess learning, and convince, motivate, and interest students. An engaged teacher can attract students. Creating and fostering a good learning environment is beneficial to both students' well-being and their academic performance. I thought before, and I think now, that one of the most important tasks of a teacher is motivation. There are no "unfit" students. There are unmotivated students, students who want only to pass the exam, and students who wish to learn. Each of these groups should be taught in a slightly different way. But all these students are together in one class. My first problem is to detect which group a student belongs to. The next challenge is to find a teaching method that suits their needs without limiting the learning opportunities of others.

Unfortunately, this cannot be measured. Everything will depend on individuals and requires interaction. This situation sometimes causes misunderstanding and even resentment of my methods among other engineer-teachers, saying, "*Why do so much if you can't see a measurable effect anyway?".* Everything can be calculated and checked theoretically in the technical sciences, and the results will be repeatable. Apparently, engineers (including myself), accustomed to precise ways of doing things, often have problems updating teaching forms. I often see the approach: "*If it works, why change it*". Upon reflection, I find this incorrect. Continuing to do the same thing for several years results in a lack of modernization of the issue and student dissatisfaction. It's not that students must always have the most up-to-date information. Still, the lack of modification makes the subject unusable, especially in programming, where new elements constantly appear. Changes, gradual but also systematic, are necessary.

Here, I would like to describe the planning, execution, and self-evaluation of the tasks I initiated.

CHANGING THE PROFILE OF HISF STUDIES - PLANNING, IMPLEMENTATION, AND EVALUATION

It turned out that both students and teachers were not entirely satisfied with the existing program. I aimed to create a "red line" across the engineering program and all courses that fit together. To achieve this goal, I changed some subject programs and integrated their content to complement each other. Learning should occur gradually; each semester, students should repeat existing skills and learn new things, preferably as an expansion of previous courses.

This has been accomplished by, among other things, adapting courses to market demands, technical requirements, new opportunities, and teaching methods:

- "Measurement Technology" was moved to the second year and renamed "Measurement Systems and Instrumentation" (which included more practical examples and LabView software). At the same time, "Industrial communication systems and databases", as a more complex subject, was moved to the third year (networks, databases, Internet, SCADA systems).
- The JAVA environment was adjusted for use in all years of study in the subjects: "Programming", "Electronics and Computers", "Measurement and Instrumentation Systems," "Industrial Communication Systems and Databases", "Project Administration", "Computer Networks", and "Senior Design Project". This allowed students to increasingly develop programming skills in the same environment but in different subjects. In addition, it allowed them to use free software.
- LabView is the only specialized and paid software for use in many subjects: "Electronics and Computers", "Measurement Systems and Instrumentation", and "Control Systems". As a result, students were able to learn practical components tailored to various subjects, and the school was able to rationalize purchasing funds.
- Increasing the role of digital electronic components (Verilog, FPGA, Arduino, Raspberry Pi) in "Electronic basis 1", "Electronic basis 2", and "Electronics and Computer" by the expectations students expressed in individual subjects and during projects.

In general, most people were satisfied with the changes. The skills in the subjects were repeated and developed. There were many different forms of teaching and examination. Written exams with the computer, oral exams, presentations, and projects. These changes also inspired further work on modernizing education. A few years later, I prepared several new courses:

- "Advanced Programming" - where students could learn modern methods and technologies in programming in a theoretical AND practical way (evaluation based on seven middle-size projects).
- "Computers in networks" - where students could learn the principles of computer networks and information exchange in industrial systems and apply this knowledge in practical tasks with programming, databases, and graphical interfaces (evaluation based on three large projects). In 2019, students co-authored a scientific publication (Fojcik et al., 2019).

ASSESSMENT IN THE SCIENCES - PROJECT

In the French university model, the exam is a social confirmation that the student has mastered the expected knowledge and can move on. But how do we measure knowledge? Students do not want the classic form of exams because it does not fit with job expectations. (khrono) For example, an engineer usually works in a team, divides a task into smaller groups, communicates with experts when faced with challenges or seeks information from various resources, and usually has a deadline for completing a task or project in a few weeks or months. To meet students' expectations, at HiSF we introduced six major projects in 6 semesters of study. Students with a teacher chose a topic and then worked on the assignment. The project ended with a public presentation. Students were pleased with this form of instruction. They were able to study more individual topics that interested them. Projects in different years were coordinated with each other. In the first year, students did not have to strictly follow the rules of reference or describe and justify the choice of method. In subsequent semesters, however, these requirements were already enforced. The idea was that students gradually learned how to work independently, collect and verify materials, and write reports.

Often, projects were prepared with the cooperation of external institutions. Project (MF_CV) courses were constantly developed through feedback from students and teachers and scientific literature. Initially, the project consisted of several periodic group meetings, report writing, and a final presentation, which were mandatory parts of the process. We received much positive feedback, but some groups had problems with planning, self-efficacy (understood by the students as reluctance to ask questions), and regularity. After a discussion among teachers, we decided:

- Introduce a pre-project report and approval of the chosen topic and scope of the project,
- regular meetings: students, teacher, and employer to discuss the concept and progress of the students and to avoid misunderstandings and generally increase or deviate from the first idea,
- trial presentations to the public, students presented the project and received feedback on their work.

We obtained many positive results. Some students even presented their projects at national and international conferences and wrote scientific articles (MF_CV). During this process, I discovered that students often needed additional guidance to present tasks in an engineering way, describe the course of the project, and use references correctly. For this reason, we included a language teacher and a librarian to work on the projects. Unfortunately, the projects required resources like time, money, and willingness. After merging into HVL, all projects were eliminated in favor of joint lectures and labs.

<u>MIKROPROJEKT</u>

After a few years, we found that students had no oral presentation skills during the presentation of their graduation projects. To remedy this, we applied "*fagutviklingsmidler*" for funds to prepare and test the conversion of one written report into an oral presentation. It was the same content in some subjects but in a different form, and in others, it was a completely new task. "Microprojects" were special activities in the lab credited based on an oral presentation. Students were to learn new skills, see how oral presentation works, and gain experience. The project was conducted in 2022-2023, simultaneously in 4 subjects. The results were very encouraging. Both teachers and students were motivated, willing, and committed. Unfortunately, a one-time presentation allows for feedback, but follow-up is needed to improve and consolidate behavior. Therefore, we want to continue working on projects so that students can work systematically on projects.

SYSTEMATIC WORK IN TEACHING

<u>PREPARATION FOR TEACHING AND LEARNING</u>

As a tutor and instructor, I have noticed that students are often interested in new concepts and technologies. They want to learn what it is and how to use it. In the beginning, students often have little idea about the subject. For example, they expect to learn programming right away. My job is to explain the situation and show what, how, and why we will do it in class. Learning takes time and motivation. It is a process that develops by gaining knowledge and experience in small steps. It is easy to lose motivation and to "fall out" of the rhythm of systematic learning. The idea, developed through years of experience and discussion, is that students learn theory (through short videos, articles, discussions, and presentations), solve selected tasks while working in groups, and then independently. In my opinion, such a structure helps students experience that they can cope with the tasks. If they have any problems, they can ask for help with the exercises or discuss some challenges with me during consultation hours. Programming is a complex field. Students often think they understand the task, but when they try to apply their knowledge in practical exercises - they fail. For many of them, this is frustrating and can lead to discouragement. I want to avoid this by giving them feedback on their learning progress. In all my subjects, I prepare many short, anonymous tests. Students complete a task and then mark their sheet with some unique symbol (not their name). Later, I give a descriptive assessment of the tasks and provide feedback to the students. This evaluation is used to show the students whether they are on the right track at this particular moment or whether they need to repeat some topics. The purpose of these tests is not to stress the students - only the student knows the description - but to show them what they have learned, present their progress, explain any mistakes, and motivate them to continue learning.

THEMATICS

I specialize in programming, computer networks, electronics, and ICT. This is part of STEM (science, technology, engineering, and math) courses. I systematically update my skills. It is necessary to prepare a good, modern, and exciting program, especially in computer science, where the knowledge of modern methods constantly changes. Hence, there is a need to update the curriculum continually. The need is not only for "hard" skills, such as programming principles, mathematics, and regulation theory, but also for "soft" skills (time management, creativity, cooperation, critical thinking). This is indicated by the Bologna process (Ash, 2008)
In computer science, ideas and methods from 10 years ago are already outdated, so the teacher should introduce modern knowledge and appropriate ways. Having an extended curriculum with articles, websites, and current experience (own or invited lectures/specialists) is valuable. My "philosophy" is to prepare a program that includes the following:

- "historical" information (about 20%) necessary for understanding the development of the environment and principles,
- "standard" information (about 60%) from books and given materials,
- new updates (about 20%) - from current research or after discussion with students.

In each lecture, I prepare matching assignments so that students best understand the ideas and discuss how they see them. Often, a bit of humor (a meme, a funny picture) allows for easier understanding or a moment of relaxation. Then, we solve practical tasks together. Some students "got lost", so I started an interactive and anonymous test, prepared to show possible problems and their solutions. Later there is another task that students can already solve on their own. Each lecture requires separate preparation. Each time, I consider what content and assignments will fit the class. A significant part of the notes from the previous year can be used, but a large part is always tailored to a specific class.

COURSE STRUCTURE

I have a similar structure for most of my courses. At the beginning, I discuss the program for the year and ask for comments.

- I provide students with a short video (5-10 minutes) to watch before the lecture as an introduction to the topic. Students become familiar with the issues, and it is easier for them to join the discussions during class. This is inspired by the flipped classroom method.
- I start the class by introducing the new module and discussing with students their understanding, questions, and concerns. There is always a mix of classic and online activities. I use theory, definitions, terminology, examples, and teaching tools like a whiteboard, OBS, PowerPoint, and Visual Studio with access to collaborative coding via LiveShare and interactive elements like paper tests, Kahoot, Mentimeter, Padlet, etc.
- At the next meeting, there are approximately 2 hours of hands-on exercises where students solve (in groups) exercises based on the previous lecture. This work is done in physical and remote groups (Zoom, Teams), in collaboration with other students, under the teacher's guidance.
- All my activities are streamed and recorded in OBS studio software (keeping students anonymous) in HD, 30fps, using 2-3 wireless cameras and two wireless microphones. Recordings are made available on Canvas LMS (Canvas LMS, 2021). The structure of the modules in one of my courses is shown (attachement07)
- Every two to three weeks, there is a hands-on lab. First, we discuss how students understand the assignments, and then students solve them by preparing a report or presentation. The time for completion is usually two weeks. Students can and should contact me with questions during this time. If no one has questions, I bring them up myself at the next meeting. After the reports are turned in, I evaluate them all descriptively and send feedback on what they should improve next time before the next lab. Doing the lab again but with a different set of questions is possible. My goal is to assist students who, for various reasons, failed to complete the assignment so that they do not lose their chance to take the exam. Everyone has a chance, but they have to solve the task.
- Starting in 2020, I also introduced the possibility of voluntary online consultations, where students can ask questions about anything related to the subject and their studies.

All my activities are discussed and coordinated with students. They see the opportunity to influence the content (to some extent), the form of teaching (classical, digital, mixed), the types of activities (lecture, group work, discussion, reflection), and the pace. My teaching "habits" have been tested with one teacher and many teachers on the course with good results. We share our knowledge on:

- types and forms of digital activities,
- project-based learning,
- implementation and adaptation of new software,
- types of teaching (flipped classroom, classical, blended),
- digital labs,
- methods of student assessment in projects, labs, and exams,
- making our results public at conferences and working groups.

In my courses, all labs/exercises were planned as part of systematic work, from the easiest to the most complex. It was possible (but unnecessary) to use a partial solution from the previous exercise in the next one. Thus, at the beginning of the programming course, we prepare together some basic functions (e.g., reading an integer with error handling) which students can then freely use and modify (e.g., reading a floating-point number, with a certain accuracy, reading several numbers) during all activities in subjects related to programming. It works like a building with LEGO bricks. Having simple "blocks", we can easily create more complex blocks from them. All knowledge lies in the rules of block treatment. The ability to modify such functions can boost further work and help students understand the methods of building large programs from smaller parts. Systematic work creates a "scaffolding" for future knowledge.

SUBJECT CONTENT

In my subjects, many teachers collaborate; we share knowledge and experience and work together to create a good subject plan for students in which we add changes every year based on new student comments. Unfortunately, when working in groups, there is often a strict adherence to the course structure and a lack of adaptability. E.g., when a course is taught identically on three campuses by multiple teachers, any change (e.g., by teacher illness, days off, shifts) results in a mismatch between the situation and the plan and the need for the student to complete the knowledge independently. Putting the student at the center is impossible with such teaching, even with everyone's goodwill. We need more flexible and open possibilities to teach. Also, Meld St. 16 (2016, p.21) shows there is still much room for improvement:

> *Studentaktive læringsformer brukes ikke i stor nok grad. Plenumsforelesninger og tradisjonelle eksamensformer dominerer. Undervisning, veiledning og vurdering er noe av det som får lavest skår av studentene i Studiebarometeret.*

SUMMARY

My goal was and is to motivate others through cooperation (social constructivism), to gradually - step by step - get out of one's "comfort zone", so that something more is achieved in cooperation. It doesn't always work out, but you can't give up. I do not have one favorite activity. I believe that a teacher should do a variety of activities.

I would also like to see more visibility of HVL in the country and beyond. Again, these are the remnants of an engineer's attitude. As an educator, I would like students to receive expected knowledge in an accessible and understandable way, develop creative, critical thinking, and "soft skills", and be assessed correctly to benefit them and society.

CRITERION 2: DEMONSTRATES A SYSTEMATIC, RESEARCH-BASED, AND SCIENTIFIC APPROACH TO TEACHING

PEDAGOGICAL PARADIGMS

There are many, e.g., behaviorism, cognitivism, and constructivism. These are just theories but with their methods, goals, and ways of implementation. Each such theory represents a holistic approach to teaching. While everyone agrees that there is no better or worse method, there is no way to prove that a particular method works better. **Behaviorism** (Ertmer &

Newby, 2013), often associated in a simplified version with Pavlov's dogs, involves learning certain behaviors, reflexes, and memory accumulation of a particular body of knowledge or behavior. This is even indispensable in competitive sports, where athletes are supposed to think about action and acquire "muscle and nerve memory". Their action is so fast that without "behavioral automation," they cannot act fast enough. This is also useful in training for emergency rescue (accidents, fire, etc.), where rescuers must act quickly and safely. The theory lists fixed patterns, repeated actions (not necessarily with understanding), and positive and negative reactions. These actions may be desirable and helpful at the beginning of the course. But a programmer can't just rely on repetition and memorization. Understanding, problem-solving skills, and talking to others - breaking down a problem into smaller parts that can be solved in a group - are necessary.

On the other hand, understanding through cooperation and examples is part of Lev Vygotsky's **social constructivism** (Vygotsky, 1978). Constructivism defines activity as development through systematic and collaborative work: "zone of immediate development" and "scaffolding" (Kurt, 2020). Vygotsky consistently defines the zone of immediate development (fig. 1) as the difference between the current and potential levels of cognitive development. Development in the zone of immediate development involves social interaction, dialogue, and mediated activity between students and their teachers. It is an ongoing process - like building a scaffold.

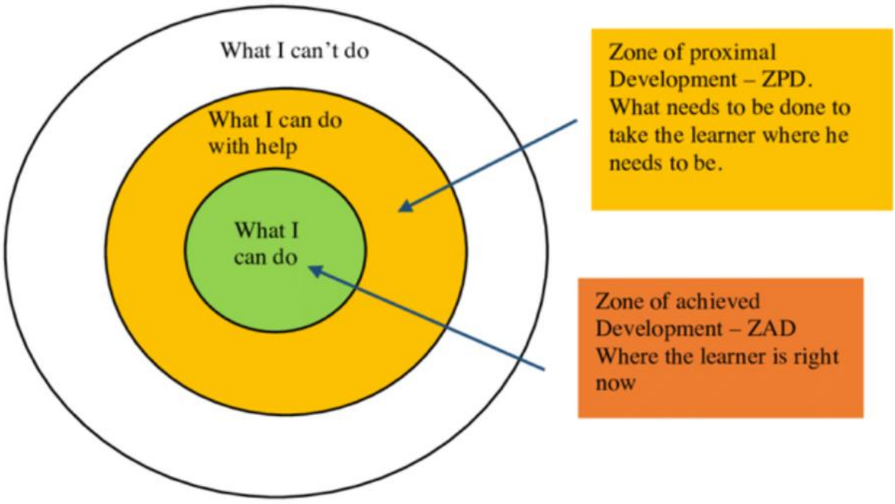

Fig. 1. According to Vygotsky, the zone of closest development is the distance between what a student can do (solve a problem) on his own and what he can do under the guidance of an adult or in cooperation with more capable peers (Vygotsky, 1978).

This concept - Zone of Proximal Development - ZPD suggests that we need certain elements to help students achieve more knowledge and skills. These may include (Kurt, 2020):

- other people as a teacher, co-teacher,
- a type of activity such as discussion, collaborative exercise with a whiteboard or programming tools,
- existing materials: books, slides, videos, programming environments, the Internet.

Cognitivism, on the other hand, is about understanding facts and how they relate to each other, evaluating them, and differentiating them. Nowhere is it said that understanding should be quick and "automatic." Instead, it is the other way around. Comprehension is a slow and systematic process. It can work differently for each person.

Each theory holistically represents the learning process, using its principles and matching rules. It is possible to apply several theories in succession, while the problem is mixing elements from different theories. Suppose a teacher declares to use a cognitive science approach and at the same time conducts a written exam on time-solving tasks. In that case, this is a certain contradiction of assumptions. One should not act according to one theory and examine according to another theory. This leads to a misunderstanding of the goals and trivialization of teaching.

INDIVIDUAL APPROACH TO EXAMS - CHALLENGES

Do exams test knowledge? Often, it is a quantitative criterion, especially when grading. This makes the education system look like a haphazard combination of selected elements from well-known pedagogical models. On the one hand, we have the student at the center, stimulated to creativity and independent thinking. On the other hand, evaluated through a quantitative written exam, during which he could not present all his acquired knowledge. This is not a pedagogical approach.

Can a written exam show students' ability to think creatively, collaborate, and discuss? Rather not. The exam mostly tests declarative knowledge, not procedural knowledge. (Berge & Van Hezewijk, 1999) The very design of the exam dismisses most of the advantages of the proposed teaching. I, myself, have encountered this attitude of students who, given a choice of one of two tasks (many closed questions on writing specified code or a short descriptive task requiring thinking), chose closed questions saying, "*This will be easier to write because you don't have to think.*"

On another note, I noticed some students had misconceptions about preparing for the final grade. Students often received lower grades than expected based on their work during the semester. We started a research project (Exam-project) with other teachers to learn more about this issue. After discussions with students and teachers and an analysis of previous years' exam results, we found that this was due to a misunderstanding of the exam technique. Each exam has its own form, requirements, and expected outcomes. Many students were afraid to give answers they were unsure of. They thought, "*I'm not sure; it will be safer not to write anything.*" Many students did not understand the expected form, which resulted in them not attempting to answer and instead left blank. In the worst year, students left over 25% of exam questions unanswered. This happened to all students - regardless of their knowledge (fig 2.).

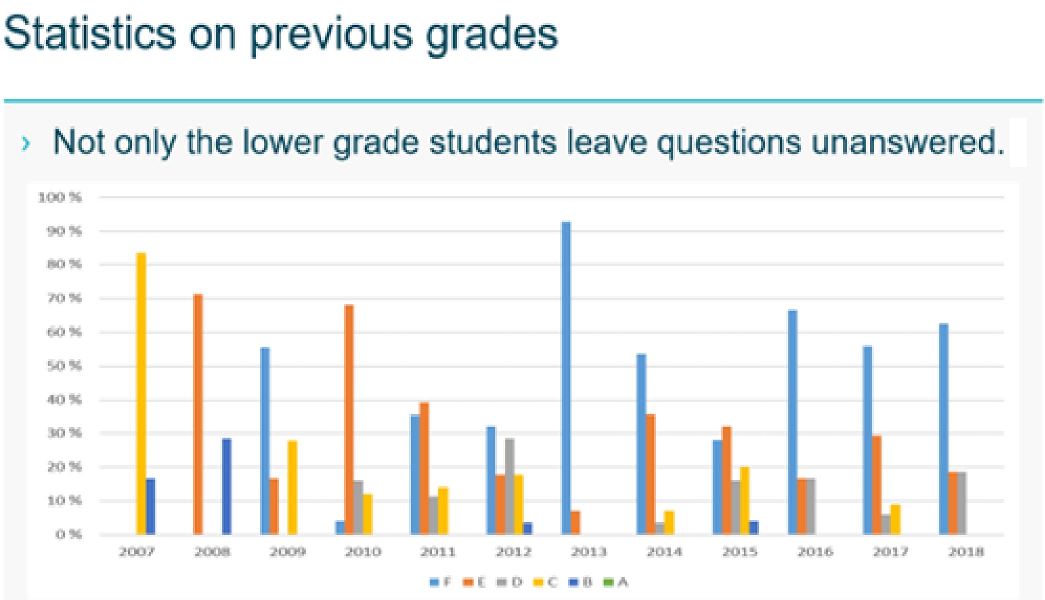

Fig. 2. Students with all grades did not even try to answer questions.

Although most students took a course on exams, it was insufficient for many of them. We started research on the subject and added practical advice for students to lectures, discussions on types of exams, mock exams, and additional meetings. This proved to be much needed. After a few years, amount of unanswered questions was reduced from 25% to 5%, significantly raising final grades. (Fojcik et al., 2019, 2020a)

Another challenge is the type of questions on the exam. It's easy to ask and evaluate yes/no questions, but how do you test students' understanding of complex items? How to prepare reflective questions for a programming course? In written exams, students are occasionally asked to write a program and explain the methodology. These questions require much more time for preparation and evaluation - and time is scarce in the university system. One solution may be to use project grades instead of exams. I have introduced this approach to learning in many courses as part or full assessment. In projects, students apply their knowledge to practical, real-world tasks. They are responsible for planning, preparation, implementation, and results. They must use knowledge "by doing," not just referencing and memorizing. For this reason, not only their declarative knowledge but also their procedural knowledge can be tested. (Fojcik et al., 2020b).

ADDITIONAL ELEMENTS

In my opinion, the ability to prepare the structure of courses, the choice of curriculum, knowledge of university models, and pedagogical paradigms are only part of the necessary knowledge. A teacher should understand students and explore how to help, encourage, and motivate them. Psychology, sociology, anthropology, economics, and politics provide precious aids and clues about students' attitudes, motivations, expectations, social situations, opportunities, and requirements. Without this "additional" knowledge, a teacher may miss the expectations of students, may not understand them, or may even be ignored as not matching expectations. It's not about complete matching but mutual understanding. A teacher should neither allow students to do everything nor restrict them completely. It is essential to understand the goals, ways, and actions. Students from other countries, cultures, and economic situations may react differently.

SUMMARY

Conferences, research, talks, literature, and courses - all help to promote and share knowledge. I have carried out various scientific and teaching activities in formal and informal groups. (MF_CV) Such activities are needed because students have increasing expectations. Something good now may not necessarily be good in 10 years. Another factor is unexpected changes - like a pandemic. Then, much change is needed, but are we, as teachers, ready to change our teaching styles? Do we know what to do, how to do it, and why?

I talk to students initially and try to understand their goals and expectations. I try to find a way to convey the program properly. Unfortunately, the economic situation often prevents significant changes. Subjects with many teachers often have "topic inertia". This results in a lack of change and student dissatisfaction (studiebarometer) due to the obsolescence of form or content. My goal is continuous (albeit gradual) updating. This is something we cannot abandon.

CRITERION 3: HAS A COLLEGIAL ATTITUDE AND IS AN ACTIVE PEDAGOGICAL COLLABORATOR, FOCUSING ON SHARING EXPERIENCES RELATED TO THE QUALITY OF EDUCATION

An essential part of a teacher's work is sharing knowledge already learned and the willingness to learn new things. This can be done by participating in seminars and presentations, engaging in new projects and subjects, preparing new ones, involving students, and encouraging collaboration with other teachers from HVL and beyond. We are about to start a new Master's course. As one of the responsible, I would like to apply the existing solutions and listen to others about what can be improved.

I would like, together with colleagues and students, to further link teaching and research for better sustainability, which is also an aim of the HVL strategic plan. Students should understand responsibility (including social and environmental) in engineering activities. Cooperation helps a lot; everyone has different skills and greater synergy. Collaboration with administration, leaders, inter-school, and international is also essential. There are various opportunities and requirements at each level. Cooperation can be divided into several areas:

- Collaboration with colleagues has enabled me to grow as a person - gaining skills, seeing the needs of others, and being able to support them. Collaboration facilitates getting ideas for research, pedagogical work, participation in supervising colleagues and students, involving students in research, and collaboration with industry and hospital.
- Collaboration with leaders has enabled me to make organizational changes, plan new activities, expand offerings for students, change subjects, and improve competencies. As a member of "*utdaningsutvalg*", "*fakultetsråd*" and a union representative, I know the situations, opportunities, and expectations. I like the HVL academy initiative - a place to exchange ideas and share information.

- In turn, cooperation at a higher level has allowed me to learn about new trends in research and development, show my activities, and receive feedback, and ask and answer questions. This includes participation in UHR-MNT Elektro, "dosentforenig", and cooperation with universities like the Silesian University of Technology.

COOPERATION AND SHARING

All of the above activities were conducted in groups. They resulted from cooperation with students and teachers in various departments. Thanks to cooperation with, among others, people from the Art Education and the Teachers Department, I learned a different approach to robots and their role in education, as described in (Fojcik et al., 2023).

Thanks to the new knowledge, I could participate in the activities of the FIN group, the pedagogical group, and our informal group and share knowledge in various ways: locally, nationally, and internationally. This has led to many joint results (cristinMF). I am pleased that our activities have been rewarded by "*undervisningskvalitetpris*" and nominations from HVL for the DIKU award. (attachement11)

SUMMARY

Pedagogy is a type of attitude that deals with "upbringing, teaching, and socialization at all ages and in all walks of life" (Imsen, 2011). It is something that people are influenced by and relate to. However, the same actions for one person may produce a completely different result for someone else. Reproducible results cannot be verified with the same outcome because people are different. The pedagogical approach does not give ready-made solutions but helps to ask questions - what am I doing? Why am I doing it? Can I do something different? You must understand theoretical principles and practical actions to be a good teacher. Pedagogy can help you know the student's attitude and find a way to make learning possible. My goal is to continuously learn and inspire students to learn through both theoretical and practical skills related to working in pedagogical matters. But that's not all. Many elements, e.g., psychology, culture, economic and political situation, affect the learning process by, among other things, shaping the students' goals, motivations, aspirations and expectations, long and short-term goals. Without understanding this, the teacher may be misunderstood. Sometimes, due to certain constraints or economic assumptions, it is impossible to do everything that can be done, but this does not excuse us from trying. Andrews at all. (1996, p. 101) noted that:

> "*excellence in teaching is complex and difficult to achieve. It is about content expertise and methodological technique, as well as about participants in the educational enterprise valuing and achieving quality outcomes*."

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