Information Systems
Final Report - Group 2

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1 Executive Summary

This report aims to improve the current teaching process at the Norwegian University of Science and Technology (NTNU). As this is a large task, we chose to focus on grading assignments and exams through the use of artificial intelligence (AI) and improving the process of providing feedback to the course, and how to arrive at the desired goal state. In this report we have visualized how the current processes for grading and feedback works, through BPMN models and how we wish to change it by utilizing AI through improved BPMN models. At the end there is an implementation plan included, on how to gradually get to the desired state of incorporating AI into the grading and feedback processes.

Historically, the use of information and communication technologies (ICTs) have vastly improved and changed the universities worldwide for the better, and a new area in this field is the use of AI, which we believe can be used for automating and effectivizing many repeated tasks that currently take a lot of work. We wish to improve the teaching process by streamlining the feedback process for students to the teachers to streamline this process with the help of AI and standardized forms. Currently there is no use of AI to effectivize these areas and we believe it could provide meaningful advantages and free up resources to be used elsewhere.

Integrating this technology into grading assignments will reduce the workload for teaching assistants (TAs) and the professors at the university, allowing them to focus on other things which could result in improved and more personalized learning for the students, as well as less stress for all parties involved. The feedback given to the students through the grading of assignments would also be more objective and streamlined as it is performed by the AI, which would make for more consistent grading, removing the subjective factor a human grading would bring. By using AI for the course specific feedback forms at the end of semesters, we would gradually improve the courses at NTNU by having standardized forms and would be able to track this change over time. This would provide the students with higher quality learning and improve the students' results in courses. The transition into using AI for these processes would need to be gradual in order to not meet significant resistance from the affected parties at NTNU. Risks and potential pain points are outlined in the report and the steps that should be taken to mitigate these are also discussed.

2 Background

2.1 ICT in Education Over the Years

The integration of Information and Communication Technology (ICT) into education, particularly in higher education, is increasingly recognized as a transformative force [1], reshaping both teaching and learning in substantial ways. In a world marked by constant technological and societal change, the role of ICT in the university setting extends beyond simply introducing digital tools; it fosters a dynamic environment that prepares students for a digitally-driven global economy and cultivates essential skills for the modern workplace. The COVID-19 pandemic underscored this need, accelerating the adoption of online and blended learning models worldwide and revealing the potential of ICT to bridge educational gaps when in-person learning is disrupted.

ICT in education encompasses a broad array of tools, including computers, tablets, interactive whiteboards, smartphones, and digital platforms, which collectively support diverse learning styles and facilitate access to extensive resources. This access, combined with digital capabilities, empowers educators to move away from traditional lecture-based approaches and adopt more interactive, student-centered teaching methods. For instance, the flipped classroom model allows students to study content outside the classroom and engage in interactive activities during class, optimizing learning time and fostering collaborative problem-solving skills.

Research and recent Horizon Reports [2] have highlighted the trends ICT brings to education, such as the shift towards e-learning, personalized adaptive learning, and collaborative platforms that foster engagement and inclusion. ICT enables students with special needs to access tailored educational resources, reducing learning barriers and promoting inclusivity. The use of ICT in education also nurtures higher-order thinking skills, such as evaluation, reflection, and strategic planning-capabilities critical for success in a 21st-century knowledge economy.

The benefits of ICT extend to developing digital literacy and ICT capability, essential for students to navigate an increasingly interconnected society. ICT fosters collaboration, as digital tools naturally create opportunities for teamwork, whether through shared projects or interactive discussions. Additionally, ICT has proven [1] effective in motivating students, as many young learners are captivated by technology, which can make learning more engaging and improve retention. Through technology, students can visualize complex concepts with simulations, access knowledge instantaneously, and enjoy a variety of educational experiences that are both fun and meaningful.

For educators, ICT offers significant advantages, including access to a vast array of digital resources and teaching tools, which support the creation of diverse lesson plans that accommodate varying learning preferences. Training and professional development in ICT are essential for teachers to fully utilize these tools, as digital literacy among educators ensures that technology is used effectively to enhance the educational experience rather than becoming a source of distraction. ICT training helps teachers create more engaging, interactive lessons and enables them to integrate technology seamlessly into their classrooms,

from the use of learning management systems to innovative apps and content repositories.

However, integrating ICT into higher education is not without challenges. Schools must invest in adequate infrastructure, ensure equitable access to technology, and address the digital divide exacerbated by socioeconomic disparities. Without proper resources, the risk remains that some students may fall behind, particularly those with limited access to devices or internet connectivity. Additionally, technology's potential to distract students highlights the need for intentional and structured use of ICT, reinforcing its role as a supportive tool rather than a replacement for traditional teaching.

The ongoing evolution of ICT in education continues to shape educational policy worldwide, as seen in the integration of digital skills within national curricula, such as the [3], which emphasizes digital literacy as a core capability. ICT policies in educational institutions act as roadmaps, guiding how digital resources are utilized and ensuring consistent development of ICT capabilities. Through thoughtful planning, professional development, and the establishment of ICT policies, educational institutions can maximize the benefits of digital integration, ensuring that both students and educators are prepared to thrive in a digitalized world.

In conclusion, ICT is an essential component in modern higher education, offering extensive opportunities to enhance learning, increase accessibility, and prepare students for future careers. By leveraging ICT's potential and addressing its challenges, educators can foster a learning environment that is both inclusive and adaptive, ensuring that technology remains a powerful, positive influence in the academic growth and personal development of students.

2.2 ICT in NTNU

The rise of ICT has significantly transformed the Norwegian University of Science and Technology (NTNU), like most other universities in the world, reshaping both the educational experience and the university's research landscape. With robust digital platforms and tools, NTNU has made education more accessible and flexible, catering to the diverse needs of a growing student population across its multiple campuses. ICT integration has enabled NTNU to offer a range of online courses and blended learning models, which combine traditional lectures with digital content accessible anytime. This flexibility allows students to learn at their own pace, deepening engagement and facilitating the inclusion of part-time students and working professionals. Digital tools also enable seamless collaboration through platforms like Blackboard, Innsida, Microsoft Teams, Canvas, and Zoom, allowing students and professors to connect, share resources, and conduct discussions beyond the physical confines of classrooms.

ICT has also driven innovation within NTNU's research environment. Researchers now have access to advanced computational tools, data analysis software, and cloud storage, streamlining research workflows and enhancing NTNU's research capabilities. Additionally, digital tools for collaboration foster international research partnerships, enabling NTNU researchers to work with experts around the world in real time.

Globalization has brought a diverse influx of international students, faculty, and collaborative opportunities to NTNU, which changed many courses from being taught in Norwegian to being taught in English. To cater to an increasingly global community and remain competitive in the international academic arena, NTNU has expanded its English-taught courses, particularly in graduate and research-focused programs. This shift enabled NTNU to attract students from around the world, fostering a multicultural learning environment and encouraged cross-border academic collaboration. Teaching in English has not only widened NTNU's appeal to international students but also equipped local students with language skills essential for participating in globalized fields, aligning with NTNU's mission to develop graduates who can contribute effectively in international contexts.

3 Teaching at NTNU: AS-IS Situation

3.1 Overall Teaching Process

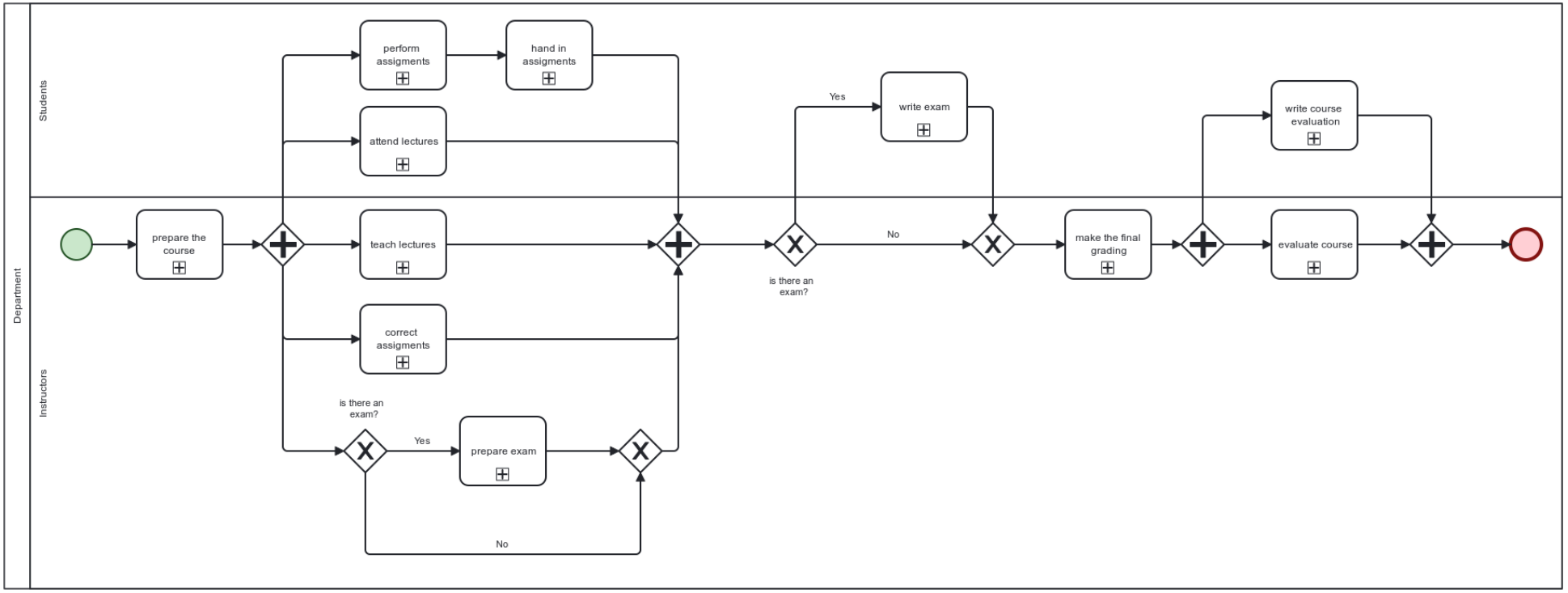

Figure 1: Overall teaching process BPMN diagram.

To begin with, here we have an overview of how the teaching process works (Figure 1). It does not have any detail, so as to make it more understandable with one look.

But this can be analyzed further, and also identify where the problems we have decided to talk about more thoroughly are located in the general overview.

To begin with, the teacher must prepare the course. This is a rather big subprocess, as it has many procedures before it can be considered complete. First, the instructor must hand in general plans of the course to the head department. To do that, first they must review the description, the previous programme and consider transitional arrangements. Once sent to the head department, they match all the courses and professors, and the instructor can proceed to make the rest of the planning for the course. They must choose learning activities, the extent of campus versus digital and asynchronous versus synchronous, create the needed learning resources, choose the learning spaces and decide on learning tools. After that, they decide on assessment forms, ensure the criteria and requirements are (or will be) stated clearly and decide the grading criteria. This means also choosing whether the course will have an exam or not.

With that, the course can start, simultaneously preparing lectures and assignments. Students attend classes, study and perform assignments that then can be corrected by the teacher or TAs. This grading of assignments system will be further analyzed, as it is one of the problems selected for this report. The course proceeds, following a dynamic of lectures, seminars, use of tools and handing in of assignments.

Also, if the grading of the course includes an exam, the preparations for it have to be made. This is also a big subprocess, as a date and time has to be found, there should report if there is a need for a 3rd party software, the instructor must create a list of students eligible and send it to administration. And depending on if the exam is digital or not, a set of tasks should be made, like creating the question set in Inspera, ensuring the language options, the guidelines and the deliveries, getting in contact with the administration and handling external examiners. But once everything is prepared, the students who are eligible can go to make the exam and hand it in properly following the rules established.

Once all of this is finished, the instructor and TAs can make the final grading. And after that, the other process that was further analyzed in this report comes into scene: evaluating the course. This is made simultaneously by the students and the teachers since feedback from both is needed. After that, the evaluation is saved and in the next iteration it will be taken into consideration and the course could be changed accordingly.

And that is the general overview. It is modified from course to course, some processes could be further parallelized, and possible exceptions have not been taken into account. The idea is to provide a general context and workflow, in order to then understand where our problems are located in the whole teaching system.

3.2 Feedback Process

The first subprocess we want to focus on is the feedback subprocess. This subprocess deals with the general feedback options to a course over the semester.

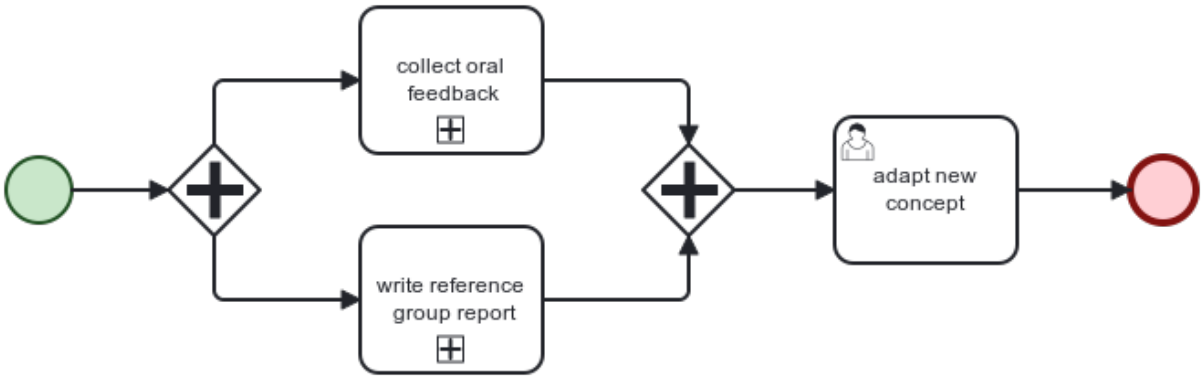

Figure 2: Feedback process as-is BPMN diagram.

The BPMN (Figure 2) for this subprocess shows that it includes two more subprocesses. We chose to have it this way, to make it easier to understand how the feedback subprocess works. In general, there are two ways to give feedback. The first, and obvious way, is to give direct oral feedback. This means that students can talk directly to someone, and the feedback is processed as soon as possible. The second way to give feedback is the system with the reference group every course has. This system collects feedback over the whole semester and at the end, the feedback is processed. Let's take a look at these two subprocesses.

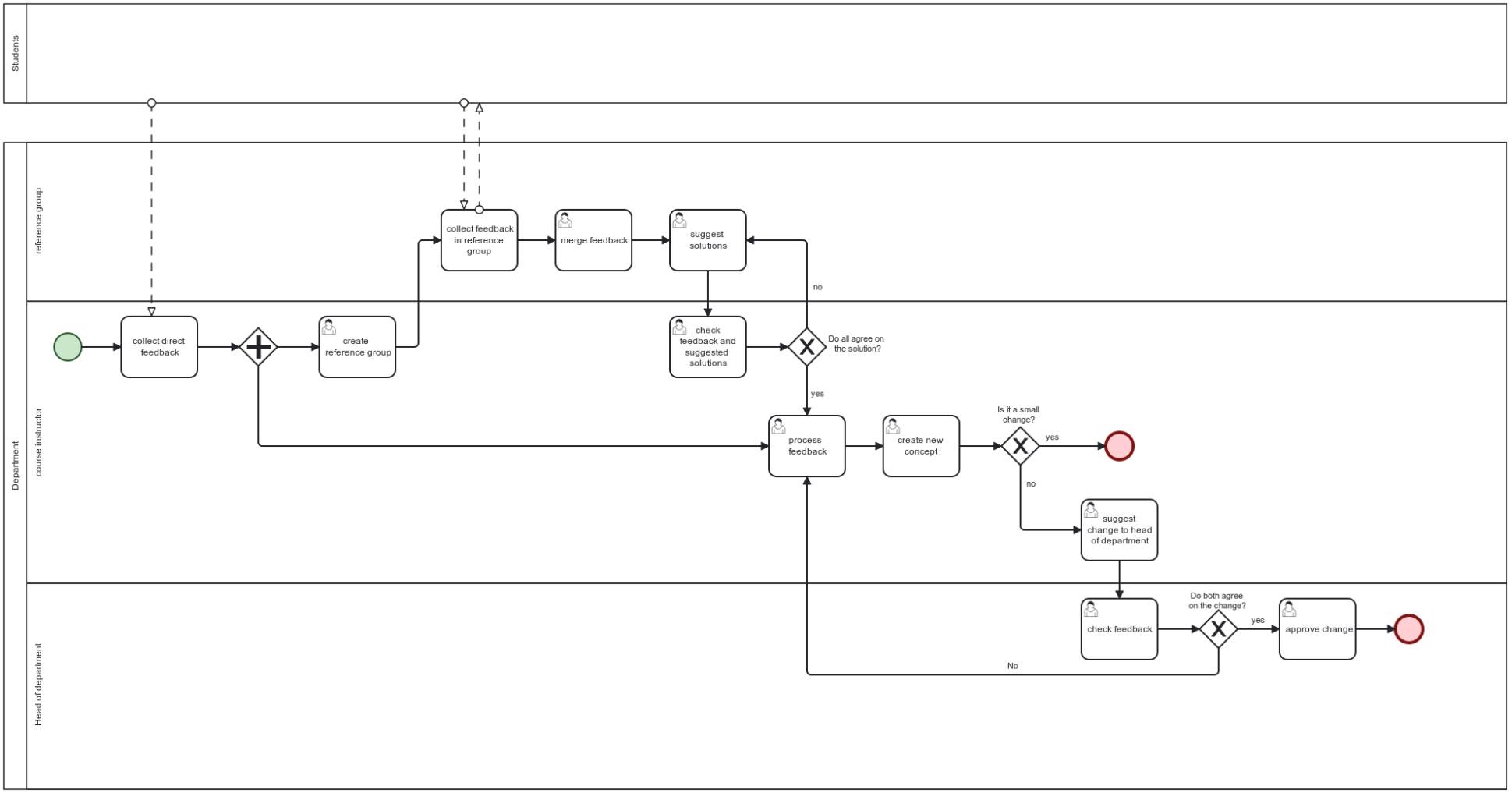

Figure 3: Oral feedback subprocess as-is BPMN diagram.

In Figure 3, the BPMN about the general oral feedback, you can see that the two main contact people for feedback are the course instructor and the reference group. Both are always open for feedback. Also it should be mentioned that both collect feedback in parallel. In the reference group case there are three important tasks. First of all the reference group has to collect feedback from the students. Here there are several ways to do that (surveys, by mail, oral, etc.) every reference group can do that however they like. At the end the following tasks are more important. The reference group must merge all the feedback they get and, in a last task, come up with some solutions they can suggest to the course instructor. In the last step, the reference group and the course instructor must discuss the feedback and the suggested solutions. If both agree and a solution is found, they can move on. If not, the reference group (and the course instructor) should come up with a new solution to suggest.

After agreeing on a solution, the work goes to the course instructor. This is also the point where the two parallel paths meet again. If a course instructor gets some direct oral feedback from students or if he agreed on a suggestion from the reference group, the next task is to process the feedback and come up with a new concept, which includes the (suggested) feedback solution. If this new concept only has small changes compared to the old concept (e.g. design of the lecture slides, etc.), the course instructor can just change the concept, and the feedback is successfully processed. If the new concept includes some major changes in the general course concept (e.g. adding newer research to the curriculum), the course instructor must talk to the head of their department to see if these changes are somehow possible to implement in the course. If so, the change can be made, and the feedback is successfully processed. If not, the course instructor must come up with a new concept or way to implement the received feedback to the course. When the subprocess finishes, the main process continues, merging with the reference group feedback and adapting the new concepts.

Overall, this subprocess can run multiple times in one semester and sometimes it is also possible to combine some feedback into one solution and one new course concept. But for small changes the subprocess offers the opportunity to implement small changes very quickly.

The subprocess for the reference group feedback report is shown in Figure 4.

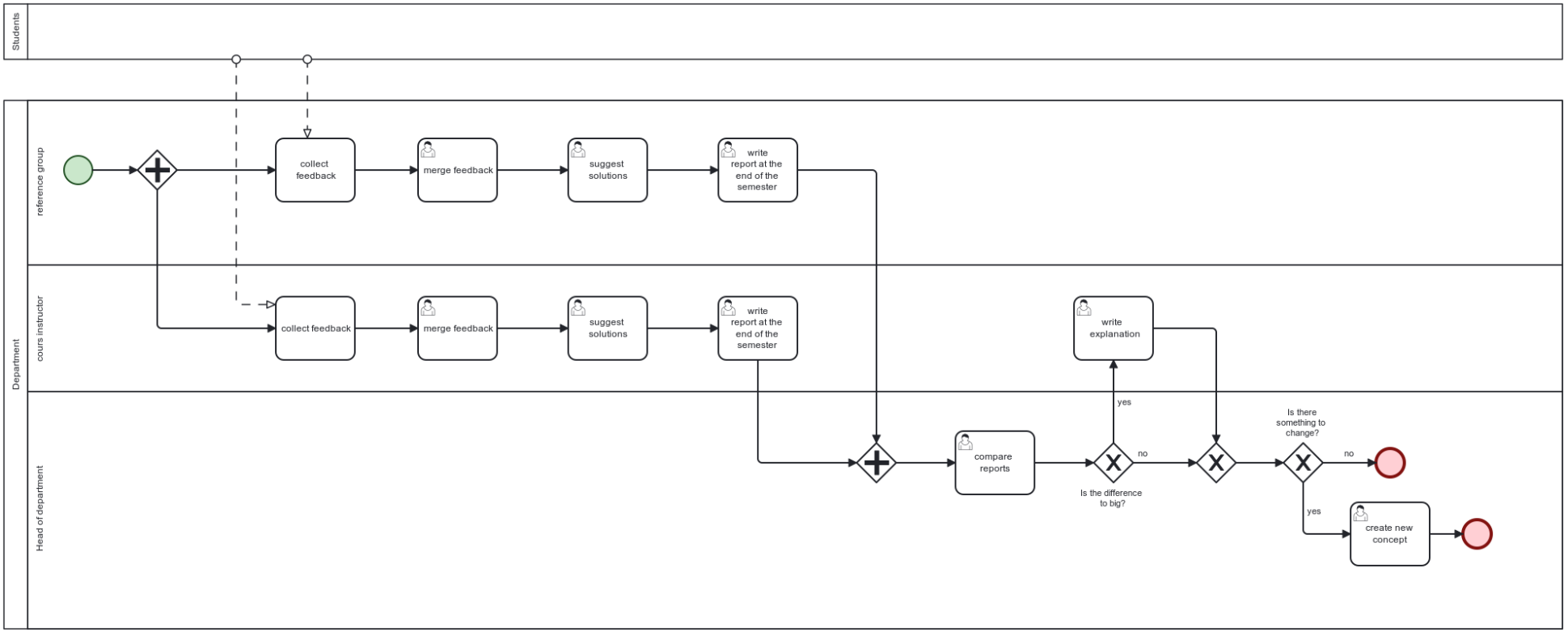

Figure 4: Reference group feedback subprocess as-is BPMN diagram.

Figure 4 is quite easy to read and understand. The reference group and the course instructor are open for feedback over the whole course period. After collecting all the feedback both parties merge the feedback and come up with solutions on how to deal with the feedback. In a last step both write a report on the course including the feedback and some possible solutions. All of this happens in parallel. At this point both reports are handed to the head of the department, and they compare the two reports. If the difference between the two reports is too big, the course instructor must write an explanation why there is this difference. If not the head of the department will decide if there should be some changes to the course concept or not. If so, they create the new course concept including the feedback and the suggested solutions from the two reports. And similarly to the other subprocess, when the subprocess finishes, the main process continues, merging with the direct oral feedback and adapting the new concepts.

With this kind of feedback, the head of the department always gets two views on the course and can decide how to change the course concept based on more than one opinion. Overall, the entire feedback is merged into one process and this described subprocess takes one whole semester to complete. So far, the whole subprocess to deal with feedback does not include any computer-based information systems.

3.3 Assignment Grading Process

Figure 5 shows the as-is state of the assignment grading process. The process begins once the assignment deadline has passed, after the students have submitted their assignments for grading through a digital platform, usually Blackboard or Ovsys, depending on what is chosen for the course. Each assignment submission is then assigned to someone for grading. This may be either a teaching assistant, in the case that the course has teaching assistants available, or the professor, in the case that there are not. The assignees will then grade each assignment submission and provide written feedback, which may be very time consuming, depending on the scope of the assignment and the number of assignments assigned to each grader. The assignment grades and their feedback are then submitted back to the digital platform, where they are stored in a database. If this is done before the grading deadline, the assignment grades and feedback are returned to the students. If the grades and feedback are not uploaded by the grading deadline, the teaching assistant may receive a warning and a new deadline to complete the grading and feedback by. If the grading was assigned to the professor, they may provide an explanation for the delay, and then grade the assignments by a later date.

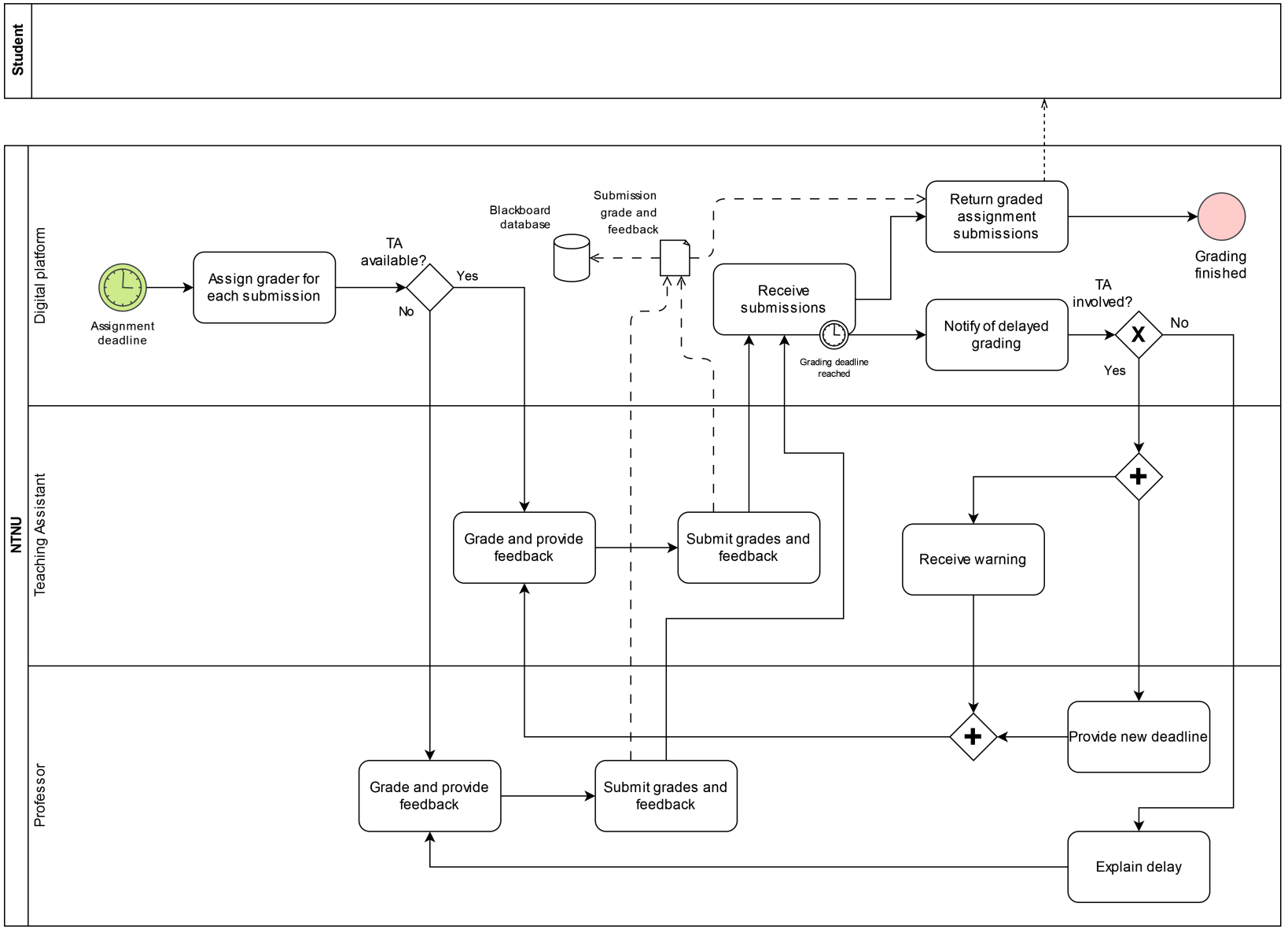

Figure 5: Assignment grading process as-is BPMN diagram.

4 Teaching at NTNU Next-GenAI: TO-BE Situation

4.1 Feedback Process

The TO-BE situation for the feedback process is very similar to the AS-IS situation. We would like to add one subprocess, the "AI feedback form".

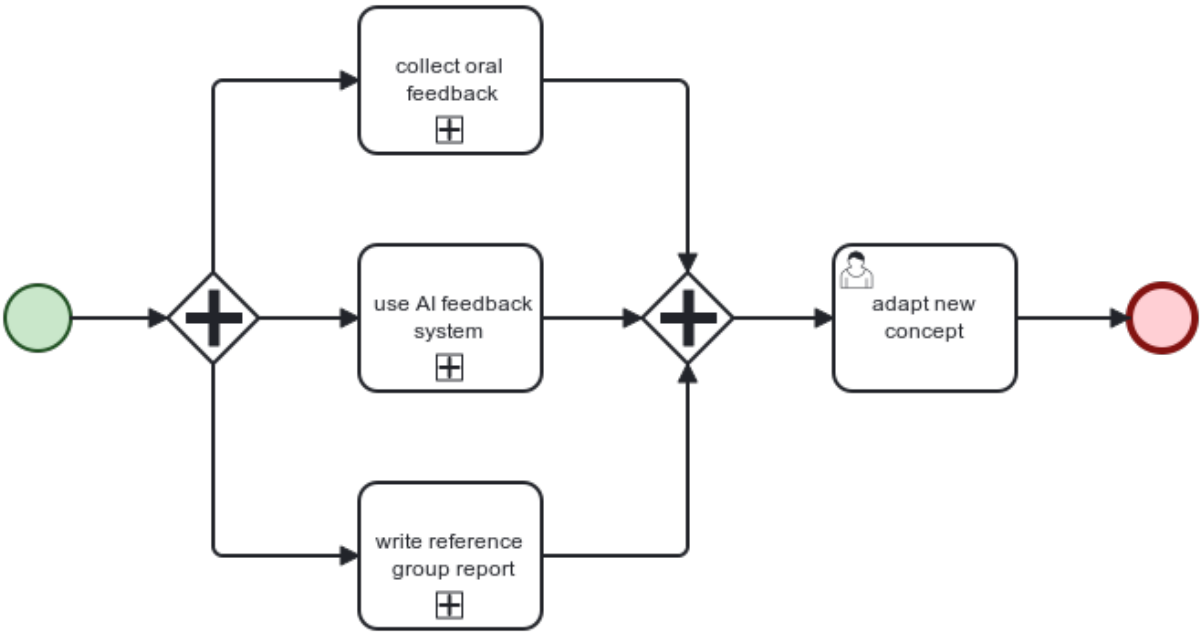

Figure 6: Feedback process to-be BPMN diagram.

The new subprocess includes a computer based Information system and is shown in Figure 7.

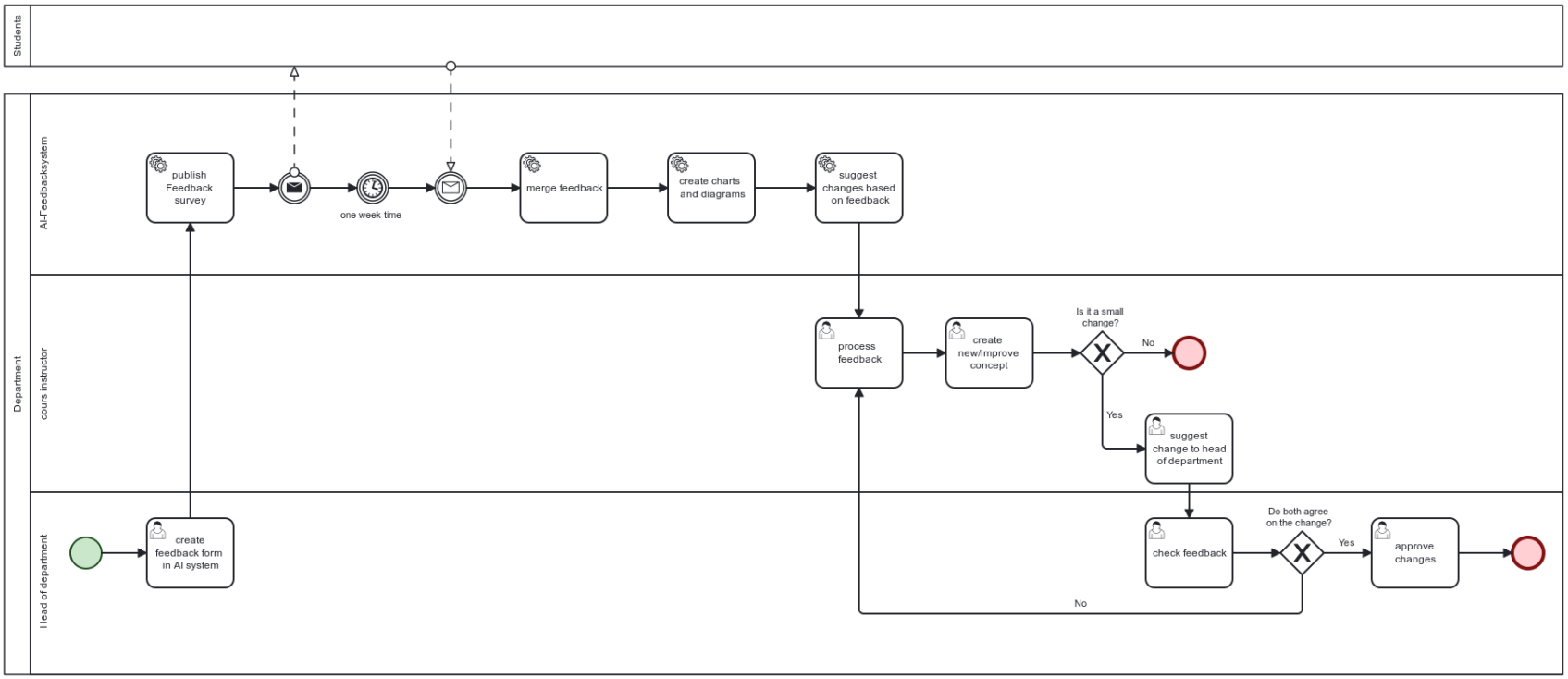

Figure 7: AI feedback subprocess to-be BPMN diagram.

The new subprocess begins with a task assigned by the head of the department. Their first responsibility is to create a standardized feedback form that will be used across all courses. It is crucial that the head of the department is directly involved in this task, as it ensures that the feedback form remains consistent and standardized across courses, a key factor for the reliability of the collected data. Why this uniformity is so important will be discussed in more detail later. Once the form is created, the AI feedback system can publish it, making it accessible to students. We recommend publishing the form toward the end of the semester, as this timing allows students to give a comprehensive overview of their experiences.

After the form is published, students have a one-week window to complete it and provide their feedback. This timeframe encourages timely responses while the content of the course is still fresh in the students' minds. Once the week is up, the AI system collects all submitted forms and merges them into a consolidated dataset. This entire process is handled digitally, ensuring efficiency and accuracy. At this point, it is also worth noting that most of the feedback questions are structured as rating scales from 1 to 5, making the data easy to quantify. For example, a question might be phrased as follows: "Did you understand how the assignment tasks were formulated?" Here, a rating of 1 would indicate "I didn't understand them at all," while a 5 would signify "everything was perfectly clear."

With this type of structured question, the system can now generate detailed charts and diagrams that illustrate how students rated each aspect of the course. This is a task ideally suited for an AI system, as it allows for rapid data visualization and analysis. We refer to this as an information system because, in our plan, the AI will store all feedback data from previous years, across multiple courses, to enable diverse comparative analyses. For instance, the system can create a chart that shows feedback trends for a specific course over the last five years, as well as comparisons to overall departmental averages. By offering a range of comparison options, the system gives both the head of the department and course instructors flexibility in deciding which areas they want to emphasize or improve.

Focusing on specific areas would mean taking the processed feedback and using it to revise or refine the course concept. At this stage, the BPMN diagram mirrors the final steps of the existing AS-IS process diagrams. If the feedback suggests only contains minor adjustments, the course instructor may implement these changes independently. For more significant revisions, however, the instructor would need to consult with the head of the department, providing suggestions and ensuring that any proposed changes are feasible.

A key advantage of the new AI system is that it not only provides comparative charts and diagrams, but also suggests specific improvements to the course based on the collected feedback. The system includes a summary paragraph highlighting what is currently effective, which aspects should be adjusted, and – most importantly – how these changes could be implemented. These recommendations serve as supportive insights for course design, allowing instructors to use or adapt them as they see fit.

In summary, the primary objective of this TO-BE subprocess is to implement an AI-based information system that not only collects and compares feedback across various contexts but also suggests ways to enhance the teaching process. Comparisons could include feedback from previous years for the same course, data from other courses within the department, and the average feedback from students across the department. Standardizing the feedback forms across all courses is crucial for achieving this level of comparability and ensuring consistent data.

With this system, feedback becomes more objective and representative, preventing individual, outspoken opinions from disproportionately influencing the overall impression. In the current AS-IS process, satisfied students are often less likely to provide feedback, while critical voices are more prominent, which can lead to feedback that may not reflect the majority's opinion. In the TO-BE scenario, all students are asked to provide feedback, resulting in a more representative dataset.

Additionally, the ability to compare feedback across different courses and over multiple years allows departments to track progress and evaluate the impact of new course concepts or changes. This insight makes it easier to see whether adjustments are achieving the desired outcomes. Overall, the new AI feedback system offers an additional, more comparable, and objective perspective on student feedback. Since the current feedback methods will remain in place, this AI-driven system acts as an extra layer, ensuring that no existing feedback options are lost.

Most importantly, however, the system goes beyond comparison by actively recommending improvements. This added functionality helps streamline the feedback process into actionable insights, enabling instructors to make targeted adjustments more effectively. By providing tailored suggestions, the AI system empowers educators to continuously refine their courses, directly addressing areas that may benefit from enhancement.

4.2 Assignment Grading process

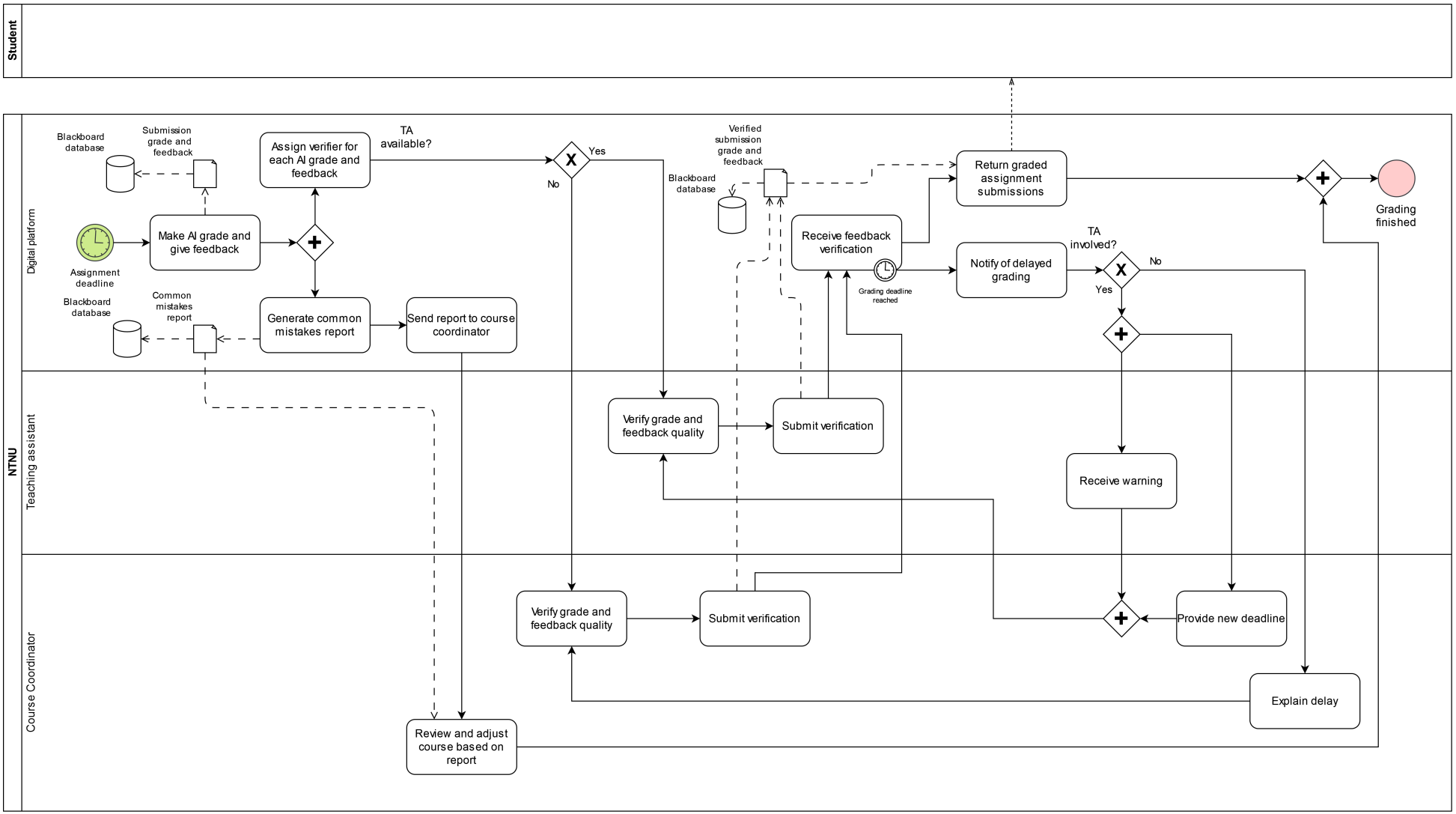

Figure 8: Assignment grading process to-be BPMN diagram.

Figure 8 for the assignment grading process integrates AI with digital platforms to enhance grading efficiency and improve feedback quality. This model addresses the significant challenges of manual grading in large academic settings, where the time required for evaluations can impact the quality of student feedback.

AI-driven grading utilizes machine learning and natural language processing (NLP) algorithms to assess student submissions based on predefined grading criteria aligned with educational objectives. This automation allows TAs and course coordinators to focus on instructional support rather than repetitive grading tasks. The system provides personalized, actionable feedback that helps students understand their strengths and areas for improvement, contributing to enhanced learning outcomes.

A key innovation of Figure 8 is its approach to error analysis. As the AI processes submissions, it identifies common errors and generates a comprehensive report highlighting these issues. This report enables educators to make data-driven adjustments to course content and teaching strategies. If many students struggle with a specific concept, the course coordinator can implement targeted measures, such as modifying lecture content or creating supplemental resources.

To ensure the accuracy and quality of feedback, the model incorporates a human verification phase. Teaching assistants or designated verifiers review the AI-generated grades and feedback to confirm their relevance and alignment with pedagogical standards. This step addresses potential misinterpretations by the AI and ensures that students receive constructive and high-quality feedback.

By combining AI efficiency with human oversight, the TO-BE model creates a balanced grading approach that enhances the quality of student assessments. The model not only streamlines grading processes but also empowers educators to refine their teaching strategies based on actionable insights derived from student performance data.

In summary, the TO-BE model represents a transformative solution for grading and feedback in academic settings. By leveraging AI technology and human verification, the model enhances grading efficiency, provides insightful error analysis, and ensures high-quality feedback, ultimately enriching the learning experience.

5 From AS-IS to TO-BE: Implementation Plan

5.1 AI System in Feedback Process

5.1.1 Implementation Process

To implement the AI feedback system within the existing feedback process, the first step is to clearly define the objectives and scope of the implementation. This involves establishing the specific goals, such as standardizing feedback forms across all courses and generating actionable insights from the collected data. Identifying the initial courses and departments for rollout is also crucial at this stage. Next, the development of the AI system can commence. This includes defining technical specifications for the system, ensuring it has the capacity to collect, store, and analyze feedback data effectively. Additionally, the AI model should be trained to recognize patterns and suggest improvements based on the feedback it processes. With the AI system developed, the next step is to integrate it into the existing feedback process.

Once the AI system is ready, the design of the standardized feedback form should be finalized in collaboration with the head of the department. This form must include both quantitative and qualitative questions to capture comprehensive student feedback.

To ensure smooth implementation of the AI system, a pilot testing phase should be initiated. Selecting a few courses for this pilot will allow for controlled testing and the collection of feedback from both instructors and students regarding the system's functionality and usability.
Following the pilot phase, the results should be analyzed to identify trends and areas for improvement. Any necessary adjustments to the AI system or the feedback process can be made based on this analysis. Once adjustments are complete, full rollout can commence. This involves conducting training sessions for instructors and department heads to ensure they are familiar with the AI system and how to interpret the generated feedback reports. After training, the AI feedback system can be officially launched across all identified courses and departments.

After implementation, ongoing monitoring of the system's performance is essential. This allows for continuous refinement based on user feedback and educational needs. Regular assessments of the impact of the AI feedback system on teaching effectiveness and student satisfaction will provide insights for further improvements. Overall, the successful implementation of the AI feedback system within the feedback process hinges on careful planning, testing, and continuous evaluation to ensure it effectively enhances the teaching and learning experience.

5.1.2 Risks

AI learning:
One of the greatest challenges for the AI system will be the learning process. To suggest changes in the course based on feedback, the system requires extensive data and time to learn this behavior. The issue immediately after the system's implementation is that

there are no comparable data from previous years or other courses to analyze the feedback against. Consequently, the initial years of comparison will not be as meaningful or substantial as they will be after several years of usage.

Nonetheless, it is crucial for the system to be used continuously, as it cannot gather data without these initial years.

One possible way to address this issue is to utilize data from previous years, such as feedback reports from reference groups. However, to make this data useful, the reports must be transformed into the format that the AI system uses for data processing (i.e., questions with rating responses). Additionally, the system requires information on the changes made by course instructors after receiving feedback in prior years. If all this information is available and formatted appropriately, the learning process will proceed much more swiftly.

Security and Trust:
Even though the system will use a lot of relevant data for its training and output, security is not a problem. The data used is just forms and statistics from a course, so in general it is not confidential. It is truethough, that students may want to keep anonymity of their submitted feedback, so that should be ensured.

That is also related with the trust that the students must deposit on the system, and how much are students willing to give feedback. In case it were marked as a mandatory activity for everyone, there is a risk of them not being completely honest because they do not want to be bothered with thinking through the questions. Feeding the system with fake data is a really big issue because it will make the system useless. But also, making it optional could end up with not having enough data to give valuable suggestions and analysis.

Frequency of change and Social behavior:
A problem which already existed before the implementation of this system is how much change should really be applied each year. Making a lot of changes just from one year's feedback might lead to more problems or not really improving anything. Every generation of students is different, and there are many external influences every year, so the teachers must ensure the AI model is well trained before following the change suggestions. Also, making many changes at the same time might not let the AI system to really get the cause-consequence flow.

And lastly, the opposite can also happen. Teachers might not want to try new things all the time, and students might feel unheard or as if giving feedback will not make any difference. This is also a cultural and sociological issue that has been there from the beginning of educational improvement, but the system might help fixing it as it makes the whole process easier, more anonymous and more comfortable.

5.2 AI System in Grading Process

Currently, only simple, multiple choice assignments are able to be graded reliably and correctly by AI, as well as certain types of assignments that have an expected output, such as certain types of programming assignments. While this already lessens the workload required in order to grade assignments, the ideal to-be scenario will be that a more advanced AI is able to grade any type of assignment reliably, only requiring human verification, with little to no corrections needed to the AI grading.

While incorporating AI into the assignment grading process for non-multiple choice assignments will give substantial benefits to both the teaching staff and the students, the process to go from the current as-is situation to the idealised to-be situation described in subsection 4.2 will involve several intermediate steps, which will be covered in subsubsection 5.2.1. After the implementation process is described, some of the associated risks and factors that may impede this process will be discussed in subsubsection 5.2.2.

5.2.1 Implementation Process

In order to implement an AI into the grading process for more types of assignments, and in order for it to learn how to give constructive feedback to the students for the assignments they submit, it will first need suitable training data. This can be collected by implementing a mechanism into the digital platform used by each course. The mechanism should collect the assignment grades and feedback, along with the original assignments, and preprocess this, such that it can be used to effectively train an AI model for the grading and feedback process. In the case that an assignment involves a non-written deliverable, such as a visual or aural component, additional AI models may be required to be developed for each of these. Collecting this large amount of initial training data is crucial to develop a good AI model.

Once sufficient initial training data has been collected, AI models may be trained using these. The trained models may be evaluated on an annual basis, to determine by the course coordinator if they are at a stage that is ready to be used during the grading process during that year's course. Once deemed ready for initial roll-out, the models may initially only be used as a tool to give TAs suggestions for points to give feedback, rather than to assign grades, all while still collecting more training data for grading. This gradual introduction of AI models in the assignment grading process ensures that the output of the AI model is consistent with that of TAs.

Once the AI models are consistently able to grade assignments and give feedback at a consistency and quality similar to or exceeding those of TAs, the models may be used as part of the grading and assignment feedback process, with the workload of TAs being reduced to only verify the output of the AI models.

The implementation process of the AI generated common mistakes report is will be similar to that of the assignment grading. Once sufficient training data has been collected, the AI model's reports may be evaluated by the TAs and the course coordinator. If it is

found to sufficiently cover the mistakes done by the students, it may eventually generate the reports for the course coordinator, without the oversight of TAs, with the course coordinator adapting the course according to the report.

5.2.2 Risks

Data collection

In the context of integrating AI into any information system, as is evident from initial observations, data collection, management, and analysis are essential for building an effective and reliable system model. Specifically, in the grading process, historical data from previous years can be utilized to train the AI, enhancing predictive accuracy and consistency.

However, it is important to note that the data discussed must be in a digital format, a requirement not always met within academic departments or institutions, where ICT infrastructure may vary significantly. As a solution to this limitation, an initial data collection phase may be necessary, including the digitization of previously paper-based records and grading annotations.

Ensuring both the volume and quality of data is thus fundamental to successfully embedding AI within an institution's ICT framework, thereby aligning learning management systems with academic goals and enabling reliable, AI-driven improvements in support of learning.

Security

The integration of AI within the grading process aims to accelerate the correction and evaluation procedures for instructors, providing prompt feedback to students. Implementing AI in this context necessitates stringent data security measures to protect students' sensitive information. The primary goal of AI in grading should be to evaluate student performance based solely on the submitted content, devoid of any personal identifiers. Ensuring this requires that data remains anonymized both during the training phase and in the inference phase, where assessments are conducted. Anonymization and pseudonymization techniques must be employed rigorously to maintain privacy, thus aligning with both data protection regulations and institutional security policies.

Limited assignment types

While the idealised to-be scenario involves the AI model being able to grade and give feedback to any type of assignment, some assignment types may be more difficult for the AI to evaluate. More technical assignments that require a more in-depth understanding of a topic is something that even advanced current LLM models have difficulties with. Non-written assignments that have a visual component, an aural component, or that involve several mediums may be especially difficult for an AI model to grade. An assignment with a less rigid form of correct answer may also be especially difficult for an AI to consistently grade.

Some assignment types may need more time before an AI model is ready to use, and some may always require a human to grade them. Whether or not this is the case will have to be decided by the course coordinator for each course.

Double Effort

The integration of AI in grading and feedback processes at NTNU introduces a potential risk of double effort for TAs and professors, particularly during the transitional phase. As educators adjust to AI-assisted systems, they must not only continue with traditional grading methods to ensure accuracy and continuity while the AI algorithms undergo refinement, but they also have to correct the AI's suggestions. This means that, in addition to grading student assignments and providing feedback, they must also assess and rectify the AI's recommendations to ensure they align with educational standards and provide meaningful guidance for students.

This parallel workload may lead to significant time management challenges and risks of burnout. For instance, educators are tasked with manually verifying AI outputs to uphold grading standards and fairness, effectively doubling their workload, especially in large classes.

To alleviate this burden, NTNU could implement phased timelines and pilot programs to gradually introduce AI systems, allowing educators a smoother transition. Furthermore, adding support staff for AI verification and offering training sessions can ease the adaptation process, helping minimize redundancy while ensuring the system's reliability.

Resistance of Teachers and Students

The transition to AI-driven grading and feedback is likely to meet resistance from both teachers and students, as it disrupts traditional academic roles and raises concerns regarding reliability and autonomy.

Teachers may feel that AI integration threatens their pedagogical authority, potentially reducing grading to a mechanical process and diluting the personalized feedback they currently provide. Students, in turn, might question the AI's capacity to fairly and accurately evaluate their work, perceiving it as impersonal or prone to errors.

To address these concerns, NTNU can emphasize transparency within AI algorithms, clarifying how assessments are conducted and verified for both educators and students. Additionally, launching pilot programs that incorporate feedback from both groups can help refine AI grading mechanisms, build trust, and support a gradual, collaborative adaptation to this evolving educational tool.

6 Conclusion

The project was developed through the time span of a month and a half. The team made regular meetings throughout the development and stayed in contact using multiple platforms to ensure that everyone took part on the major decisions. Then, some tasks were divided in smaller groups of teammates who worked in parallel, but always keeping communication so that everyone knew how the development of each part was going. In the last meetings, we shared and discussed our tasks, commented on some issues and fixed the problems we could find along the way, until the project was finished successfully.

The project has been focused on two basic subprocesses, in order to find a proper solution for them. Both use AI, so all the work, issues and risks related to it come into scene. Still, other problems at the beginning of the project design were taken into consideration, and there are many areas in which AI can be very useful to implement throughout the teaching process. So, in general, we can conclude that using generative AI and ICTs, and implementing the solutions provided for the chosen problems, could improve the overall efficiency and contentment of both the instructors and students.

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