

The Quality of Feedback and Its Influence on the Preparation of the Future Teacher

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Abstract

Quality education is created by quality teachers. For a teacher to be able to carry out a quality lesson with the pupils, they need to think over and prepare it in advance. Preparing for a lesson in writing can be a valuable and practical tool for a teacher. Learning to prepare quality preparations for lessons while studying at a university can significantly impact on the professional practice of the teacher. In the article, we focused on observing the influence of the feedback provided to preservice teachers on their developed preparations for physics lessons. We conducted a survey with two samples of physics preservice teachers who were creating written preparations for physics lessons and then giving them feedback. We quantified the created student preparations using the evaluation rubric and statistically processed the results obtained. We found a statistically significant increase in point scores in the first sample. In the second sample, the process was repeated, so two feedbacks were given to the students. In both groups, we noticed a statistically significant improvement in the quality of the created preparation for the lesson after the feedback was provided after the first preparation. However, after providing feedback on further preparation, there was no such significant improvement.

Introduction

During their studies, students of physics teaching should acquire basic didactic knowledge including the planning and organisation of lessons and ways of inducing, implementing, and managing the cognitive and learning processes of pupils in physics (Janovič, 1999). Among a physics teacher's essential competencies and skills, Janovič (1999) mentions the ability to draw up detailed written preparations for lessons and implement them at the required level. We consider it necessary for students to learn how to make the highest quality preparations and to be able to formulate them appropriately in written form. We want to verify that the established requirements for physics teaching students are also implemented in practice. In that case, this can significantly impact their future profession as a physics teacher, the quality of education, and conducting high-quality physics lessons for pupils.

In the learning process and process of improving the quality of student preparations for physics lessons, properly provided feedback can help. We will present the provision of feedback based on our proposed evaluation tool – the evaluation rubric. Demkanin (2018) argues that giving feedback to students is one of the most important and often the most challenging tasks of a teacher.

In the article, we present the results of a survey that we conducted with two samples of physics preservice teachers. The survey aimed to find out whether written preparations for physics lessons of future physics teachers are improving due to the feedback provided. First, we verified the current abilities of students regarding the creation of written preparations. We quantified this state of affairs using the evaluation rubric (supplementary material). In the next

step, we provided feedback to students. We repeated this process. That is, the students created new preparations for physics lessons, and we assigned them a point score. We then statistically processed the results.

Feedback in the context of preparations for a physics lesson

Every good teacher entering the classroom should have some idea and plan for implementing the upcoming lesson in advance. The reasons for the usefulness of preparing for the lesson are given by Jensen (2001): In preparation, the teacher defines the objectives of the lesson, determines how much time they want to devote to each part of the lesson, writes down a list and order of activities that he wants to carry out with the pupils. When creating tests and examinations, preparations are a valuable resource because they are a reminder of what topics the teacher and the pupils dealt with. If the teacher teaches the same course again, thanks to the preparations, they can avoid mistakes in advance and learn from previous experience. A well-prepared lesson plan is essential for a substitute teacher who is expected to teach what has been planned for the day. Jensen (2001) further adds that preparing for a lesson is a really useful tool that can serve as a document reflecting our philosophy of teaching, the goals of working with students, or as a manual based on textbooks that were then up-to-date.

We can conclude that lesson planning is an integral part of the profession of a teacher. The formation of preparations is one of the main tasks of the teacher. Lessons must be planned appropriately, and that teaching based on improvisation, uncontrollable activism, or routine must be avoided. Gallego (2007)

Activity of the teacher can be divided into three parts: before the lesson, during the lesson and after the lesson. Before lesson, the teacher is engaged in the planning of the teaching process, the preparation of teaching equipment and the suitability of the classroom. During the lesson it is the actual implementation and execution of educational activities. After the lesson there should be an evaluation and assessment of the completed preparation (Haynes, 2010). We will focus on the preparation of the teacher before the lesson.

It might seem that this is a one-way linear process, however, with each step it is necessary to look both forwards and backwards. This means that when planning a lesson, it is necessary to think in advance about the assessment, target requirements and so on. After each planned, implemented and evaluated preparation, the teacher is better informed, has acquired new experiences, findings and information about the topic, students, or the method of teaching. Based on these experiences, the teacher can gradually improve their preparations and the entire educational process.

In the process of improving in the formation of preparations for lessons, it is helpful to receive feedback. According to Fink (2005), feedback should be frequent, immediate, discriminatory, and loving.

To compile a curriculum, according to Fink (2005), we need to identify the following points:

1. Identify critical situational factors. – Situational factors represent, for example, the specific context of a teaching situation. We are interested in the number of pupils in the class, how long the teaching units are, how often they should be implemented, what the form of teaching will be, face-to-face or online, and whether the lesson will be in the classroom or the laboratory, and so on. Further, the general context of the

educational situation considers the school's educational plan and the value system. The nature of the subject considers the ratio of theoretical and practical, convergent, and divergent ways of teaching. The characteristics of pupils consider the social and health conditions of pupils, the focus on the professional goal, previous knowledge and experience, preferred learning styles. The characteristics of the teacher are focused on values and beliefs, the strengths and weaknesses of the teacher, and the level of knowledge about the subject.

2. Set yourself:

- a) Learning objectives and answering questions: What should pupils learn in a given course or subject? What should distinguish students who have completed a given course from those who have not?
- b) Educational activities with the help of which the teacher achieves the set educational goals. In education, the active attitude of students should prevail over the passive one. Students will acquire knowledge better if they actively participate in the teaching process. It can include various activities, debates, simulations, solving group problems, activities with equipment and materials, and others.
- c) Providing feedback and assessment is necessary so that students and the teacher know if the set learning goals have been met.

3. Make sure that these key components support and reinforce each other.

Fink (2005) recognizes two types of evaluation: auditive assessment and educational assessment. Figure 1 illustrates the process of both types of evaluation. Assessment is one of the ways of feedback for pupils.

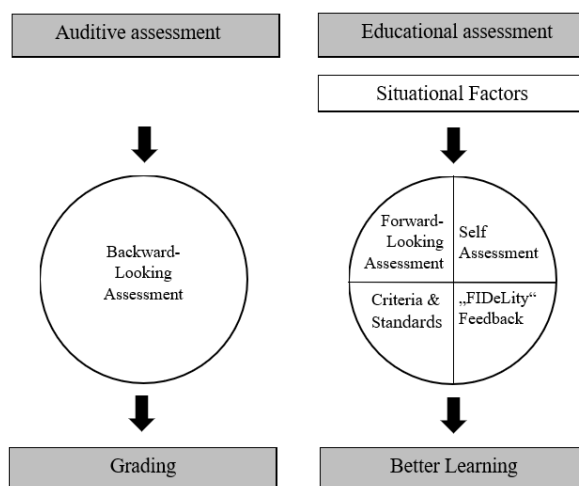


Figure 1: Two types of assessment by Fink (2005)

The auditive assessment is based on the determination of the level of knowledge and leads to classification, the award of a grade or other numerical evaluation. We could also call it a traditional or more frequently occurring evaluation. The retrospective assessment is designed to verify that students have learned all the expected knowledge.

Educational assessment helps pupils in the learning process. It considers input situational factors. The forward-looking assessment is designed to determine whether students are ready to use the knowledge even after the end of the current learning period. The tasks are based on real situations. It is necessary to clearly define the norms and criteria for what kind of work is considered good, acceptable, or exceptional. It is also essential that opportunities are created for pupil self-assessment. Later in real life, students may often encounter situations where they will have to assess their performance for themselves. Fink (2005) designs the mnemonic device "FIDeLity." The feedback that the teacher gives should be as follows:

- **Frequent:** The teacher should provide feedback as often as possible.
- **Immediate:** The teacher should provide feedback to students as soon as possible.
- **Discriminating:** Students should be clearly given guidance on the differences between poor, acceptable and exceptional work.
- **Loving:** Feedback should be provided empathetically and affectionately.

Your own self-reflection can also have a significant impact. Hiscox, Papakonstantinou and Rayner (2022) conducted research and report that written reflection had a significant positive impact on students' self-efficacy in their oral presentation and communication skills.

As part of the survey, which we will describe in more detail below, we provided feedback to physics teaching students on the created preparations for physics lessons based on the evaluation section we created (Gejdošová & Velmovská, 2022) inspired by several authors (Arribas et al., 2019; Fink, 2005; Hubeňáková, 2016; Haynes, 2010; Jensen, 2001; Liew et al., 2019).

Evaluation rubric

According to Davidson (2014), the evaluation rubric is a table that describes individual performance levels based on a particular criterion of interest. Also, well-established headings should encourage the use of sound evaluative judgement and the use of common language and commonly used concepts, which can increase consistency among evaluators (Davidson 2014).

An evaluation rubric is a suitable tool for evaluating student work and any qualitative works, tasks, or tasks drawn up, such as student preparations for physics lessons.

To evaluate student preparations for a physics lesson, we have created an evaluation tool – an evaluation rubric that defines the evaluation criteria. (Gejdošová & Velmovská, 2022) The process of creating the evaluation rubric consisted of several steps. In the first phase, we concentrated on the study of literature focused on lesson planning and the creation of evaluation headings. We were inspired by several authors dealing with evaluation sections (Arribas et al., 2019; Hubeňáková, 2016; Liew et al., 2019) implemented in the educational process. When creating the content and key elements of the evaluation rubric, called the categories that we will evaluate in the presented preparation, we relied on the works of various authors (Fink, 2005; Hynes, 2010; Jensen, 2001). Subsequently, we created the first draft of the evaluation rubric. It was necessary to verify the reliability of the assessment heading. We chose the method of assessment of the evaluation rubric by several external evaluators (inter-rater reliability) (Gavora, 2013). Using the rubric compiled by us, evaluators (experts in the field) assessed the preparations for the lesson compiled by preservice teachers. Available experts in the field at the university were selected as evaluators. Should the evaluators achieve a high level of

agreement in the evaluation, we can declare the rubric created by us for evaluating the preparations to be reliable. We have implemented the experts' recommendations in the evaluation rubric and modified it several times if the evaluators achieved a high level of agreement in the evaluation.

The evaluation rubric we compiled contains 15 criteria for evaluating preparations for a physics lesson. Furthermore, it is aimed at preparations in written form, which will be created by students – future physics teachers. We added a point score to each criterion and detailed each grade. The maximum points earned for each criterion are 3 points, except for the year/class criterion, where a maximum of 1 point can be obtained. So, the maximum number of points a student could receive for the created preparation for the lesson is 43 points.

The evaluation rubric compiled by us consists of the following categories:

- compliance with the state educational program
- time schedule
- year/class
- teaching goals
- previous knowledge of students
- teaching forms
- teaching methods
- equipment
- questions and tasks
- empirical methods of cognition:
 - choosing an empirical method
 - the procedure of the empirical method
 - conclusion of the empirical method
- conclusion of the lesson
- physical correctness
- general impression

We expect that students will create preparations for lessons based on active research of students in the form of experiments and empirical methods. Soonjana and Kaewkhong (2022) found in a survey that science teachers need effective training in order to develop inquiry-based science teaching.

Student preparations for the lesson

Part of the university preparation of physics preservice teachers is also the creation of preparations for physics lessons. It is necessary for students to learn how to make the highest quality preparations and to be able to formulate them appropriately in written form. By student preparation for a physics lesson, we mean a written preparation that is concise, but contains all the essential parts – categories that are characterised in the evaluation rubric. The created preparation should be written unambiguously so that, according to it, another physics teacher can also teach the lesson.

We require the created preparations for physics lessons from physics preservice teachers in sufficient detail in written form. If we want a comprehensive view of the student's proposed lesson and subsequently be able to provide feedback, they must mark in written form even the parts that an experienced teacher does not need. It is not enough for them to think them through in advance.

We want students to learn how to create quality preparations. We realise that a teacher with several years of experience does not need to create written preparations for lessons in such a detailed form as we expect them from students of physics teaching. For this reason, the evaluation rubric and the provision of feedback are presented by us only aimed at student preparations for physics lessons.

Providing feedback

In providing feedback, we were inspired by several authors. Hattie and Timperley (2007) understand feedback in the context of teaching as information related to the person's performance or understanding provided by a teacher, peer, book, or self.

In providing feedback, Hattie and Timperley (2007) set three questions to achieve effective teaching: Where am I going?, How am I going? Where to next?

However, answering the three above questions does not yet tell us how we will achieve the set goal, so we will extend this model with another question, "How will I achieve the set goal?".

When providing feedback to physics preservice teachers on the created preparations for lessons, it is helpful to set a goal, define what we want students to achieve and what the feedback is supposed to help them with. In our case, we have defined that we want physics preservice teachers to improve their abilities and skills in teaching physics lessons.

We can formulate the second question, "How am I doing?" more broadly, "What state am I currently in about the given goal?" In search of answers, we carried out an observation of preservice teachers when teaching pupils. We analysed their outputs from several perspectives to determine their current state of teaching skills and abilities.

We decided to achieve the set goal with the help of written preparations for physics lessons. Students create preparations for given topics, and we give them feedback after each preparation and observe if their preparations are gradually improving. When providing feedback on class preparation, we again answer the above four questions. We determine the elements of ideal preparation and evaluate the currently created preparation of students through a point score. We expect to improve after the implementation of the provided feedback. We also expect to create better preparation compared to the previous one.

The answer to the fourth question "Where to next?" offers us several options for preservice teachers: to develop the habit of creating preparations for lessons (not necessarily in written form, but at least think through the lesson plan in detail), a deeper understanding of the meaning and usefulness of preparations, to reflect on their own preparations for classes, not to be afraid in the future to ask colleagues to reflect on the preparations and lessons taught.

Feedback does not have an effect its own. There must always be an educational context for the feedback. (Hattie & Timperley, 2007)

Using the evaluation rubric, we can determine the levels of the area under study and communicate the characteristics of the expected highest level, thereby providing quality feedback. Hubeňáková (2016)

Survey on the quality of preparation due to feedback

The survey we carried out with preservice teachers was to determine whether their written preparations for physics lessons improved due to the feedback provided. As providing feedback is a critical element in improving the quality of student output, feedback could also positively impact the written preparations for physics lessons created by future physics teachers.

Therefore, we established the following hypothesis, which we verified as part of the survey:

H: Students after providing feedback on the created preparation for the physics lesson get a higher point score than before providing feedback.

First, we needed to determine what quality preparations for physics lessons the students could prepare. We then gave them feedback and gave them a new assignment to create further preparation for another physics lesson. We repeated this whole process several times.

Research sample

The survey comprised two research samples. The first research sample consisted of 18 students in the first year of part-time additional pedagogical and extension studies. These teachers want to obtain a qualification for teaching another apprenticeship subject – physics. We evaluated 18 students' preparations for various primary or secondary school physics topics.

The second research sample consisted of students who, in a year, will be graduates of teachers of physics. The entire year was involved in the research, which equates to 10 students.

Methods

First, we surveyed with 18 students of additional pedagogical studies. As part of the course, we instructed students in advance to create preparation for the lesson. Their task was to create a written preparation for a physics lesson for any grade and topic in elementary or high school. We warned them not to forget the important parts that the preparation for the lesson should contain. However, we did not show the students any sample preparation, nor were they familiar with the structure of such preparation. Based on their preparation for the lesson, any physics teacher should be able to conduct the lesson and achieve the desired goals.

Subsequently, we studied and evaluated 18 student preparations. Students chose different physics topics for elementary or high school. We saw significant differences in the form of the prepared preparation. Some students wrote a brief structured text within a single doc/pdf file. Some created a presentation for screening for pupils in addition to the basic file. Others also added a worksheet for the pupil or a test for repetition, or tests for several different groups. In some cases, six ensembles belonged to one student's preparation.

For each student's preparation, we assigned a score according to the criteria in the compiled evaluation rubric. According to this evaluation rubric, we could quantify individual student preparations. Given that we explicitly told students to make a lesson plan that would include an experimental activity, we were able to make full use of the evaluation rubric (supplementary material) for assessment. However, we consider the evaluation rubric suitable for evaluation of theoretical lessons as well (without representation of experimental activity), because then we do not take into account the evaluation of the experimental part, and the maximum number of points for such preparation will therefore be lower, and we will convert the point score into percentages. For each student preparation, we have prepared in writing feedback reflecting the

criteria and evaluations from the evaluation rubric. If students received less than the maximum points for any category, we wrote to them according to the evaluation rubric what the shortcomings were. In some cases, we just drew attention to the problem parts, at other times we also suggested improvements. Students also presented interesting ideas for activities with students, for which we gave them positive feedback. They were positively rated for the categories in which they received the whole number of points.

Subsequently, after providing feedback, we sent students a new assignment to create another written preparation for a physics lesson. We rated these preparations again and were able to compare the point scores. The maximum number of points that students could obtain was 43.

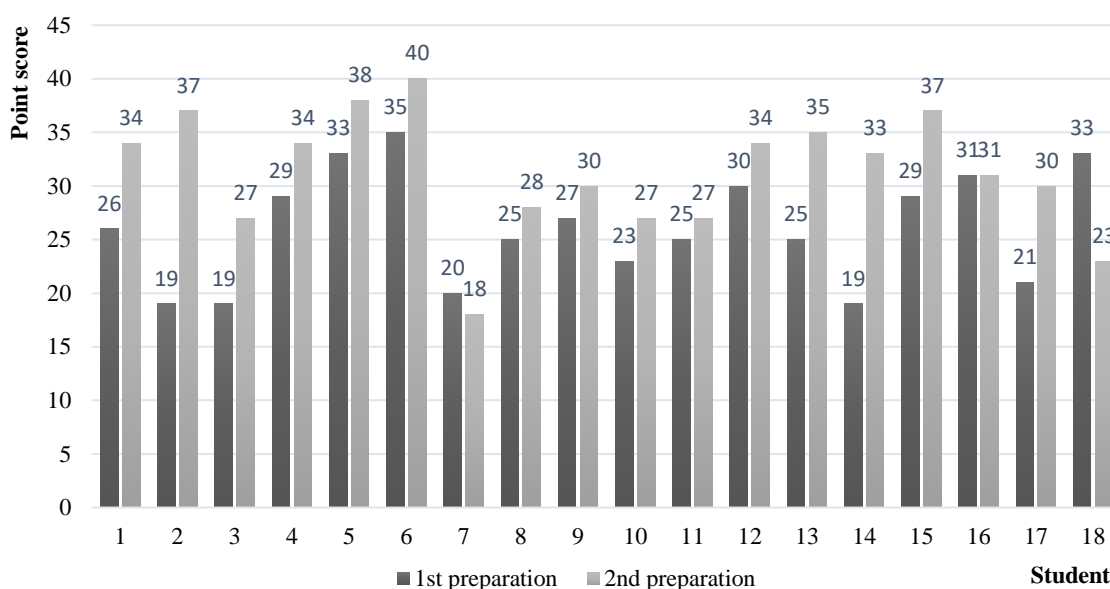
We proceeded similarly with the second research sample but created preparations for physics lessons on predetermined topics and for the specified year of pupils. With this research sample, we repeated the process several times. Each student created a total of 3 different preparations for the lessons, and we gave them feedback after each.

Ethics approval

The conducted survey was guided by the ethical guidelines for educational research established by internal regulation no. 23/2021 of the Comenius University in Bratislava (Univerzita Komenského v Bratislave, 2021). The survey sample was adult university students who participated in the survey voluntarily, and their anonymity was preserved. Funding for the survey was obtained from a university grant to support young researchers. The responsibility towards the grant was fulfilled through financial management and productive, responsible, and systematic work. All articles and ideas of other authors have been properly cited, and authors' rights has been respected.

Research findings

Graph 1 below compares the point scores of individual students from the first research sample before and after providing feedback.

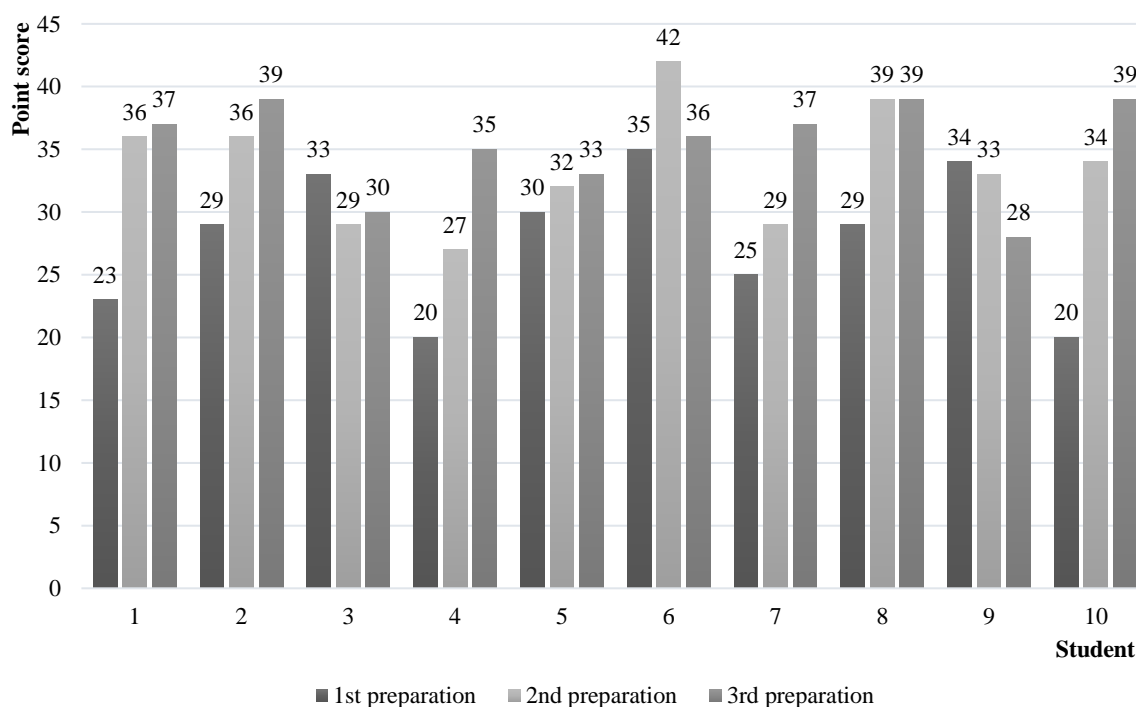


Graph 1: First sample. Point evaluation of the 1st and 2nd preparation for the physics lesson

If we look at the scores of students individually, then for most, there is an increase in the point score. In two cases, there was a decrease in the points obtained, which we explain by the insufficient focus of the student on the task given. Expected performances are listed in the evaluation rubric in the supplementary material. The average point score of the first lesson preparation is 26.1 and of the second lesson preparation is 31.3. The average point score increased after providing feedback.

We also statistically compared the point scores that the students obtained for the 1st and 2nd preparations for the lesson. When verifying hypothesis H, we established the null hypothesis H₀: After providing feedback on the prepared preparation for the physics lesson, students get the same point score as before providing feedback. When verifying it, we compared two sets of data - the number of points students received for their preparations for lessons before and after providing feedback. First, we investigated whether we could consider the data distribution normal. Based on the Shapiro-Wilk normality test for the data sets belonging to the data sets with the first and second preparation ratings (all p-values > 0.05), we do not reject the null hypothesis of a normal distribution of the data. Therefore, we used a one-tailed paired Student's t-test to calculate the p-value. P-value = 0.001 < 0.05 means we reject hypothesis H₀ about the equality of mean values. We found that statistically better results were achieved by students who evaluated the second preparation. Therefore, we do not reject hypothesis H.

In graph two below, compare the point scores obtained by students of the second research sample. The students created three preparations for the lessons and received feedback after each.



Graph 2: Second sample. Point evaluation of the 1st, 2nd, and 3rd preparation for the physics lesson

The average point score obtained by the students for creating the first preparation for the lesson is 27.8, the second preparation is 33.7 and the third preparation is 35.3. After providing feedback, the average score of students increased.

We verified whether the increase in point score is statistically significant. Based on the Shapiro-Wilk normality test for the data sets belonging to the evaluation of individual preparations (all p-values > 0.05), we do not reject the null hypothesis of a normal data distribution. Therefore, we used a one-tailed paired Student's t-test to calculate p-values for individual combinations of evaluations of student preparation. P-values are presented in table 3. For the comparison of the first and second preparation, the p-value = $0.005 < 0.05$, so we reject the hypothesis H_0 about the equality of the mean values. In the statistical comparison of the second and third student preparations, the p-value was > 0.05 . In this case, we do not reject the H_0 hypothesis. There was no significant shift that would be statistically demonstrable.

Table 3: P-values, comparison of 1st, 2nd, and 3rd preparation for a physics lesson

Preparation	1st	2nd	3rd
1st		0.005	0.009
2nd			0.156

Providing feedback to students helps them create better preparation for physics lessons. The average point score for both research samples increased after each feedback. For the first sample, there was a statistically significant shift in the point score. In the case of the second sample, which included 10 students, there was a statistically significant shift after the first feedback, after the second feedback was provided, there was no statistically significant shift in the point score. Since the students did not have instructions in advance on what the preparation should contain, there was a significant improvement after the first feedback was provided. The second student preparation was significantly better than the first. In the third preparation, therefore, we could no longer expect a significant improvement, even if, based on a comparison of the mean values, there was an improvement, although not statistically significant. In the second sample, the small number of students involved in the survey and statistical processing may also be a key factor. If we look at the students individually, most of them have seen an increase in their point scores. In the first sample of students, there was a decrease in the points obtained in two cases, which we explain by the insufficient focus of the student on the task given. The increase in point scores occurred in 16 students of the first research sample. In the second sample, there was a decrease in points in 4 created preparations, and in the remaining 16 preparations there was an increase in the point score.

Conclusion

In the paper, we presented a survey to determine the quality of preparations for physics lessons created by future physics teachers. Furthermore, subsequent identification of the influence of the feedback given to students on the created lesson preparations.

In theory, we relied on the work of many authors dealing with lesson preparation and feedback. We devoted a separate section to the evaluation rubric we created to evaluate student preparations. Thanks to the evaluation rubric, we assigned point scores to student preparations and were able to provide students with feedback reflecting the criteria of the evaluation rubric. Preparations for physics lessons were created by a physics preservice teacher at the university. Two research samples of future physics teachers were involved in the research. The first

research sample consisted of 18 students, the second research sample consisted of 10 physics preservice teachers. Students created written preparations for physics lessons on any or a given topic. According to the evaluation rubric, we evaluated the student preparations and assigned a score to each category. We provided written feedback to students that reflected both the positives and negatives of their work. We have repeated this process several times.

We have statistically processed the obtained results. In the first research sample, there was a statistically significant shift in the point score that students received after providing feedback. In the second research sample, students created three preparations for physics lessons. After providing the first feedback to students, there was also a statistically significant increase in point scores in this sample. After the second written preparation was made and further feedback was provided, there was no statistically significant shift in the point score. Even a small number of students in the second sample can be a limiting factor for statistical processing. Providing feedback to students helps them to create better preparation for physics lessons.

We plan to continue our research. We will repeat the process of providing feedback several more times and then observe the students in the physics lessons. We will verify whether students have also improved their teaching skills in physics classes thanks to the preparation improvement.

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Supplementary Material – Evaluation rubric

Criterion	3	2	1	0
Compliance with the state educational program	The content of the lesson is planned in accordance with the state education program in physics and fulfills the declared performance of the students.	The content of the lesson is planned in accordance with the state education program in physics and partly fulfills the declared performances of the students.	The content of the lesson is planned in minimal accordance with the state education program in physics and does not fulfill almost any of the declared performance of the students.	The content of the lesson is not in accordance with the state educational program in physics and does not meet the declared performance of the students.
Time schedule	The timetable of the lesson is given in the preparation. Activity lengths are appropriately estimated.	The timetable of the lesson is given in the preparation. The duration of some activities is not quite properly estimated.	The timetable of the lesson is given, but the time intervals for the activities are chosen inappropriately.	The timetable is not given.
Year/class	X	X	The correct year/class for which the preparation is intended is indicated. (If necessary, essential information about students in a particular class can be briefly stated.)	Year or class is not given or is given incorrectly.
Teaching goals	The learning goals are given at the beginning of the preparation. The goals are expressed by an active action verb and the conditions for their fulfillment are clear from the wording of the goals - performance conditions, and the performance standard is important so that the goals are measurable. The goals are focused on the student.	The learning goals are given in the preparation. The goals are focused on the student, but the performance conditions and performance standards are not completely clearly defined.	The learning goals are given in the preparation. The goals are not clearly defined or they written too extensively. Performance conditions are not clear, performance standard is not given. The goals are not focused on student.	Teaching goals are not given.
Previous knowledge of students	Topics or concepts that the students should already know and are related to the current topic are given at the beginning of the preparation.	In the beginning of the preparation, most of the key topics and concepts that the students should already master in connection with the current topic are presented. Or several topics are listed that are not necessarily related to the current topic of the lesson.	Topics or concepts that students should already master are listed very generally, or most of the key topics to which the current topic is connected are absent.	Previous knowledge is not mentioned in the preparation.
Teaching forms and methods	It is clear from the text what form of work is involved in the individual activities.	With most activities, it is clear what form of work the activity is to be carried out.	With most activities, it is not clear what form of work the activity should be implemented.	For any activity, it is not clear in which teaching form it should be implemented.
Teaching forms and methods	Teaching methods are appropriately chosen, they can effectively achieve appropriately set teaching goals.	In most activities, the teaching methods are appropriately chosen, and it is possible to achieve the set teaching goals with them.	In most activities, the teaching methods are not appropriately chosen in order to achieve the set teaching goals.	In all activities, the teaching methods are inappropriately chosen due to the effectiveness of achieving the set goals. Or it is not clear from the preparation what teaching methods are to be used.

	Equipment	At the beginning of the preparation, all the aids needed for the lesson are listed, which must be prepared in advance. The tools are defined precisely enough.	The necessary aids are listed in the preparation, but they are not listed at the beginning of the preparation or are not sufficiently specified.	Not all aids needed for the lesson are listed.	The necessary aids for the lesson are not listed.
	Questions and tasks	In the preparation, questions, tasks or activities are formulated, which the teacher will assign to the students during the lesson. The questions are appropriately worded, they are not suggestive or otherwise misleading. Tasks and activities are appropriately selected with regard to the grade/age of the students and with regard to the given topic and the fulfillment of the set goals. Brief correct answers are also given.	In the preparation, questions, tasks or activities are formulated, which the teacher will assign to the students during the lesson. Most of the questions, tasks and activities are well formulated, they are appropriately selected with regard to the grade/age of the students and with regard to the given topic and partially lead to the fulfillment of the set goals. Most correct answers are not listed.	In the preparation, most of the questions, tasks and activities are formulated inappropriately, they are not completely appropriately chosen with regard to the year/age of the students and with regard to the given topic. Questions, tasks and activities do not lead to sufficient fulfillment of the set goals. There are no correct answers.	There are no questions, tasks and activities intended for students in the preparation.
Empirical method of cognition	Choosing an empirical method	The experiment reflects the set goals of the lesson and is interesting for the students. Teaching methods are appropriately chosen, which stimulate students' research and the development of scientific work abilities.	The experiment sufficiently reflects the set goals of the lesson and is interesting for the students. The teaching methods are not chosen the most appropriate, but they still encourage students to research and develop scientific work skills.	The experiment reflects the set goals of the lesson very poorly. The experiment is not very interesting for the students. The teaching methods are rather inappropriately chosen, that is, they stimulate only minimal student research and the development of scientific work capabilities.	The experiment does not reflect the set goals of the lesson. The experiment is not engaging for the students. The chosen teaching methods do not stimulate students' research and do not lead to the development of scientific work skills.
	The procedure of the empirical method	In the preparation, a brief but clear implementation procedure is given.	The preparation contains a clear implementation procedure, but it is written unnecessarily extensively.	The implementation procedure is indicated in the preparation, but it is not completely clear. It is written with insufficient precision.	The preparation contains an ambiguous implementation procedure. Or the procedure is not indicated at all.
	Conclusion of the empirical method	Additional tasks or questions related to the empirical method are listed, which lead to the determination of the acquired knowledge.	There are several tasks or questions that partially follow the empirical method, which lead to a partial confirmation of the acquired knowledge.	A minimum of additional tasks or questions are listed. The tasks and questions are only marginally related to the empirical method and do not lead to almost any confirmation of the acquired knowledge.	There are no additional tasks or questions that would follow the empirical method and lead to the determination of the acquired knowledge.
	Conclusion of the lesson	At the end of the preparation, there is a summary pointing out the most important concepts, activities, or findings from the given lesson. It can be a speech by the teacher, questions asked by students or a summarizing activity.	At the end of the preparation, there is a summary pointing out almost all the most important concepts, activities, or findings from the given lesson.	The summary at the end of the lesson does not highlight the most important concepts, activities, or findings from the lesson.	At the end of the preparation, there is no summary pointing out the most important concepts, activities, or findings from the given lesson.

Physical correctness	Assignments of activities and tasks are physically correct. The individual parts of the lesson follow each other in a meaningful way. Correct professional terminology is used.	Most activity and task assignments are physically correct. Almost all parts of the preparation follow each other in a meaningful way. Indications of incorrect technical terminology.	Assignments of activities and tasks are partially correct. Most of the activities are not meaningfully organized, they do not follow each other. Distinctive signs of incorrect professional terminology.	Assignments of activities and tasks are physically incorrect. Activities do not follow each other. Correct professional terminology is not used.
General impression	The text is clear, clearly structured, appropriate use of images or graphs for better clarity. Use of appropriate vocabulary, without grammatical errors and without complex sentence constructions. The preparation does not contain redundant parts.	The text is clear and generally well structured. Adequate use of graphic elements. Use of appropriate vocabulary with few grammatical errors without unnecessarily complicated sentences. A minimum of redundant parts.	Clarity and structure are sufficient. Absence of images and charts or their inappropriate use. Distinctive signs of inappropriate vocabulary. Lots of grammatical errors or redundant parts.	The text is very poorly structured, seems chaotic or unclear. Absence of images and charts or their inappropriate use. Use of inappropriate vocabulary. Lots of grammatical errors or redundant parts.