

Preparing teachers of secondary vocational schools to teach a vocational subject

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Abstract

The paper focuses on the preparation of a secondary school teacher for a teaching unit, both the methodological and the content part of the preparation. Detailed attention is paid to the individual parts of the methodological preparation of teachers of vocational subjects because the preparation is often underestimated in practice. It is necessary to emphasize that the acquisition of students' competences during education depends in each subject on the way in which the content of the curriculum is conveyed to the students and what kind of tools the teacher uses for this purpose. This includes not only the formulation of educational and educational objectives but also the choice of the appropriate structure of the teaching unit, the choice of teaching methods, the use of relevant aids, special classrooms, etc. The general concept of teacher preparation for a teaching unit is linked by the authors with real examples from pedagogical practice.

Keywords:

Methodical teacher training
teacher content preparation
teaching methods
educational objectives
structure of the teaching unit

1 Introduction

The student is currently perceived in the learning process as an active object of education. Most of the work in the educational process must belong to the students. The teacher directs the teaching unit, determines student activities, and adjusts the pace. The teacher, in the role of educator, mediates learning, helps and guides students. The teacher is therefore a specialist who manages the learning situation and stimulates discussion, including among students. Instead of imparting ready-made knowledge to students, it creates the conditions for students to learn directly by doing. In other words, the teacher is, literally: an expert in moderating the discussion, leading the conversation, and is therefore responsible for the entire process. The teacher is responsible for professional legality, appropriateness of the level of students and for the content fulfilment of the planned educational objectives. A teacher is an expert in facilitating students' actual learning - that is, mastering the material to the required level. (Clark & Starr, 1981), (Hall & Meyer & Rose, 2012).

The teacher is also responsible for creating the environment, conditions and appropriate atmosphere for the student's optimal learning. In this context, it is important to emphasize that the teacher uses a wide range of teaching methods that bring more efficiency, more creativity and allow students to solve problems in different ways. A prerequisite for a successful educational process is a high degree of motivation and student activity.

Student activity is essential in both contact and non-contact learning, such as self-study or individual student training outside of school. In addition to imparting knowledge, it is also necessary to prepare students for the period after graduation, i.e., the transition to practice. To teach students how to learn, to teach them effective methods of how and where to obtain information, to teach them how to critically evaluate information and

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process it effectively and how to use it effectively. In this way, we lead students to the need to learn and motivate them for their further personal development. Emphasis is placed on the complexity of training in the cognitive, psychomotor and affective areas. Theoretical knowledge still remains the necessary foundation and starting point for skills in the cognitive, psychomotor and affective components of the student's personality. The previously mentioned components are also part of building students' attitudes. It is definitely necessary to reduce outdated and dysfunctional knowledge that unnecessarily burdens students' memory. (Abell & Appleton & Hanuscin, 2010).

2 Setting educational objectives - the teacher's method of preparation for the teaching unit

Defining the educational objective is one of the important components of teacher preparation for teaching, so that theoretical teaching or practical training is effective. The teacher is based on the educational objectives defined by the Framework Educational Programme (FEP) and the School Educational Programme (SEP) and implements them in the teaching process so that most students achieve them. The mentioned documents contain general objectives, vocational objectives, and comprehensive objectives. Unfortunately, not all students achieve the same result. Of course, the level of achievement of goals depends not only on the student's abilities but also on external circumstances. The objectives, therefore, express the ideal state of development towards which the student is moving. At the end of a teaching unit or thematic unit, the teacher has to use evaluation mechanisms and possibly revise the set objectives for the future (react or return to some topics, assign self-study, announce consultations). In some cases, it is necessary to initiate negotiations to change the SEP. (Petty, 2013), (Švec & Šimoník & Filová, 2003).

Teachers are more comfortable working with precisely formulated objectives in the SEP. Teacher preparation for teaching usually takes place in four steps (Sadecký, 2007), (Hall & Meyer & Rose, 2012):

- The teacher analyses educational documents. The teacher is based on the general curriculum, FEP, SEP, characteristics of the school subject and determines the desired educational objectives. It is true that all set objectives must be met. It is certainly not true that one objective equals one teaching unit.
- The teacher sets specific educational objectives for a particular teaching unit. The teacher breaks down the educational objectives into facts, concepts, relationships, principles, laws, procedures, activities. The teacher answers his/her own question: what knowledge, skills, and habits should students acquire in the lessons they study as part of their homework? What, to what extent and to what extent should students be able to know? What will be required in practice, under what conditions and to what depth. What positive changes should be made in the cognitive, psychomotor and affective domains?
- The teacher will plan the activities for students during the teaching unit that are necessary to bring them to the desired target level. It determines the teaching strategy, effective methods and forms of teaching. Determine what students will write out in a notebook, define how they will answer questions, work in a group, list, recognize, apply, perform. In this step, it is also necessary to determine the method and criteria for feedback. Diagnostics should be firmly linked to student activity throughout the teaching unit, not just at the end of a lesson or several lessons.
- At the end of his/her preparation, the teacher plans the scenario of the individual phases of the teaching unit, i.e. the teacher's activity, the organisation of the lesson, the classroom, the aids, and the didactic technique. He/she must not forget to think through the response in case the set objectives are not met. at the same time, it is necessary to think about how and when to verify whether the objectives have actually been met.

A common mistake, especially among novice teachers, is the idea that the teacher's preparation for a teaching unit is only in the actual transfer of the vocational content to the students. The teacher's preparation for teaching requires sufficient time and concentration, as well as the teaching itself.

3 Teacher preparation for teaching

The teacher's preparation for the teaching unit consists of educational content and methodological part. The content part of the preparation is the actual content of the curriculum that the teacher delivers to the students.

Methodological preparation is the way, the educational process by which the vocational content (content part) is transformed by the teacher to the students. In the next part of the paper, we will focus on methodological preparation, which is often underestimated by novice teachers. Teacher preparation for teaching should always be in written form. Table 1 outlines the possible content of a methodological preparation for a teaching unit. The form of the methodological preparation may vary in graphic form, but the individual components usually appear in each type of preparation. In the further part of the paper, we will focus on concrete methodological preparation for the subject of Engineering Technology. (Rys, 1979).

School Subject:	Specialization:
Class:	School year:
Lesson number:	<i>It is specified in the relevant thematic plan.</i>
Topic:	<i>It is specified in the relevant thematic plan.</i>
Learning objective:	<i>What are students supposed to learn, what are they supposed to develop?</i>
Methods and ways:	By what method will the goal be achieved? a) Educational content: outline of the curriculum, the definition of the core curriculum; b) methodology: methodological procedure, choice of teaching methods, didactic tools and techniques;
Organisation of the lesson:	What working conditions need to be ensured (organisation of space, tools)? What type of lesson organisation will best suit my methodological concept?
Specific didactic considerations:	a) How to activate students? (How to arouse their interest in cognition, in learning activities?) b) What will be the most difficult part of the curriculum for students? c) How to ensure time and content continuity in the curriculum (what do students already know about the topic, how do cross-curricular relationships apply)? d) How to ensure a differentiated and individual approach to learners? e) How to ensure students' working interaction? f) How to ensure their learning outcomes? g) Developing a system of questions and tasks (learning tasks) to present, practise and test students' mastery of the learning, including homework. h) Other considerations (e.g. hygiene, safety, etc.).
Educational possibilities:	How can I use the curriculum educationally, which aspects of personality will be affected by the topic or the chosen approach?
Time project of the lesson:	a) How much time can be devoted to each phase of the clock? b) How much time does it take to prepare students at home for the next lesson?

Table 1: Methodological preparation of the teacher for the teaching lesson (source: own)

4 Example of methodical preparation for the subject Engineering Technology

Preparation for teaching is based on the FEP “41-55-H/01 Repairer of agricultural machinery” and builds on SEP Repairer of agricultural machinery. Secondary education (ISCED 3) is completed with a certificate of apprenticeship (vocational certificate). The school subject Engineering Technology is taught in the first year for one hour per week. The total number of lessons in the school year is 32. The course syllabus includes the following topics:

- properties of technical materials
- testing of technical materials
- machining
- technical materials
- heat treatment of steel
- foundry
- hot metal forming
- welding, soldering, thermal cutting and bonding of materials
- surface treatment

The teacher analyses the FEP and SEP. The aim of the analysis is to create a long-term preparation, a thematic plan for the subject of Engineering Technology. (Sup, 1985), (Turek, 2010)

Methodical preparation for teaching (short-term preparation)

Field of study: Repairer of agricultural machinery

Teacher:

School year:

Teaching time:

22nd-27th lesson

Class: OZS 1; 1st year

Number of lessons: 5 - each lesson builds on the content of the previous lesson, each lesson includes at the beginning a repetition of the educational content already covered, an explanation of the new educational content and at the end a repetition of the currently presented educational content.

Name of the thematic unit and its definition: Hot metal forming - Part VIII. (The thematic unit is included at the end of the second half of the school year, the first year of study; cross-curricular links can be seen with the subjects of Technical documentation, Mechanical engineering, Agricultural machinery and equipment, Vocational training; the content of the subject, including the thematic unit, is the theoretical basis for the subject Vocational training and subsequently for real production practice)

Content of the thematic unit: Forming technology, Forging, Rolling, Drawing and extrusion, Pipe manufacturing. Each lesson of the thematic unit (Hot metal forming - Part VIII.) focuses on one technological process mentioned in the content of the thematic unit. The relevant part of the presentation (see below) and the work with the textbook are used to explain the new educational content. The 27th lesson is the last lesson in the sequence of the thematic unit and should be a summarizing lesson and a complement to the previous lessons. The diagnostic follows in the 28th lesson with a knowledge test (10-minute).

General objectives of the selected thematic unit:

- the student lists the materials used for hot metal forming; (target category - memorization)
- the student characterizes the principle of technological processes used in hot metal forming; (target category - understanding)
- the student interprets the necessary conditions of safety and hygiene in the working environment; (target category - application)
- the student applies the acquired knowledge when searching for examples of production (in lessons and homework); (target category - application)

Topic of the lesson (27th lesson): pipe manufacturing

Cognitive educational objectives:

- the student defines pipes by type of manufacturing and by the material; (target category - memorization)
- the student is able to explain the principle of the technological process of seam pipe manufacturing; (target category - understanding)
- the student characterizes the advantages and disadvantages of the seam pipe; (target category - understanding)
- the student derives conclusions from the perspective of occupational safety and hygiene in relation to the topic; (target category - understanding)
- the student is familiar with the notation of pipes in technical documentation; (target category - application)

Affective Educational Objectives:

To create conditions through Practical Examples so that students gradually understand the technical preparation and design production as a basis for the repair of agricultural machinery; Safety and hygiene at work in operations must be repeatedly emphasized in the Vocational Training as well as in theoretical vocational subjects.

Basic terms: semi-finished product for pipe production, extrusion, seamless pipe, seamless pipe.

Didactic tools: textbook, drawing on the whiteboard, teaching presentation, pipe cuttings, drawing documentation.

Classroom equipment: blackboard, whiteboard, data projector, PC.

Organisation of the lesson: frontal teaching (optimal number of students in the class 20, max 25); method of explanation, discussion, work from presentations with references to the textbook.

Special didactic aspects:

- Students will be motivated by concrete examples from technical practice.
- The explanation is supplemented by a presentation so that the students can better understand the content; for self-study, students will take important notes in their notebooks.
- Students' activities will be continuously checked (by questions) for their understanding of the educational content; students will be given a basic homework assignment.

Review questions from previous lessons (from 22 to 26):

1. What is produced by die forming? (Answer: forgings)
2. What technology is used to produce the wires? (Answer: drawing)
3. What is the product of forging? (Answer: forging)
4. On which devices is die forging performed? (Answer: hammer, press)
5. How is extrusion forming done? (Answer: the metal to be extruded is placed in the extrusion cavity and is forced out of the cavity by the extruder)
6. What products can be produced by extrusion? (Answer: hollow products, pipes, containers, packaging)

After the students' answers, the teacher returns to review the homework from the 26th Lesson - as a motivation to explain the new educational content.

Explanation of new educational content:

1. The development of pipe production, types of pipes.
2. Technological procedure of production of seam welded pipes.

Summary of the lessons and practice of basic terms:

- How do the properties of the pipes differ depending on the different types of production?
- What are the types of pipes? Describe according to the technological process of their manufacturing.
- Explain what the terms SEAM Pipe and SEAMless Pipe mean.

Homework assignment:

Find and write in your notebook where pipes are used in agricultural production.

Find and write in your notebook where pipes are used in the construction industry (the task is oriented to the everyday life of the students).

Phases of the lesson:

1) *Motivation*

Motivational interview and discussion on the topic - use of pipes in agricultural production, pipes used for agricultural machinery and equipment; pipes used in building industry. To build on the locksmith and repair practice with regard to small trades and other uses.

2) *Repetition*

Use knowledge from previous lessons of Technical documentation, Mechanical engineering, Agricultural machinery and equipment, Repair Technology, Vocational training; Since the students are in their first year of secondary school, i.e. after graduating from primary school, their own experience is not assumed.

3) *Explanation of new educational content*

We use previously acquired knowledge from the subject of Mechanical engineering, Agricultural machinery and equipment, Repair Technology, and Vocational training. Of course, we also use the motivational part of the teaching unit, according to the level of this knowledge (in continuity) we choose the next approach.

We will highlight the basic parts of pipe manufacturing, description of the technological process of pipe manufacturing - work with the textbook, and tutorial presentation. At the end of the lesson, students will watch a video that shows the whole industrial manufacturing of pipes.

Note-taking in the notebook: For subsequent home preparation and preparation for exams, students will make a simple note in a notebook. It is a summary of the whole thematic unit. This notation should be projected to students using a slide show. This notation should be projected to students using a slide show. Alternatively, the text can be printed out and handed out to the students to paste into their notebooks. From a didactic point of view, it is preferable for the students to write the text down - given that they are students of a vocational subject (ISCED 3). We recommend a follow-up check of the notebook by the teacher. Note-taking in the notebook only determines the requirements for knowledge of the curriculum; practical skills are taught in another subject.

Pipe manufacturing:

- a) seamless pipe production: rolling, drawing, extrusion;
- b) production of seamed pipe (or welded): It is made from strip steel that is heated in a gas furnace and passed through profiling rollers that twist the strip. Another pair of rollers press the pipe and its edges together so that they are butt welded. Classification of seamed pipes according to the weld: with longitudinal seam, with helical seam; Welding is carried out either by circular electrodes or by induction. Only rarely is welding with gas burners used.

Advantages of seamed pipes: they are cheaper than seamless -> production can be more easily automated.

Disadvantages of seamed pipe: - is its leakage at high pressure and at high temperatures. However, their quality is increasing with the development of new technologies.

Homework assignment:

Find and write in your notebook where pipes are used in agricultural production.

Find and write in your notebook where pipes are used in the building industry (a task directed to the practical life of the students).

4) *Closing of the lesson - summary of the educational content covered - repetition*

Summary of the material covered, essential information (in the form of a discussion with students - use of student activity - questions mentioned above), evaluation of student activity (praise, reminders - what they should focus on during home preparation, etc.). At the end of the lesson, the teacher announces a 10-minute test on the covered topics (Hot metal forming - Part VIII.). Due to the short time allocated for the course (1 lesson/week), it is chosen to verify the knowledge by means of a written test.

Time project of a classical teaching unit (45 min):

Introduction of the teaching unit (greeting, writing in the class book) – 2 min.
Motivation – 3 min
Repetition – 5 min
Explanation of new educational content – 20 min
writing notes in the notebook – 7 min
Homework assignment and its explanation – 3 min
End of the lesson – 5 min

Educational slide show - Annex 1 (the slide presentation is prepared for 5 lessons, thematic unit Hot metal forming - Part VIII.; it can be used not only to introduce individual technological procedures but also to summarize the educational content; it can be provided to students in electronic or printed form, as a learning resource for home preparation).

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5 Conclusion

In practice, real influences must be taken into account. There are many factors that affect the conditions of the teaching process, often negatively. It is necessary to take into regard the changing entry level of students admitted to secondary vocational schools. Students with different motivations for the same field of education and different special educational needs met in the classrooms. Many of the difficulties in teaching stem from the high number of students in classrooms and the limited capacity of schools to implement group teaching. These factors must be considered in the teacher's preparation for the lesson.

Important for teacher preparation for the teaching process are:

- what is the professional content
- what I want to achieve in educational content, to become aware of taxonomic categories.
- which teaching strategy to choose;
- how I will assess learning outcomes.

The teacher's preparation for the lesson presented by the authors has been verified in pedagogical practice. Especially the examples in the form of pipe cuttings and the demonstration of drawing documentation. The real aids increased the students' interest in the problem being taught. From the subsequent verification with a didactic test and an oral examination, we can say that the students understood the educational content faster and easier compared to the control group. The authors also base their findings on their many years of teaching experience.

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