



## **TEACHER'S DIDACTIC COMPETENCIES WHEN TEACHING NATURAL SCIENCE SUBJECTS AS A LEARNING ENVIRONMENT FACTOR**

**H. Grecmanová,**

**E. Urbanovská,**

**D. Gonda<sup>i</sup>,**

**V. Cabanová**

PhD, Department of Pedagogical Studies,  
Faculty of Humanities at the University of Žilina,  
Slovakia

### **Abstract:**

The relationship of primary and secondary schools pupils to natural science subjects is often discussed together with teacher's didactic competencies that are implemented when teaching natural science subjects. The aim of the paper is to find out how pupils from chosen primary and secondary schools in the Slovak Republic evaluate didactic competencies of natural science subjects teachers in the framework of the overall learning environment evaluation of these subjects. The means to fulfil this objective is the analysis of corresponding questionnaire items oriented on the learning environment when teaching natural science subjects. A partial aim is to compare the evaluation of natural science teachers didactic competencies from several points of view: school type (at primary and secondary schools), gender issues (boys and girls), in relation to the overall learning environment and in relation to learning environment at primary and secondary schools.

**Keywords:** teacher's didactic competencies, natural science subjects, teaching of natural science subjects, learning environment when teaching natural science subjects

### **1. Introduction**

The teacher with his/her competencies is one of the central factors that significantly determines the quality of the teaching process (Skalková, 2007, Kalhous, Obst, 2002). The way of the teaching process organization, planning and management of individual activities, the teacher's attitude to pupils, the level of his/her pedagogical communication influences its whole course, the result and impact of the educational process on the

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<sup>i</sup> Correspondence: email [barboragondova@gmail.com](mailto:barboragondova@gmail.com)

pupil's personality development. The teacher is the co-creator of the class environment, consequently of the learning environment (Grecmanová, 2008).

## 2. The teacher's personality

According to the OECD experts, teachers are people "*whose professional activities cover the transmission of knowledge, attitudes and skills specified in formal curriculum programmes to pupils and students in educational institutions.*" (Průcha, 2009, p. 396) According to the definition provided by the Pedagogical Dictionary (Průcha, Walterová, Mareš, 2009, p. 261), the teacher is one of the principal factors of the educational process, a professionally qualified pedagogical employee, with a shared responsibility for the preparation, management, organization and results of this process.

J. Manniová (2012, p. 71) introduces three principal profiles of the teacher's personality: *gnoseological profile* (the teacher's wide and deep knowledge, professional base, general knowledge that is denoted as human wisdom or natural intelligence); *axiological profile* (the teacher's value orientation, personal qualities, abilities to learn and improve himself/herself in concord with the emotional, intellectual and moral side of his/her personality) and *praxeological profile* of the teacher's personality (practical skills – behaviour, negotiations and activities) (Manniová, 2012, p. 71).

E. Ondřejová and B. Koukola (2004) describe the teacher's personality with the help of the enumeration of his/her roles. They mention these roles: the transmitter of knowledge and skills, motivator, moderator, commentator, facilitator, manager of pupils' activities, harmonizer, organizer and consultant.

The role of the teacher has been changed in connection with the historical development; together with this, new requirements on the teacher's professional equipment appear. The constructivist understanding of learning is emphasized instead of the transitive character of education; the teacher has become the pupil's guide on the his/her way to knowledge, facilitating his/her education. The teacher helps to construct knowledge and skills to learn, create, become oriented, think critically and solve various problems (Ondřejová, Koukola, 2004; Vašutová, 2004; Grecmanová, Urbanovská, 2007; Obst, Kalhous, 2009; Juklová, 2013).

According to Z. Helus (2012), it is necessary to broaden the teachers' professional equipment with respect to the tasks that are currently imparted on teachers. He sees the necessity of a new approach to the teachers' professional equipment in three primary spheres. The first sphere is the *endangerment of teachers* and the aggravating of possibilities of the effective teaching, mainly in some regions. The teacher is caught in marginal situations for the solution of which he/she is not equipped. The existence of these situations is connected with the *unruliness* creating an unbearable environment full of inattention, quarrels, aggression; with the *absence of motivation*, the occurrence of *socially pathological phenomena* and the *disruption of relationships among pupils*. The second sphere covers *new curriculum topics, new demands*. According to Z. Helus (2012), new demands on the coping with new and new topics, recently elaborated, might as a result

evoke the feelings of endangerment by his/her own incompetence. The third sphere is represented by "*possibilities of realizing the effectivity of the teaching process*" that cover new knowledge from the pedagogical, psychological and didactic spheres, new concepts, informational and communication technologies. They offer the teacher a wide spectrum of innovative possibilities, inspiration for the improvement of his/her work. It requires a higher representation of special trainings, coaching, supervision, self-help and self-educational activities of the teachers themselves in the postgraduate preparation and in the subsequent lifelong education.

### 3. Teacher's professional competencies

The issue of desirable professional competencies is still topical and it is being discussed in the scientific literature. If we arise from the primary understanding of key competences as "*the sum of knowledge, skills, attitudes and values important for the personal development and realization of each individual in the society*" (in Průcha, Walterová, Mareš, 2009, p.124), the primary teacher's professional competencies are defined as the sum of knowledge, skills, attitudes and values necessary for the execution of the teacher's profession. (Průcha, Walterová, Mareš, 2009, p. 261) According to J. Vašutová, the teacher's competence is a receptive notion that "*expresses a complex of his/her abilities (knowledge, skills, attitudes, experience, etc.) whose grounds are acquired by a student in the preparatory education and are developed in his/her further professional career*" (Vašutová, 2001 in Průcha, 2009, p. 409; Vašutová, 2004). Peter Jarvis understands competencies as a stage of skills and knowledge (and attitudes) development that is necessary for the effective coping with the working performance according to the professional standards valid in a given period (Tureckiová, 2012, p. 193). It is a capability or skill needed for the successful activity or negotiating execution. It is considered to be a measurable capability.

According to J. Šťáva (2012, p. 125), this capability covers: the professional subject readiness together with the pedagogical, psychological and didactic readiness, the working capability, the personal profile, moral qualities, and the personal and working focus. He singles out individual competence components that act on each other, they complement and influence each other.

Various authors categorize competencies in various ways. Generally speaking, it is possible to divide competencies into two basic groups: key competencies and professional competencies that might be closely interconnected (Tureckiová, 2012, p. 193).

It is possible to arrange competencies into individual spheres/groups according to various viewpoints. Already in 1996, Ch. Kyriacou (1996), in his book devoted to the key teacher's capabilities (in the sense of competencies), divides the key teacher's capabilities (competencies) into seven primary groups on the basis of teacher's primary activities:

- 1) Planning and preparation;
- 2) Realization of a teaching process unit (class);
- 3) Management of a teaching process unit;

- 4) Class environment;
- 5) Discipline;
- 6) Evaluation of pupils' performance;
- 7) Reflexion of his/her own work and evaluation (self-evaluation).

J. Šťáva (2012, p. 128) arises from a similar point of view, i.e. according to the teacher's procedure when preparing, realizing and evaluating the teaching process, and he divides the teacher's professional competencies into:

- **projective competencies** that include abilities and activities connected with planning and preparation of the teaching process. It means: observing the school objectives and content, observing the field of study or learning, subject; evaluating the educational functions and possibilities with respect to the society and pupils; studying of the educational work conditions, etc.; preparation of educational means, etc.;
- **realization competencies** that are manifested in the pedagogical communication with pupils, in the teacher's organizational activities; in the class; in the concentration of the pupils' attention on the teaching process; in the pupils' motivation; in the revision, checking and creating of the favourable atmosphere, etc.;
- **diagnostic competencies** that cover activities of checking and evaluation (checking and evaluation of pupils' knowledge and skills; the evaluation of the teaching process effectivity; checking of his/her own educational work);
- **class managerial competencies** that concern mainly the systematic organization of conditions, events, processes and activities in the class (Šťáva, 2012, p. 128).

According to V. Švec (in Průcha, 2009, p. 409), a classification cannot capture the complexity of teacher's pedagogical activities; nevertheless, it is crucial to set the content frame for the planning of teachers' preparatory education curriculum. The frame is demonstrated with the help of the competences. In this understanding, the J. Vašutová's (2004, pp. 106-109) research team defined seven generally expected key spheres of competences:

- 1) subject competencies (field of study);
- 2) didactic and psychodidactic competencies;
- 3) pedagogical competencies (general pedagogical);
- 4) diagnostic and intervention competencies;
- 5) social, psychosocial and communicative competencies;
- 6) managerial and normative competencies;
- 7) professionally and personally cultivating competencies.

The **didactic competencies** cover: mastering of teaching and learning strategies; the capability to utilize didactic repertoire and the ability to adjust them to pupils' individual needs and requirements of a specific school; the awareness in the sphere of educational programmes and the capability to work with them when creating own educational projects; knowledge from the sphere of evaluation theories and the capability

of their application; the ability of utilize informational and communication technologies for the support of pupils' learning (Vašutová, 2007).

V. Spilková (in Průcha, 1997, p. 217) enumerates within **psychodidactic competencies** mainly the competencies necessary for the creation of favourable conditions for learning, i.e. to motivate for learning; to activate thinking; to create a favourable social, emotional and working atmosphere; to manage the pupil's learning processes – to individualize them from the point of view of time, speed, depth, the extend of help; to interpret the topic, grounds of individual fields with respect to pupils' age peculiarities.

**Didactic competencies** represent **an important part of the teacher's required key competencies**, as they are specified by D. Polonský and D. Macháček (2005). V. Cabanová (2006) analyses the competencies in detail and she includes the below mentioned into the group of didactic competencies:

- the acquirement of the ability to identify principal elements of the pedagogical process and to understand mutual group relationships and interactions within the group;
- via suitable strategies of both direct and indirect intervention, to introduce conditions of optimum cooperative and peer learning;
- the acquirement of the ability to set clearly and unambiguously the teaching process objectives hierarchy;
- the acquirement of the ability to work with curriculum effectively;
- the acquirement of the ability to apply pedagogical principles suitably and appropriately in the educational process depending on specific educational conditions;
- the acquirement of the ability of the effective application of progressive organizational forms, method and material didactic means of education;
- the acquirement of the ability to apply the creative and innovative approach to the educational process;
- the ability to utilize modern teaching aids in a suitable and appropriate way (Cabanová, 2006).

#### **4. Didactic competencies and the learning environment**

The above-mentioned didactic and psychodidactic competencies closely relate to the learning environment. It is possible to suppose that the quality of the learning environment depends also on the way how well and adequately the teacher is able to implement the teaching strategies, to utilize the didactic repertoire and to adjust them to pupils' current needs, to create favourable conditions for learning. Here, the teacher acts not only as an active co-creator of the teaching process, independent social being (Lašek, 2007), but also as its evaluator together with the pupils. The teacher is sometimes to be considered the principal factor of the school environment. His/her age, sex, motives, values, interests, attitudes to the teaching process, etc. influence a different intensity of

the learning environment (Grecmanová, 2008); thought according to F. Eder (1996), the influence of the teacher's features on the learning environment in the classroom has been investigated to a little extend.

What is the learning environment?

Although there does not exist a unified definition of the term **learning environment**, it is possible to define it as *"a feeling that is created via the perception, experiencing and evaluation of the objective reality (the teaching process environment) by permanent participants in the teaching process (mostly pupils, but also teachers). It originates by the filtration of objective factors and situations into the feelings of its participants. The perception of the process by pupils and teachers is more significant than the process itself. The perception does not reflect the reality; it becomes its construction."* (Grecmanová, 2008). The learning environment of natural science, but also other subjects, is a constituent of school and class environment. When comparing it to the school and class environment, it is linked to a specific subject (e.g. physics, chemistry, biology), pupils and teachers, in which case, it is much more influenced by the teacher's professional and personal features, the quality of his/her relations (pedagogical interactions) with individual pupils and the whole class, relations among pupils during the teaching process than in other types of environment (Reindl, Gniewosz, 2017). The learning environment is connected with the teaching of an individual teacher and learning of a specific group of pupils.

The tight relationship between didactic competencies and the learning environment arises from the above-mentioned.

The positive, favourable, healthy, good, etc. learning environment is characterized by:

- the teacher's orientation on the pupil's development, the teacher's engagement for individual pupils' needs, the support of pupils' independence and tolerance of pupils;
- the teacher's and pupils' great interest in fulfilling of duties connected with the teaching process, but also a mutual interest between the teacher and pupils;
- the trust of pupils to the teacher in the teaching process supported by mutual positive relations; the teacher accepts also adequate pupils' criticism;
- conflicts are solved rationally;
- there does not exist the teacher's domination (the depersonalization of power);
- adequate teacher's requirements on the pupils' performance;
- when assessing the pupils, the teacher has the tendency for a higher rationale of good marks;
- the support of spontaneity, flexibility and emotionality of the teaching process by the teacher;
- the emphasis on independent thinking, creativity, enthusiasm;
- frequent innovations and experiments, various impulses for learning, cooperation, the development of creativity in the teaching process;

- the openness of the teaching process towards the public, the organization of meetings with artists, experts from industry and politics; order in the teaching process, lower absences;
- the class works as a team;
- the pupils' motivation to learn and pleasure during the teaching process;
- frequent contemplation of the teacher and pupils about the sense of learning and the content of the subjects;
- minimalization of stressful situations in the teaching process;
- integration (Grecmanová, 2004, p. 39, Grecmanová, 2008, p. 84-88).

We do not very often encounter studies that would examine the didactic competencies in relation to the learning process. In a paper written by Fan, Williams & Corkin (2011), there are described various factors that might influence the learning environment (e. g. pupils' problemless behaviour, pupils' success in individual subjects, the presence of both parents when upbringing the pupil, the parents' education, gender and ethnicity). From the point of view of our study, it is interesting that the authors proved the **influence of gender** on the perception of rules in the teaching process. They claimed that girls are more satisfied in the classroom and they have better relationships with the teacher if the rules set within the teaching process are followed and at the same time, the evaluation is clearly arranged. Another study is devoted to the relationship of the learning environment and **the teacher's instructions during the teaching process** (Suldo et al. 2009). In her case study, the author H. Binterová (2012) paid her attention to the learning environment of mathematics and she proved the significance of **individual approach** to pupils. Furthermore, she claimed that communication and pressure on the pupils' performance need not have negative influence on their feelings by which they evaluate the learning environment. In a theoretical study, L. Ďurišová (2010) introduced a positive **influence of a cooperative learning on the learning environment**. According to Z. Geršicová (2012, p. 36), the "good" social atmosphere in the classroom is based on the mutual confidence between the teacher and pupils, on the pupils' involvement into the decision making and evaluation processes, motivation, on the encouragement from the teacher and schoolmates, on the politeness and fairness.

K. Horváthová (2005) ascertained a positive connection between the teachers' **experience** and the learning environment (the longer the professional experience is, the better the learning environment evaluation is). According to H. Grecmanová (2008), it would be suitable to follow and study the relationship in the future. The teacher's **behaviour** is a significant aspect of the learning environment; it was proved in the research done by M. Jerusalem a M. Schwarzer (1991, p. 126). E. Petlák (2006, pp. 38-39) speaks also about the specific influence of various types of the teacher's behaviour on the learning environment. J. Mareš and P. Gavora (2004) inquired into the relationship between the authority and the learning environment; they proved the formal and hierarchical environment among teachers with the tendency to assert their power. Authoritative teachers induce a distance between the teacher and pupils, the pupils' isolation and competitiveness. Pupils enjoy group work; they get more often into conflicts

with the teacher. Speaking about helpful and friendly teachers, the pupils have the feeling of fairness, they like cooperation, they feel the concord between learning at school and at home (Grecmanová, 2008, p. 67).

## **5. Research of teacher's didactic competencies within the evaluation of natural science subjects learning environment**

### **5.1 Research objectives and methodology**

The research oriented on the didactic competencies is part of a broader research of the learning environment of natural science subjects at primary and secondary schools that was realized in the Slovak Republic in 2019.

The primary objective of the didactic competencies research is to find out how the pupils from chosen primary and secondary schools in the Slovak Republic assess the teachers' didactic competencies of natural science subjects within the evaluation of overall learning environment when teaching these subjects. A partial aim is to compare the evaluation of natural science subjects teachers' didactic competencies from several points of view: the type of school (primary and secondary schools), the gender issues (boys and girls), and in relation to other, non-didactic items of the learning environment evaluation in general and with respect to the type of school and gender.

The **research sample** consists of 454 pupils from Slovak schools. Pupils from primary schools (n=378) and secondary schools (n=76) participated in the research. The age of the participants ranges within the interval from 10 to 18 years. There are 269 girls among the participants (i.e. 59.25% of the research sample) and 185 boys (i.e. 40.75% of the research sample). We deal with the intentional choice of pupils since one of the partial aims is the adaptation of the existing questionnaire to the Slovak Republic conditions.

The basic **method for the data collection** was a questionnaire of the natural science subjects learning environment that is administrated within a broader research. The questionnaire consists of 26 assertions (statements) that give notice about individual aspects of biology, physics and chemistry teaching. The participants evaluate the frequency of the given phenomenon occurrence within a 5-grade-scale: 1. never, 2. nearly never; 3. sometimes; 4. nearly always; 5. always. The questionnaire contains also questions about basic demographic data. A detailed description of the questionnaire is provided in the study by M. Kubiátko, et al. (2018).

The means to fulfil the research objective of chosen didactic competencies is the analysis of corresponding items from the given questionnaire. Out of these reasons, items that directly relate to the teacher's didactic activities and his/her didactic competencies are abstracted away.

We deal with a set of 17 items that are further subdivided into four categories:

- 1) The support of pupil's motivation;
- 2) The utilization of teaching methods and strategies;
- 3) Checking and evaluation;
- 4) Individual approach.



The description of individual items sorted into given categories together with the average evaluation score is presented in the following text (see Table 1). Taking into account the questionnaire structure, the formulation of individual statements and utilized evaluation scale, it is possible to state the higher score always means a more positive evaluation; on the other hand, low values express an unfavourable evaluation.

## 6. Results description and evaluation

At the beginning, we introduce the analysis of individual items; subsequently, we evaluate and mutually compare individual competence categories and with respect to the school type and gender. At the end, we compare didactic competencies in relation to other, non-didactic items of the learning environment evaluation within the whole file and then, within primary and secondary schools.

### A. The analysis of individual items

We are interested in which of the chosen competencies are evaluated in the best way and vice versa. In summary, it is possible to state that competencies are evaluated in a slightly positive way. If we determine the average zone between the values 2.5 – 3.5, then the values of most items are on the margin of the average and a slight above-average in the direction to the positive pole. Only three items (26, 3 and 4) display the average score higher than 4, a very positive evaluation. There do not appear considerably negative values (see Table 1).

**Table 1:** Description of categories items with their average values and order

Item number	Category/ Item description	Average score	Order
	<b>1. The support of the pupil's motivation</b>	<b>3.4975</b>	
9	The teacher supports me when I am interested in something within the subject.	3.7886	7
14	The teacher explains how and where to utilize what we have learnt.	3.4503	13
15	The teacher tells us in which profession the given topic is applicable.	3.2537	14
	<b>2. The utilization of teaching methods and strategies</b>	<b>3.4873</b>	
13	The teacher teaches in an interesting and enthusiastic way.	3.6089	10
16	The teacher utilizes examples and teaching aids.	3.8393	6
20	When fulfilling the tasks, we work in groups.	3.2030	16
21	In the teaching process, we are guided to discuss the procedures with schoolmates when fulfilling the tasks.	3.2009	17
22	Before we move to a new topic, the teacher asks us what we already know about the given topic.	3.4524	12
25	The teacher keeps my attention thanks to his/her way of teaching.	3.6194	9
	<b>3. Checking and evaluation</b>	<b>3.985</b>	
3	In the teaching process, there are clearly set rules of work.	4.1628	2
4	I have to fulfil the given tasks exactly and reliably.	4.0232	3

5	The given tasks are continuously checked.	3.7822	
17	The results of my work are fairly evaluated in the teaching process.	3.9852	4
19	During the testing, it is checked how I understand the topic.	3.9746	5
<b>4. Individual approach</b>		<b>3.670</b>	
10	When I do not manage to fulfil the tasks during the teaching process, I am provided with help.	3.5138	11
11	When I fulfil the task sooner than the others, the teacher sets an extra work to me.	3.2347	15
26	The teacher responds to the pupils' questions concerning the topic.	4.2621	1

In the following table (see Table 2), the items are clearly arranged according to the average score value not taking into account their classification within a certain competence category.

**Table 2:** Items with their average values ordered according to the average score

Item number	Category/ Item description	Average score	Order
26	The teacher responds to the pupils' questions concerning the topic.	4.2621	1
3	In the teaching process, there are clearly set rules of work.	4.1628	2
4	I have to fulfil the given tasks exactly and reliably.	4.0232	3
17	The results of my work are fairly evaluated in the teaching process.	3.9852	4
19	During the testing, it is checked how I understand the topic.	3.9746	5
16	The teacher utilizes examples and teaching aids.	3.8393	6
9	The teacher supports me when I am interested in something within the subject.	3.7886	7
5	The given tasks are continuously checked.	3.7822	8
25	The teacher keeps my attention thanks to his/her way of teaching.	3.6194	9
13	The teacher teaches in an interesting and enthusiastic way.	3.6089	10
10	When I do not manage to fulfil the tasks during the teaching process, I am provided with help.	3.5138	11
22	Before we move to a new topic, the teacher asks us what we already know about the given topic.	3.4524	12
14	The teacher explains how and where to utilize what we have learnt.	3.4503	13
15	The teacher tells us in which profession the given topic is applicable.	3.2537	14
11	When I fulfil the task sooner than the others, the teacher sets an extra work to me.	3.2347	15
20	When fulfilling the tasks, we work in groups.	3.2030	16
21	In the teaching process, we are guided to discuss the procedures with schoolmates when fulfilling the tasks.	3.2009	17

It follows from the results that the items connected with the communication in the direction teacher-pupil (the teacher responds to pupils' questions), with the following the rules, with the checking and evaluation of pupils' work are evaluated in the most positive

way. These activities are evaluated by pupils as very frequent, appearing nearly always. Above the average limit, there are items connected with the utilization of visual aids, with interesting teaching process, with keeping the pupils' attention and with the support of their interests. On the other hand, the pupils signify the activities supporting the group work, individual approach (item 20) and the support of pupils' mutual discussions as less frequent (approaching the evaluation "never").

### B. Comparison of competencies categories – to compare them mutually and according to the school type and gender

As it is evident from Table 1, the best evaluated category of didactic competencies is the category "Checking and evaluation" (3.985), then "Individual approach" (3.670); the categories "The support of the pupil's motivation" (3.497) and "The utilization of teaching methods and strategies" (3.487) have reached a lower score.

The differences in the evaluation of the given categories from the point of view of gender and school type are not significant; they are in accordance with the overall results. In spite of this, we observe that girls, in contrast to boys, evaluate better the categories "Checking and evaluation" (3.985), and "Individual approach" (3.670); while the boys evaluate better the category "The support of the pupil's motivation". A detailed overview of the results is presented in Table 3.

**Table 3:** Differences in the competencies evaluation according to gender and school type

N.	Category/ Item description	Average score			
		Girls	Boys	Prim. sch.	Sec. sch.
	<b>1. The support of the pupil's motivation</b>	<b>3.423</b>	<b>3.532</b>	<b>3.433</b>	<b>3.645</b>
9	The teacher supports me when I am interested in something within the subject.	3.788	3.773	3.677	4.224
14	The teacher explains how and where to utilize what we have learnt.	3.346	3.519	3.405	3.487
15	The teacher tells us in which profession the given topic is applicable.	3.134	3.304	3.217	3.224
	<b>2. The utilization of teaching methods and strategies</b>	<b>3.455</b>	<b>3.454</b>	<b>3.483</b>	<b>3.369</b>
13	The teacher teaches in an interesting and enthusiastic way.	3.587	3.558	3.54	3.855
16	The teacher utilizes examples and teaching aids.	3.926	3.685	3.77	4.132
20	When fulfilling the tasks, we work in groups.	3.089	3.249	3.31	2.474
21	In the teaching process, we are guided to discuss the procedures with schoolmates when fulfilling the tasks.	3.078	3.249	3.275	2.592
22	Before we move to a new topic, the teacher asks us what we already know about the given topic.	3.468	3.37	3.407	3.553
25	The teacher keeps my attention thanks to his/her way of teaching.	3.584	3.613	3.595	3.605
	<b>3. Checking and evaluation</b>	<b>4.009</b>	<b>3.944</b>	<b>3.959</b>	<b>4.037</b>
3	In the teaching process, there are clearly set rules of work.	4.156	4.166	4.146	4.158
4	I have to fulfil the given tasks exactly and reliably.	4.067	3.989	4.042	3.934
5	The given tasks are continuously checked.	3.725	3.812	3.807	3.461
17	The results of my work are fairly evaluated in the teaching process.	4.067	3.862	3.915	4.289

19	During the testing, it is checked how I understand the topic.	4.03	3.89	3.886	4.342
<b>4. Individual approach</b>		<b>3.6816</b>	<b>3.595</b>	<b>3.667</b>	<b>3.544</b>
10	When I do not manage to fulfil the tasks during the teaching process, I am provided with help.	3.461	3.525	3.487	3.566
11	When I fulfil the task sooner than the others, the teacher sets an extra work to me.	3.19	3.199	3.357	2.355
26	The teacher responds to the pupils' questions concerning the topic.	4.394	4.061	4.156	4.711

From the point of view of school type, it is possible to highlight the difference in the evaluation of the category "The support of the pupil's motivation" that is evaluated better by the secondary school pupils; while the primary school pupils evaluate better the category "Individual approach". We suppose that this finding corresponds to the generally known peculiarities of the teaching process at primary schools, where the individual approach is to be applied more often thanks to a greater variety in the school class structure; and peculiarities of the teaching process at secondary schools, where the possibility of the application of the knowledge utilization in the praxis is emphasized and the development of the pupils' professional development is supported.

### C. Didactic competencies in relation to other, non-didactic factors

On the whole, didactic competencies in comparison to the evaluation of other non-didactic have a higher score, i.e. they are evaluated in a more positive way. It is valid both for the whole group of participants and for the groups of girls, boys, primary school pupils, secondary school pupils separately. It probably shows that they contribute more significantly to the positive evaluation of the learning environment than other studied non-didactic factors. When looking closer at other, non-didactic factors and comparing the evaluation from the point of view of gender and school type we have found out that the boys and primary school pupils evaluate the "non-didactic" factors more positively than girls and secondary school pupils (see Table 4).

**Table 4:** Evaluation of didactic competencies in relation to non-didactic factors

	Average	Average according to the gender		Average according to the school type	
		Girls	Boys	Primary school	Secondary school
Didactic competencies	3.6688	3.6421	3.6313	3.6355	3.6488
Non-didactic factors	3.2226	3.1141	3.3101	3.2391	2.9869

## 7. Conclusion and the results discussion

To summarize, it is possible to state that competencies are evaluated slightly positively. Most of the items are on the average limit or slightly above the average. None of the items

is evaluated negatively. The first category of competencies *Checking and evaluation* is assessed most positively; from the point of view of individual items, the ones that are connected with the communication in the direction teacher-pupil (the teacher responds to the pupils' questions), with the introduction of rules, with the checking and assessment of pupils are evaluated most positively. It testifies that the teacher has a strong leading role in the teaching process and it obviously emerges from the persisting traditional understanding of the teaching process. The findings correspond also to the results of foreign researches and generally, they need not be understood negatively. On the other hand, they are not fully in concord with currently supported constructivist understanding of the teaching process (Grecmanová, Urbanovská, 2007; Obst, Kalhous, 2009; Juklová, 2013)

The item of fair evaluation has a relatively high, positive score in our research; it corresponds to the Greger' findings (2006, in Janík 2009). On the other hand, it is not in concord with H. Grecmanová's findings (2008, p. 127) where the teacher's fair approach was evaluated in the middle of the evaluation scale. We suppose that namely the question of fair evaluation is under the considerably subjective attitude of the evaluated pupil that might be the reason of the established differences.

The category *The utilization of teaching methods and strategies* acquired the lowest evaluation in our research; namely the support of pupils' mutual discussion, the support of work group and the individual approach are of the least frequency. These findings correspond to the results of research studies in Czech schools that testify the dominance of the teacher's interaction with the whole classroom over the individual and group work (Hiebert et al. 2003; Roth et al. 2006 in Janík, 2009); the little frequency of non-traditional teaching ways, activities and cooperation (Grecmanová, 2008, p. 127). Likewise, Škoda a Doulík (2002, in Janík, 2009) speak about the dominance of the communication in the teacher – pupil direction, while the communication among pupils is not acceptable; the individual approach is applied in a limited rate. Concurrently, the utilization of the above-mentioned principles leads to a higher effectivity of the teaching process and to more positive values of the learning environment (Grecmanová, Urbanovská, 2007).

The differences in the evaluation of chosen categories of didactic competencies from the point of view of gender and school type within our research are not significant; they correspond to the overall results. In general, the didactic competencies are evaluated more positively than other non-didactic factors that constitute part of the learning environment evaluation; at the same time, boys and primary school pupils evaluate "non-didactic" items more positively than girls and secondary school pupils. On the grounds of these findings, it is possible to suppose that didactic competencies represent a more significant part in the positive evaluation of the learning environment, mostly when speaking about girls and primary school pupils.

The results of the given researches make us consider the reasons why the new teaching process trends, including non-traditional methods and approaches, are not utilized to such an extend as it would be expected.

## 8. Conclusion

The teacher's didactic competencies represent a significant part of the teacher's required key competencies. The competencies determine the teacher's activities, approach and communication in the teaching process; they significantly participate in the learning environment creation. This holds true also about the natural science subjects learning environment.

The evaluation of the teacher's didactic competencies from the pupils' point of view was part of natural science subjects (biology, chemistry and physics) learning environment research that was realized in chosen primary and secondary schools in the Slovak Republic in 2019. The means to assess the didactic competencies was the analysis of corresponding questionnaire items that are directly connected with the teacher's didactic activities and his/her didactic competencies.

On the basis of the analysis and data evaluation, it is possible to state that didactic competencies are evaluated slightly positively. The competencies of the Checking end evaluation category are evaluated most positively; this demonstrates the fact that the teacher has a strong leading function in the teaching process. Generally, it is not possible to assess this fact only negatively. In context with our further findings, the items of the support of mutual pupils' discussion, the support of group work and the individual approach are the least frequent ones in the observed schools, it is necessary to state that the findings are not fully in concord with the currently supported constructivist understanding of the teaching process. However, the findings from our research are in compliance with the results from other researches of natural science subjects teaching process.

The differences in the evaluation of selected competence categories from the point of view of gender and school type are not significant; they correspond to the overall results. On the whole, the didactic competencies are evaluated more positively than other non-didactic factors that are assessed within the learning environment evaluation. It is possible to assume that didactic competencies contribute more significantly to the positive evaluation of the learning environment; mostly when speaking about girls and secondary school pupils.

The principal objective of the paper, in what way the pupils of chosen primary and secondary schools in the Slovak Republic evaluate the natural science subject teachers' didactic competencies in the framework of the assessment of the overall learning environment of these subjects, was accomplished. Taking into account the above-mentioned findings, it would be possible to discuss the teaching process aspects that become apparent as less utilized, alternatively about the enforcement of teacher's competencies in these spheres.

With respect to the size of the research sample, we point out that the results validity and research conclusions are limited as they relate to the studied selected research sample of participants.

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