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Amadea Đurinić, mag. paed.
alumna of Faculty of Humanities and Social Sciences, University of Zagreb
amadea.durinic@hotmail.com
https://orcid.org/0000-0001-8056-3230

Ines Hraste, mag. prim. educ.
International British School of Zagreb Bright Horizons
hrasteines@gmail.com
https://orcid.org/0000-0001-5242-2721

Ante Kolak, PhD, Associate Professor
Faculty of Humanities and Social Sciences, University of Zagreb
akolak@ffzg.hr
https://orcid.org/0000-0002-8336-0858

PUPILS' ATTITUDES TO FORMATIVE ASSESSMENT IN SCIENCES CLASS

Abstract*: This paper discusses formative assessment in Sciences class, which integrates the knowledge of natural and social sciences. In formative assessment there are two different assessment processes – assessment for learning and assessment as learning. Both approaches value the idea of students' individual progress, and they have a pedocentric orientation. The paper focuses on assessment techniques used in class, which is operationalised in the empirical section of the paper. We established a hierarchical structure of offered techniques according to the criterium of usefulness. The students expressed their views on the process of self-evaluation and peer-evaluation in four dimensions (liking, difficulty, help with learning and discomfort). The approach to research is quantitative. The results show that the techniques we can find at the bottom of the hierarchy are the techniques which require a more complex cognitive deliberation. There is a positive attitude towards self-evaluation and peer-evaluation. In establishing the difference between attitudes in the dimension of help with learning there is a lack of recognition of the potential of peer-evaluation. This paper confirms the importance of formative assessment and points to the need for further research.*

Keywords*: self-evaluation, assessment as learning, assessment for learning, peer-evaluation*

INTRODUCTION

Sciences is an interdisciplinary class that integrates the knowledge of natural and social sciences; namely, natural, social and technological areas. It helps pupils develop knowledge, skills and attitudes for better understanding of the world around them, and it entices research, asking questions about nature, revealing the interdependence of different processes and overall easier navigation within the natural and social surroundings and making decisions for the wellbeing of the self and the community. It allows pupils to develop their personal, cultural, and national identity (Ministry of Science and Education, 2019a).

There are two assessment elements in Sciences class: acquired knowledge (all cognitive levels the pupil acquired according to the defined goals within the curriculum) and research skills (the pupil's skills)

(MZO; 2019a). Both assessment elements are manifested by grades. Assessment in Sciences should be frequent and regular throughout the school year, and it should be conducted in various ways, applying three approaches: *assessment of what is learned*, *assessment for learning* and *as learning*, all of which should have equal importance in deciding the final grade (MZO, 1029a). It is clear that the goal of assessment in Sciences class is not only the final cumulative grade but also pupils' active participation in the evaluation process, continuous monitoring of their individual progress and development, as well as coming up with adequate ways of encouraging students so that each of them can successfully fulfil their potential.

Formative assessment is an integral part of every phase of learning and teaching and it involves ″all activities in which the teachers and their students participate in order to evaluate learning, which provides information that can be used as feedback for the adjustment of the teaching and learning practices″ (Black & William, 1998, p. 2, as cited in Clark, 2011, p. 165). When the information gathered through the implementation of various activities is used for adjusting teachers' work and meeting pupils' needs, the idea behind formative assessment is brought to life – ″enabling a wider range of positive changes in classroom teaching″ (Black & William, 2006, p. 10, as cited in Black & William, 2009, p. 6).

Given that formative assessment is implemented regularly and that it gathers evidence of pupils' progress and the quality of learning and teaching on whose basis further decisions are being made (Cindrić et al., 2010; Clark, 2011; Jurjević Jovanović et al., 2020) it is characterised as a diagnostic tool (Jurjević Jovanović et al., 2020). Information/evidence gathered by formative assessment serves the teachers, the students, and their parents – the students can plan and improve their learning to achieve maximum results, while the teachers can improve their teaching methods and encourage their students in a more suitable way. The same goes for the students' parents.

In that regard, the function of formative assessment does not lie in the assessment itself, but rather in encouraging the students' learning and spotting their needs so that the teachers could meet them efficiently (Black et al., 2003, as cited in Antoniou & James, 2014; Clark , 2011). Moreover, it is posited that the decisions about the future steps, based on the information/evidence provided by formative assessment, will be better than the decisions made without such evidence (Black & William, 2009, p. 9). In that way, formative assessment shapes the further process of learning and teaching (Vrgoč & Mužić, 1999) – by correcting it, adjusting, improving, and personalising (Scriven, 1967). It does not result in a grade, but it tries to establish the students' level before the final summative grading with the goal of its improvement, so that the further grading would be more satisfactory (Brookhart, 2010). The most common division of approaches within formative assessment is on *assessment for learning* and *assessment as learning*.

According to the American *Assessment Reform Group*, (2002, as cited in Hargreaves, 2010) *assessment for learning* refers to the process of seeking and gathering evidence which serves the students and the teachers in that it helps them recognize the current level the students are on, the direction in which they should go in their learning and how best to get there. It involves evaluating the smaller parts of the evolving learning process.

Students actively participate *in the assessment for learning*, which enables them to monitor their progress together with their teachers (they understand what the goal of learning is, where they are now and how they can reach the desired goal) which makes them jointly responsible for achieving the set goals. *Assessment for learning* is directed towards the students' individual progress, namely, the comparison between their previous and current achievements in relation to the set goals (MZO, 2019b). In that way it enables criterial evaluation – the focus is placed on following the progress of each student, instead of mutually comparing the students within a group (normative evaluation), which makes it very encouraging for the students.

This approach promotes the idea of possible advancement of all students, regardless of their individual differences (characteristics, personality and the circumstances they come from, etc.) – the students have a clear idea of the learning goals, and they are given relevant feedback which is crucial for

developing a learning strategy (MZO, 2019b). The students become more motivated and more responsible for their own learning, which makes it more effective. *Assessment for learning* also enables the teachers to intervene in good time.

Assessment for learning applies different techniques of collecting and noting information through the interaction between students and teachers and just among students. For this research, we categorized the different techniques of *assessment for learning* into two groups. The first group comprises of the teaching techniques which require longer and more complex consideration of class materials (the research used *Knowledge table, Knowledge map, Learning journal, Thematic teaching*). The second group comprises of the teaching techniques which provide teachers with a quick and economical diagnostic insight into the current level of students' understanding (the research used *Self-evaluation triangulation, Red-yellow-green glass rule, No hand-raise rule*).

According to Guidelines for the assessment of processes and educational achievements in primary and secondary education (2019b) the approach to *assessment as learning* starts with the idea that assessment is a learning tool, namely, that students (with the support of their teachers) learn through assessment. Just like the approach to *assessment for learning*, it is also conducted regularly during the learning and teaching processes, and it does not result in a grade. This kind of assessment aims to develop an independent and self-regulated approach to studying by having the students actively participate in self-evaluation and peer-evaluation (MZO, 2019b). For that reason, it is a very encouraging, motivating and directing approach, just like *assessment for learning* (Jurjević Jovanović et al. 2020). In that way, the students will be more critical in the assessment of their current level of knowledge, more successful in setting specific attainable goals of their own studying, as well as choosing adequate learning strategies and regulating the cognitive, emotional, motivational and behavioural aspects of learning with the goal of their improvement (MZO, 2019b).

In order for *assessment as learning* to be successfully implemented, it is important to provide a gradual transition from externalised evaluation (teachers' feedback on the student's learning and progress) towards the internalised evaluation (where students assess their own learning and progress) – the same can be achieved by, for example, encouraging conversation about the learning process and results, taking the time for reflection on learning as well as teaching the students how to (self)-evaluate (students can assess their own and their peers' work only when they have been introduced to the criteria their teacher uses) (MZO, 2019b). The basic techniques of *assessment as learning* are self-evaluation and peer-evaluation.

Self-evaluation is a metacognitive process of becoming aware of and thinking about one's own process of learning and achieving, based on which the student sets further goals and directs their own learning process (MZO, 2019b). The student does this by adhering to pre-set criteria (learning goals) just like their teacher does. In this way, self-evaluation provides the students with a critical insight into their own work and progress and raises awareness of the advantages and disadvantages of their learning process (Bursać et al., 2016). According to Boud (1995, p. 17, as cited in Wride, 2017, p. 1) ″self-evaluation is aimed at developing the students' learning skills… It is not about individuals grading themselves nor about suppressing the role of the teacher. In short, self-evaluation allows for sharing of power, control and authority over the evaluation process between the students and the teachers (Brew, 1999, as cited in Wride, 2017).

There are several different purposes of self-evaluation: assessing the understanding of the content, the student's self-development and the demonstration of achievements (Wride, 2017); it presents one of the fundamental skills for the students' professional development and life-long learning. The validity of this process is connected to the consistency and confidence of the student during the processes of self-reflection and monitoring of their own learning (Rajić, 2013), while continuous practice of these processes provides an increasingly more accurate interpretation of one's own learning practices (Earl & Katz, 2006, as cited in Rajić, 2013).

Peer evaluation involves a form of cooperative learning regulation – ″the student is actively involved in the activities of evaluation of learning and achievements of their peers/classmates, which helps them observe, monitor, and regulate the process of their own learning, providing them with peer-feedback″ (MZO, 2019b, p. 9). Therefore, students evaluate their classmates' work and goal-attainment, guided by the pre-set criteria (van den Berg et al., 2006, as cited in Rajić, 2013). What's more, by evaluating their peers, the student gradually gains insight into their own learning.

Sciences class curriculum for primary schools (2019a) demands the application of alternative ways and methods of assessment (formative assessment) within Sciences class, and among the research on the topic we bring out the research by the author Letine (2015) which shows that teachers have more positive attitudes towards the application of alternative ways of (formative) assessment in comparison to those that are more traditional in the Sciences class.

Although some authors claim that it is impossible to successfully implement self-evaluation in primary schools, justifying their theses with the fact that younger students are less cognitively mature (Fontana & Fernandes, 1994; Ross, 2006, as cited in Wong, 2017), other authors confirmed in their research that students around the ages of 7 or 8, namely, from the very start of their primary school education, are able to conduct self-evaluation (Andrade, 2019; Du & Wang, 2008; Brown, 2008; Wong, 2016 as cited in Wong, 2017), taking into account that they need to be provided with a detailed explanation of the process of evaluation and given the criteria that they are able to understand. This means that the students have to be trained for these activities and continuously led by their teachers during their implementation, so that they could understand their use and value (Munoz & Alvarez, 2007). As soon as students understand the criteria and the whole process of self-evaluation, their attitudes towards this process become more positive (Wong, 2017). Moreover, some authors contemplate the possibility of the introduction of peer-evaluation in young pupils aged 9, as well as pupils with learning disabilities. (Scruggs & Mastropieri, 1998, as cited in Topping, 2009). Furthermore, the students with learning disabilities or lower academic success will need more specific feedback available immediately, while the same does not apply to the students of higher academic success (Mason & Brunning, 2001, as cited in McMillan, 2009).

The most useful technique of self-evaluation and peer-evaluation shown in research conducted on younger students is providing sections in tables with specific criteria which allow the teachers, students and their parents insight into the current level of understanding of each student (Nawas, 2020; Wong, 2017). It is considered that the table sections can reduce student anxiety present in (self)-evaluation and thus improve the quality of self-evaluation (Nawas, 2020).

Moreover, research points to positive and negative aspects of self-evaluation and peer-evaluation for the process of learning. The positive influence of self-evaluation is seen in the advancement of the students' competence, increased independence in work and the rise in their critical and analytical approach (Siow, 2015). A rise in confidence, motivation and metacognitive thinking has also been observed (Bursać et al., 2016; Munoz & Alvarez, 2007; Wong, 2017). Self-evaluation has a positive effect on the students' interest in the class materials and the levels of their achievement (Black & William, 2009; Bursać et al., 2016). In this way, the students eventually become more responsible for their own learning process and there is an increase in their assessment of their objectivity about their own performance (Gurbanov, 2016). Besides improving the students' learning process at school, the positive potential of self-evaluation is regarded for their free-time activities too (Bursać et al., 2016).

Although self-evaluation is considered a markedly positive activity in which the pupils/students gladly participate and consider it useful, especially for the process of learning (Bursać et al., 2016; Munoz & Alvarez, 2007; Siow, 2015; Wong, 2017) research on the topic has noted some of its negative aspects. The negative aspect of self-evaluation is reflected in it being a time-consuming and a relatively complex and demanding process (Nawas, 2020; Siow, 2015). Students mainly see self-evaluation as insufficiently objective and as a very biased process, because of which most of them are not able to see their own mistakes

in an assignment (Munoz & Alvarez, 2007; Siow, 2015). Also, they don't have the self-confidence to assess themselves more accurately (Cassidy, 2007, as cited in Wong, 2017). All of this can lead to some students disliking the process of self-evaluation (Siow, 2015).

Peer-evaluation, like self-evaluation, is also considered a useful, easy and positive activity that students mostly enjoy (Munoz & Alvarez, 2007; Siow, 2015). Moreover, some of the positive effects of peer-evaluation on the learning process include more reflection and learning, increased analytical thinking and pupil/student independence, as well as improvement in the skill of providing feedback (Siow, 2015). Some research (Siow, 2015; Stančić, 2020) shows that the assessment of peer-evaluation usefulness was even higher than that of self-evaluation. What's more, peer-evaluation is considered to have the potential to help the students who are still in the zone of proximal development to reach higher levels of development through cooperation with their peers (Stančić 2020).

Some of the negative aspects of peer-evaluation pointed out in various research include greater consumption of time, inability to be objective and its difficulty (Munoz & Alvarez, 2007; Siow, 2015). Furthermore, it can cause the loss of self-confidence, especially in cases of overly harsh criticism and non-constructive comments (Siow, 2015).

It is interesting that the research on the perception of formative assessment mainly varies in opinions on objectivity, difficulty, and usefulness of the processes of self-evaluation and peer-evaluation. Although research has confirmed that self-evaluation and peer-evaluation can be conducted on students from an early age, it is important for the students to be well-acquainted with the purpose of this kind of assessment. Research conducted on an older population of students shows that they are able to determine the purpose of formative assessment, its positive and negative effects on themselves, their learning process and motivation, and they are also able to assess how much they liked the processes of self-evaluation and peer-evaluation, as well as how difficult and/or unpleasant they were to them. On the other hand, some research conducted on younger children in primary school established that there was insufficient understanding of the purpose of formative assessment to them (Harris & Brown, 2013, as cited in Andrade, 2019). Although some displayed higher levels of interest and responsibility for their own learning as well as positive attitudes towards this process, in other research the students could not see the opportunity for personal improvement provided by formative assessment, but they considered assessment to be the main task of the teacher (Harris & Brown, 2013, as cited in Andrade, 2019). Even the pupils who had a better understanding of the purpose of formative assessment didn't consider it important enough because they frequently already knew where they stood and how much they knew, on their own and without external evidence, even though feedback provided them insight into their targeted accomplishments. In conclusion, the results of formative assessment research point to the importance of its further investigation.

The empirical part of this paper problematizes the satisfaction of 4th grade primary school pupils with the processes of self-evaluation and peer-evaluation as well as the satisfaction with the application of formative assessment techniques in Sciences class.

The main task of this research is to examine the attitudes of the pupils about the processes of self-evaluation and peer-evaluation as well as the satisfaction of the applied techniques of formative assessment in Sciences class, namely:

- Establish a hierarchical structure of the offered techniques of *assessment for learning* according to the criterium of usefulness, from the perspective of the pupils
- Examine the pupils' attitudes about self-evaluation through four dimensions (liking, difficulty, help with learning, and discomfort)
- Examine the pupils' attitudes about peer-evaluation in four categories (liking, difficulty, help with learning, and discomfort)
- Establish if there is a difference in the pupils' attitudes on self-evaluation and peer-evaluation in four categories (liking, difficulty, help with learning, and discomfort)

Based on these tasks, we established four hypotheses:
H1: In the hierarchical structure of *assessment for learning* techniques the pupils will place higher value on the techniques which involve longer and more difficult consideration of class materials in comparison to the other techniques.
H2: The pupils will display positively oriented attitudes, which point to the satisfaction with the process of self-evaluation.
H3: The pupils will display positively oriented attitudes, which point to the satisfaction with the process of peer-evaluation.
H4: The pupils will differ in their attitudes towards peer-evaluation, unlike in their attitudes towards self-evaluation.

METHODOLOGY

We used a quantitative approach in the research, so a questionnaire was devised as an instrument to survey the attitudes of the pupils towards formative assessment in the Sciences class. The application of quantitative approach with the help of the questionnaire made sure that we test the theories and hypotheses of the research on a large number of subjects, which allows for easy access (based on relevant data) to better understanding of the researched phenomenon – formative assessment.

The survey was conducted in May and June of the school year 2020/2021 in the 4th grades of seven primary schools in Zagreb.

The research sample consists of 128 pupils. The sample is purposive, and all the participating pupils were part of a treatment group in quasi-experimental research.

Purposive sampling made sure that all the pupils were subject to two approaches of formative assessment – *assessment for learning* and *assessment as learning* – in every lesson of Sciences class. Also, the uniformity of the sample was ensured by having all the teachers use the same class materials and formative assessment techniques during their Sciences classes.

After the surveys on pupils' attitudes toward formative assessment in Sciences class were filled in and collected, they were winnowed (valid/invalid) and the data from valid surveys were grouped into tables and processed in SPSS software for statistics.

The paper includes the methods of table and graphic presentation of the participants' answer structure and the numerical values are presented using descriptive parameters, frequencies, percentages, arithmetic mean and standard deviation.

The final hypothesis of the study, aiming to determine the differences in the participants' attitudes to self-evaluation and peer-evaluation, was investigated using an independent samples t-test, with the equality of variances assessed using the Levene's test. The results are interpreted with the 5% level of significance taken into consideration.

RESULTS AND DISCUSSION

In search for an answer for the first hypothesis of the research, which is connected to the hierarchical structure of the techniques of *assessment for learning* according to the usefulness criterium from the students' perspective, we used the pupils' answers to the following question: *Sort the following techniques according to how useful for learning during Sciences class they were to you. Number 1 signifies the technique that was the most useful and number 7 the one that was the least useful.* Table 1 shows the hierarchical structure of the *assessment for learning* techniques.

Table 1.

Hierarchical structure of assessment for learning techniques, with the related descriptive parameters

		N	**%**	$\bar{x}$	**Sd**
Self-evaluation triangulation	1	31	24.2%		
	2	24	18.8%		
	3	14	10.9%		

	4	23	18.0%		
	5	14	10.9%		
	6	17	13.3%		
	7	5	3.9%		
	Total	128	100%	**3.28**	1.88
Red-yellow-green glass rule	1	44	34.4%		
	2	30	23.4%		
	3	13	10.2%		
	4	9	7.0%		
	5	10	7.8%		
	6	6	4.7%		
	7	16	12.5%		
	Total	128	100%	**2.95**	2.11
No hand-raise rule	1	15	11.7%		
	2	15	11.7%		
	3	16	12.5%		
	4	18	14.1%		
	5	15	11,7%		
	6	12	9.4%		
	7	37	28.9%		
	Total	128	100%	4.46	2.14
Knowledge table	1	9	7.0%		
	2	23	18.0%		
	3	22	17.2%		
	4	24	18.8%		
	5	16	12.5%		
	6	29	22.7%		
	7	5	3.9%		
	Total	128	100%	3.95	1.71

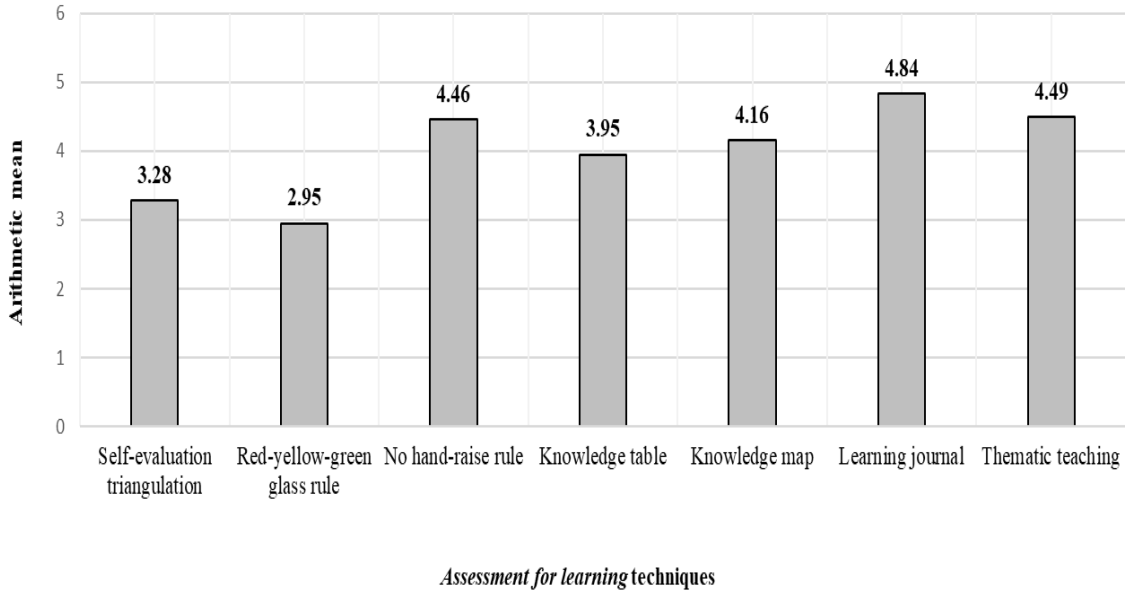
Knowledge map	1	10	7.8%		
	2	16	12.5%		
	3	24	18.8%		
	4	17	13.3%		
	5	30	23.4%		
	6	18	14.1%		
	7	12	9.4%		
	Invalid	1	0.8%		
	Total	128	100%	4.16	1.78
Learning journal	1	5	3.9%		
	2	8	6.3%		
	3	22	17.2%		
	4	18	14.1%		
	5	23	18.0%		
	6	21	16.4%		
	7	28	21.9%		
	Invalid	3	2.3%		
	Total	128	100%	**4.84**	1.81
Thematic teaching	1	14	10.9%		
	2	11	8.6%		
	3	15	11.7%		
	4	20	15.6%		
	5	19	14.8%		
	6	24	18.8%		
	7	25	19.5%		
	Total	128	100%	**4.49**	1.97

The analysis of the participants' answers yielded the following results. The lowest values of the arithmetical mean of the pupils' answers are recorded for the following techniques: *Red-yellow-green glass rule*, where the arithmetical mean of the participants' answers is 2.95, while the standard deviation is 2.11; it is followed by *Self-evaluation triangulation* where the arithmetical mean of the participants' answers is

3.28 and the standard deviation is 1.88. The highest values of the arithmetical mean of the participants' answers are recorded for the following techniques: *Learning journal* where the arithmetic mean of the participants' answers is 4.84, while the standard deviation is 1.81, followed by *Thematic teaching* where the arithmetic mean of the participants' answers is 4.49 with the standard deviation of 1.97.

Graph 1.

Display of assessment for learning techniques with their related arithmetic mean



The assessment techniques that have the lowest arithmetic mean were considered more useful for learning by the participants than those with the highest arithmetic mean. Consequently, the ranking of the techniques by their mean value presented above also represents the ranking from the most useful to the least useful technique of *assessment for learning* used during every lesson in Sciences class. Considering that the techniques estimated as the most useful – *Red-yellow-green glass rule* and *Aelf-evaluation triangulation* – belong to the techniques that quickly and economically provide teachers with insight into their students' current level of knowledge, we discard our H1 hypothesis, which assumed that the pupils would regard the techniques that required longer and more difficult consideration of class materials more useful for learning than other techniques. What's more, the participants assessed the techniques that belong to the group of those that require longer and more difficult consideration of class materials – *Thematic teaching* and *Learning journal* – as the least useful. The most prominent explanation for these results is the simplicity and speed of implementation of the techniques deemed as more useful. However, the question remains open whether the students understood the meaning of usefulness for learning, given that the more difficult techniques that have a longer duration and require more careful consideration of class materials, and already have a proven usefulness for learning, were assessed as the least useful.

The second hypothesis was aimed at testing the satisfaction with the process of self-evaluation.

Table 2.

The students' attitudes towards self-evaluation with the belonging descriptive parameters.

	N	%	$\bar{x}$	Sd

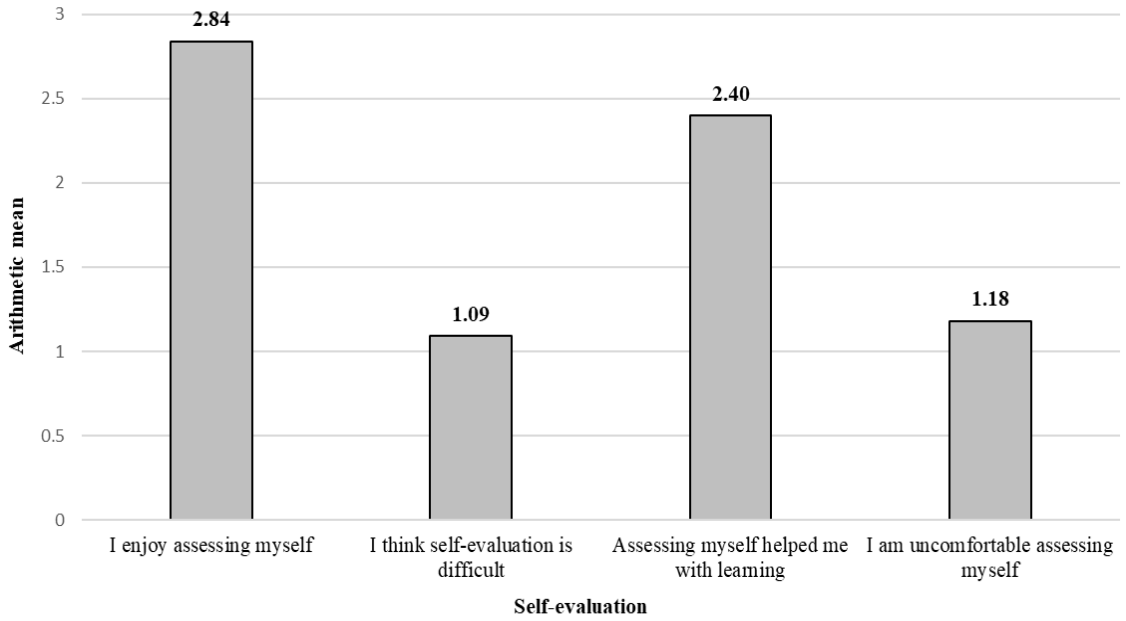
I enjoy assessing myself	I completely disagree	9	7.0%		
	I disagree	8	6.3%		
	I can't decide	25	19.5%		
	I agree	38	29.7%		
	I completely agree	48	37.5%		
	Total	128	100.0%	2.84	1.20
I think self-evaluation is difficult	I completely disagree	51	39.8%		
	I disagree	40	31.3%		
	I can't decide	17	13.3%		
	I agree	15	11.7%		
	I completely agree	5	3.9%		
	Total	128	100.0%	1.09	1.16
Assessing myself helped me with learning	I completely disagree	15	11.7%		
	I disagree	17	13.3%		
	I can't decide	31	24.2%		
	I agree	32	25.0%		
	I completely agree	33	25.8%		
	Total	128	100.0%	2.40	1.32
I am uncomfortable assessing myself	I completely disagree	55	43.0%		
	I disagree	29	22.7%		
	I can't decide	19	14.8%		
	I agree	16	12.5%		
	I completely agree	9	7.0%		
	Total	128	100.0%	1.18	1.30

The analysis of the results by statements leads to the conclusion that the study participants like the process of self-assessment and see its potential for help with learning; they don’t consider it a difficult or uncomfortable process, which confirms the second hypothesis of this research which posits that pupils will

display positive attitudes towards self-assessment. The explanation for these results relies on previous research that points to students enjoying the participation in the process of self-evaluation, and its overall positive effect on the students' improvement in academic achievements (Black & William, 2009, Bursać et al., 2016; Capan Melser et al., 2020; Hattie, 2009, Weurlander et al., 2012; Wong, 2017). Although research by some authors shows that self-evaluation is considered a very difficult, biased, and stressful process for students (Nawas, 2020; Siow, 2015) these results do not support that claim. It is important to take into account the fact that the self-assessment techniques used in Sciences class had clear criteria set in advance, as well as the assessment elements, which makes it possible that they made the whole self-evaluation process easier for the students, as well as less difficult and uncomfortable.

Graph 2.

Display of statements related to self-evaluation with their respective arithmetic mean



The third hypothesis was aimed at examining the satisfaction with the process of peer-evaluation.

Table 3.

The pupils' attitudes towards peer-evaluation and their descriptive parameters

		N	%	$\bar{x}$	Sd
I enjoy assessing my friends	I completely disagree	6	4.7%		
	I disagree	16	12.5%		
	I can't decide	20	15.6%		
	I agree	27	21.1%		
	I completely agree	59	46.1%		

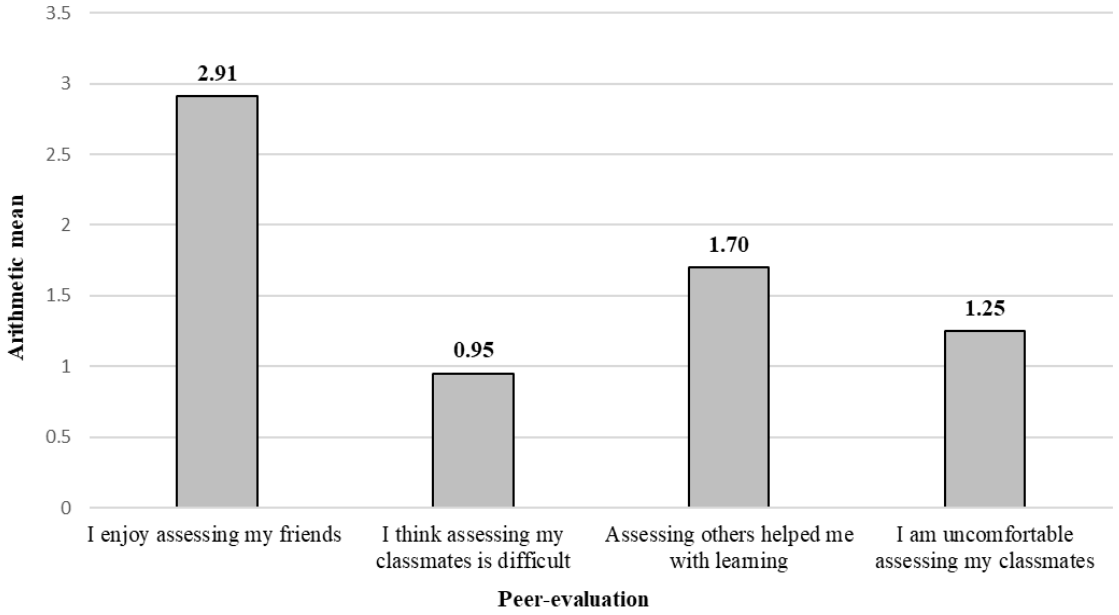
	Total	128	100.0 %	2.91	1.24
I think assessing my classmates is difficult	I completely disagree	60	46.9%		
	I disagree	36	28.1%		
	I can't decide	18	14.1%		
	I agree	7	5.5%		
	I completely agree	7	5.5%		
	Total	128	100.0 %	.95	1.15
Assessing others helped me with learning	I completely disagree	34	26.6%		
	I disagree	19	14.8%		
	I can't decide	39	30.5%		
	I agree	23	18.0%		
	I completely agree	13	10.2%		
	Total	128	100.0 %	1.70	1.31
I am uncomfortable assessing my classmates	I completely disagree	46	35.9%		
	I disagree	36	28.1%		
	I can't decide	22	17.2%		
	I agree	16	12.5%		
	I completely agree	8	6.3%		
	Total	128	100.0 %	1.25	1.24

The analysis of the results by statements leads to the conclusion that the research participants like the process of peer-evaluation; they don't consider it a difficult or uncomfortable process, but the arithmetic mean of only 1.70 established for the statement *Assessing others helped me with learning* leaves it questionable whether they saw the potential for peer-evaluation helping them with learning. Given that the research to establish positive attitudes towards peer-evaluation takes into account all four dimensions (liking, difficulty, help with learning, discomfort) the third hypothesis is only partially accepted. The explanation for these results relies on previous research that points to positive attitudes of students towards peer-evaluation – students like its application and they consider it easy and positive (Munoz & Alvarez, 2007; Siow, 2015). Despite this, it is not possible to confirm the research on the usefulness of peer-evaluation for help with learning (Siow, 2015; Stančić, 2020). Considering that the subjects went to the 4th grade of primary school, it is possible that they do not sufficiently understand the purpose of peer-evaluation

and its usefulness for themselves, but only for other students (Bourke, 2016, as cited in Andrade 2019; Harris & Brown, 2013).

Graph 3.

Display of statements related to peer-evaluation with their respective arithmetic mean



The fourth hypothesis was aimed at establishing the differences between the participants' attitudes towards the processes of self-evaluation and peer-evaluation. We compared the attitudes and established whether there was any significance in the differences within the same category of claims about self-evaluation and peer-evaluation with regard to liking, difficulty, help with learning and discomfort.

The first compared category was within the dimension of liking, which points to the affective component of the research participants, where we compared the claim *I enjoy assessing myself* to *I enjoy assessing my friends*. Table 4 shows the arithmetic mean of the participants' answers for the category of liking and the standard deviation.

Table 4.

Attitudes in the dimension of liking and their respective descriptive parameters

	I enjoy assessing	**N**	**$\bar{x}$**	**Sd**
Total	I enjoy assessing myself	128	2.84	1.20
	I enjoy assessing my friends	128	2.91	1.24

According to data from Table 4, we conducted the t-test in the examined dimension (Table 5).

Table 5.

t-test in the dimension of liking

		Levene's test of variances equality		t-test		
		F	**Sig.**	**t**	**df**	**Sig. (two-sided)**
Total	Equal variances assumed	.790	.375	-.461	254	**.646**
	Equal variances not assumed			-.461	253.693	.646

According to the data in Table 5 it is visible that the statistical significance is $p > 0.05$, (more than 5%) so we didn't establish a statistically significant difference in the participants' answers between the claims *I enjoy assessing myself* and I *enjoy assessing others*.

The second compared dimension was aimed at difficulty, which points to the cognitive component of the pupils' attitudes, where we compared the claim *I think self-evaluation is difficult* with *I think assessing my classmates is difficult*. Table 6 shows the arithmetic mean of the participants' answers in the examined dimension and the standard deviation.

Table 6.

Attitudes in the dimension of difficulty with their related descriptive parameters

	Assessment difficulty	**N**	$\bar{x}$	**Sd**
Total	I think self-evaluation is difficult	128	1.09	1.16
	I think assessing my classmates is difficult	128	.95	1.15

According to the data from Table 6, we conducted the t-test in the dimension of difficulty (Table 7).

Table 7.

t-test on statements in the dimension of difficulty

	Levene's test of variances equality		t-test		
	F	**Sig.**	**t**	**df**	**Sig. (two-sided)**

Total	Equal variances assumed	.133	.716	.971	254	**.332**
	Equal variances not assumed			.971	253.974	.332

According to the data from Table 7 it is visible that the statistical significance is $p > 0.05$, (more than 5%) so we didn't establish a statistically significant difference in the participants' answers between the claims *I think self-evaluation is difficult and I think assessing my classmates is difficult*.

The third examined dimension was oriented towards help with learning where the following claims were compared: *Assessing myself helped me with learning* and *Assessing others helped me with learning*. Table 8 shows the arithmetic mean of the participants' answers in the dimension of help with learning and the standard deviation.

Table 8.

Attitudes in the dimension of help with learning with their respective descriptive parameters

	Help with learning	**N**	$\bar{x}$	**Sd**
Total	Assessing myself helped me with learning	128	2.40	1.32
	Assessing others helped me with learning	128	1.70	1.31

According to the data from Table 8 we conducted the t-test in the dimension of help with learning (Table 9).

Table 9.

t-test on the dimension of help with learning

		Levene's test of variances equality		**t-test**		
		F	**Sig.**	**t**	**df**	**Sig. (two-sided)**
Total	Equal variances assumed	.023	.878	4.229	254	.000
	Equal variances not assumed			4.229	253.995	**.000**

According to the data from Table 9 it is visible that the statistical significance is $p<0.05$ (less than 5%) which means we established a statistically significant difference in the participants' answers between the claims *Assessing myself helped me with learning* and *Assessing others helped me with learning*, where the arithmetic mean of the participants' answers to the claim *Assessing myself helped me with learning* is 2.40, while with the claim *Assessing others helped me with learning* it is 1.70.

The last compared dimension was the feeling of discomfort which points to an affective component of the pupils' attitudes, where we compared the claims *I am uncomfortable assessing myself* and *I am uncomfortable assessing my classmates*. Table 10 shows the arithmetic mean of the participants' answers to claims in the category of discomfort and the standard deviation.

Table 10.

Attitudes in the dimension of discomfort with their respective descriptive parameters

	Discomfort with assessment	**N**	**$\bar{x}$**	**Sd**
Total	I am uncomfortable assessing myself	128	1.18	1.30
	I am uncomfortable assessing my classmates	128	1.25	1.24

According to the data from Table 10 we conducted the t-test in the dimension of discomfort (Table 11).

Table 11.

t-test on the dimension of discomfort

		Levene's test of variances equality		**t-test**		
		F	**Sig.**	**t**	**df**	**Sig. (two-sided)**
Total	Equal variances assumed	.430	.512	-.442	254	**.659**
	Equal variances not assumed			-.442	253.466	.659

According to the data from Table 11, it is visible that the statistical significance is $p > 0.05$, (more than 5%) so we didn't establish a statistically significant difference in the participants' answers between the claims *I am uncomfortable assessing myself* and *I am uncomfortable assessing my classmates.*

Given that in comparing the participants' attitudes towards the processes of self-evaluation and peer-evaluation in the categories of liking, difficulty, and discomfort there were no statistically significant differences, and considering that in the category of help with learning the statistically significant difference favoured the process of self-evaluation, the last hypothesis is only partially accepted.

The explanation for these results relies on previous research that points to similarly positive attitudes of students towards the processes of self-evaluation and peer-evaluation (Bursać et al., 2016; Munoz & Alvarez, 2007; Siow, 2015), while the noted estimation of these processes as difficult or uncomfortable (Munoz & Alvarez, 2007; Siow, 2015) is not confirmed.

The techniques of *assessment for learning* and the techniques of *assessment as learning* which the pupils used to self-evaluate and peer-evaluate were designed to be used as part of every lesson. They were also completely adapted in content to every lesson and topic. Their purpose was not only to provide the teacher and their students with feedback on the students' progress but also to motivate the students and be an incentive for revising and practicing the taught content.

Such integrated techniques did not create any stressful aspects of assessment nor were they recognised as such. According to all of this, we can explain the similarly positive attitudes of the pupils towards the processes of self-evaluation and peer-evaluation in the categories of liking, difficulty, and discomfort, where there were not statistically significant differences.

Regarding help with learning, where the statistically relevant difference favoured the process of self-evaluation, the explanation relies on the fact that all of the used self-evaluation techniques in Sciences class had been designed according to the principle of analytical sections based on which the pupils knew in advance which elements and criteria of assessment were set, which is exactly the thing that some other research (Nawas, 2020; Wong, 2017) points out as essential for help with learning. On the other hand, the techniques of peer-evaluation did not include pre-defined elements and criteria of assessment, but they involved a public and open expression of pupils' opinions about their classmates' work, which could account for them not perceiving and recognising it as help with learning.

CONCLUSION

Assessment is an indispensable part of education, and it is modified along with the changes in the society. Modern schools advocate for the implementation of formative assessment as integrated in the process of learning and teaching, with an emphasis on the quality of the process of learning, giving quality feedback to the students with the intention of individualising the processes of learning and teaching, and emphasizing the students' overall development as well as helping each of them achieve maximal results. It is cooperative assessment that includes teachers and students – students become active participants in formative assessment via self-evaluation and peer-evaluation, and different techniques are devised to implement it. It is carried out in two ways: *assessment for learning* and *assessment as learning* and it has many benefits for the students as well as the teachers. Some of the positive effects formative assessment has on students include higher academic achievements, increased motivation and diligence in learning, increased ability of critical thinking and awareness of one's own learning as well as the influence one has on it, and an increase in confidence and positive self-image. Some of the positive effects formative assessment has on teachers include continuous acquisition of information about their students' knowledge and understanding during the process of learning and teaching, which provides insight into acquired knowledge, the students' learning styles, their motivation, convictions and interests, based on which the teachers can plan further teaching in accordance with the students' real needs. In the area of *assessment for learning* techniques used during every lesson in Sciences class, there were two distinct groups: the techniques that require longer and more difficult consideration of class materials (they allow for reflection, analysis, synthesis and summation of the learned material as well as connecting different parts of different lessons, which enables higher levels of consideration), and the techniques that quickly and economically provide the teachers with insight into the students' current level of understanding. Our research proved that pupils prefer the assessment techniques that are simple and notably short and are mainly designed to provide the teachers with a quick review of the developments and the pupils' level of knowledge, so that they can plan their lessons accordingly. These results do not mean that the teachers should only apply the quick signalization techniques, but they imply that further research is needed to check what exactly the pupils found more useful in the techniques they assessed as more useful and whether they really made their assessment according to usefulness or, for example, according to duration, frequency of their application, feelings of comfort or discomfort towards public speaking, dynamism, usage of certain materials, etc.

The analysis of the pupils' attitudes towards self-evaluation established positively directed attitudes to the process of self-evaluation with the pupils recognising its potential for help with learning and not considering it a difficult nor uncomfortable process. These results support some previous research which established that students gladly engage in the process of self-evaluation and that it has a positive effect on the level of their achievements, namely it improves their learning (Black and William, 2009, Bursać et al., 2016; Capan Melser et al., 2020; Hattie, 2009, Weurlander et al., 2012; Wong, 2017). Although, for example, some research claims that self-evaluation is a very complex, difficult, biased and stressful process for students (Nawas, 2020; Siow, 2015) this research did not yield such results.

The analysis of the pupils' attitudes towards peer-evaluation established positively directed attitudes to the process of peer-evaluation; it was not considered to be a difficult or uncomfortable process, which confirms some previous research – peer-evaluation is considered an easy and positive process (Munoz & Alvarez, 2007; Siow, 2015). However, the low arithmetic mean established in the category of help with learning shows that, despite being liked by the pupils, it cannot be ascertained that peer-evaluation is useful for help with learning among the examined pupils. However, the research by Siow (2015) and Stančić (2020), for example, considers peer-evaluation more useful for the process of learning than self-evaluation. On the other hand, judging by the conclusions of research conducted on younger pupils in primary education (Bourke, 2016 as cited in Andrade, 2019; Harris & Brown, 2013), it is possible that the

pupils don't sufficiently understand the application of peer-evaluation to themselves (but only to others) and are thus unable to assess its potential for help with learning. This piece of information provides the basis for further research and, for example, the establishment of the relation between the process of self-evaluation and the students' academic performance and the relation between the process of peer-evaluation and the students' academic performance. It also points to a pedagogical potential of cooperative learning and collegiality in peer relationships.

The last hypothesis referred to comparing the pupils' attitudes towards self-evaluation and peer-evaluation (*The pupils will display more positive attitudes towards peer-evaluation than self-evaluation*). While creating the hypothesis, we prioritised peer-evaluation, considering the potential for increased difficulty and discomfort that self-evaluation might cause some pupils primarily due to their personal character (considering self-evaluation a big responsibility or an unsuitable process, enhanced self-criticism, etc.). The analysis of the pupils' attitudes towards self-evaluation and peer-evaluation did not establish statistically relevant differences in the level of liking, difficulty, and discomfort between the two processes, which supports some previous research (Bursać et al., 2016; Munoz and Alvarez, 2007; Siow, 2015). Given that students' attitudes towards these processes vary in hitherto research, this research does not establish that any of the processes poses a greater difficulty or discomfort for the students. A statistically significant difference is only established in help with learning, which favoured the process of self-evaluation.

In conclusion, the results of this research point to the usefulness of certain techniques of formative assessment in the Sciences class, which the practitioners can further consider and implement taking into account the circumstances of every individual class, the working conditions and the lesson itself. Moreover, given that positive attitudes towards self-evaluation and peer-evaluation have been established among the pupils, they should be encouraged in Sciences class. This research can be furthered by qualitative examination of the pupils' opinions on the applied techniques of formative assessment with the purpose of establishing the reasons behind them rating the techniques in a certain way, as well as including the variables such as sex, academic performance, and their mutual relation to the attitudes towards the processes of self-evaluation and peer-evaluation.

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