A Case Study of Biology Teaching Practices in Croatian Primary Schools

Abstract: The aim of this case study is to present the most frequent teaching methods used by biology teachers in the Republic of Croatia, based on the observations made during biology class and the teachers’ statements. The study included six distinguished primary school biology teachers, along with their seventh-grade classes. The data comprised an interview with each teacher and twelve class observations. The results show that biology education in the Croatian educational system is mostly traditional, whereby students mostly practice listening to the teacher (34%) and answering the questions (18%). In summary, the majority of teaching consists of teachers presenting the content materials and asking questions or engaging students in specific individual or group activities. The present study has determined a lack of student questions and class discussions. Additionally, the nature of teachers’ questions does not encourage students to think and provide extensive answers. For this reason, the study suggests that teachers encourage students to ask questions and organize teaching activities in ways which will contribute to more class activity and deep learning of students. Despite some acknowledged limitations, the results of this study can contribute to a better understanding of the teachers’ experiences in authentic science classrooms, in specific contexts.

Keywords: biology teacher, biology classes, teaching methods, classroom observation

1 Introduction

New generations of teachers face new opportunities and implications (Wang, 2019), as do new generations of students. Abdullah and Hendon (2016) point out that twenty-first-century students need to think critically and use problem-solving techniques, communicate, cooperate, create, and innovate to prepare for the twenty-first-century workplace. In following the new paradigm of modern education, it is important to ensure that teaching methods are dominated by interest in the effectiveness of learning through activities and methods which engage students in practical activities closely related to learning. The emphasis should, therefore, be on the students’ independent study of literature, study of principles, development of a research plan, prediction of expected results, and gaining the ability to self-evaluate all these elements (Wurdinger & Qureshi, 2015).

Porozovs, Liepniece, and Voita (2015) emphasize that student success and learning motivation depend significantly on the teacher’s ability to encourage student interest, their selection of teaching methods, and their skill in leading the learning process. In other words, a teacher who understands student interests and knows how to select appropriate methods can largely influence the development of student interest in biology. Consequently, apart from the integration of theory and practice, communication between students and teachers is also important. Interactions during teaching contribute to the development of a deeper understanding of science in students by engaging teachers in the scientific practices of discourse and argumentation (Kuhn, Arvidsson, Lesperance, & Corprew, 2017). In this communication process, feedback is a key element that can encourage student results (Hattie & Timperley, 2007; Wisniewski, Zierer, & Hattie, 2020).

The use of methods which encourage students to learn actively contributes to the effectiveness of teaching at different levels of education (Freeman et al., 2014). Ting et al. (2023, p. 381) define active learning “as any instructional method or pedagogical approach that engages learners in their own learning process through their active involvement in class, as opposed to a passive learning and traditional
instructor-centered, lecture based pedagogy.” In the process of active learning, various forms of cooperative learning are important (Johnson & Johnson, 2018) since they positively influence different aspects of students’ learning (Tanner, Chatman, & Allen, 2003). Elkhidir (2020) points out that teaching strategies are increasingly focused on students’ interests with the aim of providing them with active and cooperative learning. “Thus, many strategies evolved as an attempt to fulfill the objectives of the learning process, by shifting the focus from instructor-driven to learner-centered teaching strategies” (p. 2). The advantages of such a learner-centered approach include the following:

- more effective learning;
- high-level student motivation;
- integration with the previously acquired knowledge;
- adjustment of teaching intensity to student needs;
- encouragement of student openness and responsibility;
- experiential learning;
- creating conditions for two-way communication (Akmalovna & Qizi, 2022).

The present aim is to offer an insight into how biology is taught within the Croatian education system, especially in primary schools.

2 Theoretical Framework

Jeronen, Palmberg, and Yli-Panula (2016) conducted a literature review in which they emphasized the value of inductive methods, where instruction begins, for instance, with observations, experimental data to interpret or a real-world problem to be solved (p. 7). In the analyzed articles, they noted twenty-two different teaching methods. The most frequent ones were cooperative learning, outdoor and field lessons, and experimental, interactive, and experiential learning. Teacher presentations and class discussions were also found to be largely popular teaching methods. The most prominent characteristics of teaching methods were activity, participation, and student interactivity. Solving complex problems emphasizes the need for cooperative activities in environments in which students develop various competencies important for functioning in contemporary society. Cooperative learning is considered an active process which results in the students’ shared knowledge. More than one-fifth of the articles emphasized problem orientation, cooperation, and argumentation as teaching methods. Argumentation is said to support higher-order critical thinking and to improve the understanding of biology learning content.

Porozovs et al. (2015) conducted research with the aim of evaluating biology students’ and teachers’ opinions on the most successful teaching methods in biology classes and the opportunities for making the classes more interesting. The results show that 58% of students find biology classes interesting, as well as that 56% of students believe that their ability to concentrate during the lesson depends on the task given to them. They prefer teacher presentations, listening to explanations of the learning content, and participating in laboratory and group work. The majority of students acknowledge the value of discussions, while a significantly lesser number of students are interested in doing various exercises, individual tasks, filling in worksheets, or working on projects. The least preferred teaching method for students was textbook work. Students believe that biology classes could be made more interesting by introducing more laboratory work, research, experiments, and field lessons. Students are interested in recent scientific discoveries in the field of biology and would like to discuss them during class. The most frequently used methods are lectures, explanations, demonstrations, and discussions. Teachers also use research work, practical tasks, and problem-solving. The lesser frequent methods are textwork, group, and individual work. Teachers believe that their students prefer laboratory work and discussions to listening to lectures and watching presentations or movies. They also point out the need to connect theory and practice, provide a working environment in which students feel like researchers, and integrate information technologies in teaching to develop student interest in natural processes.

Saito, Takahashi, Wintachai, and Anunthavorasakul (2021) highlight group learning as an active learning method for the improvement of teaching practices. According to Johnson and Johnson (2014, p. 841), “cooperative learning is the instructional use of small groups so that students work together to maximize their own and each other’s learning.” Johnson and Johnson (2008) believe that effective cooperative learning entails five elements: positive interdependence (group success depends on the success of each group member), promotive interaction (mutual help to achieve a common goal), individual accountability, having and developing social skills, and group processing (reflecting on the individual engagement of each group member). Since the 1970s, cooperative learning has been increasingly researched “as the generic term for group-based learning” (Strijbos, 2000, p. 1). Since the 1990s, the term collaborative learning has become more frequent. Veldman and Kostons (2019) point out that cooperative learning differs from collaborative learning in the following four dimensions: 1) the structure of tasks and activities (cooperative learning is more
structured, with more precise goals and learning procedures than in collaborative learning; 2) focus on the student or teacher (cooperative learning is more guided by the teacher, while collaborative learning is more learner-centered); 3) type of knowledge (cooperative learning is more suitable for basic knowledge, while collaborative learning emphasizes higher-level knowledge “which is derived through reasoning and questioning and requires a critical approach to learning” (p. 77)); 4) student age and level of education (cooperative learning is more suitable to primary education, while collaborative learning is more suited to students in higher education). A meta-analysis of the effects of cooperative learning that was conducted by Kyndt et al. (2013) points to a medium effect size (ES = 0.54) of face-to-face cooperative learning, which corresponds to other meta-analyses with similar results (Apugliese & Lewis, 2017; Bowen, 2000; Springer, Stanne, & Donovan, 1999). The same research determined that cooperative learning is more effective in sciences and mathematics than in social sciences and languages. Regarding the educational level, the secondary level has a lesser effect size than the primary and tertiary levels. Additionally, cooperative learning is more effective in non-Western cultures. The recommended number of members in cooperative groups is three to four students. However, in their meta-analysis, Apugliese and Lewis (2017) determined that groups of five and more students can be effective as well. In an earlier meta-analysis, Springer et al. (1999) concluded that there is no statistically significant difference between cooperative, collaborative, and mixed forms of small-group learning. That is, all three forms of small group learning are equally effective. The authors believe that this result supports the conclusion “that any movement in the direction of getting students more actively involved should be commended, not faulted, if one or more elements of a certain technique are not executed according to dogma” (Cooper & Robinson, 1998, p. 386). Finally, it should be noted that cooperative learning has a significantly greater effect on student motivation than traditional teaching (Sugano & Mamolo, 2021). All this points to the important role that cooperative learning plays in teaching that aims to promote active learning, because it “typically requires a learning partner or a small group in which the information being learned is analyzed, synthesizes, evaluated during discussions” (Johnson & Johnson, 2018, p. 68).

In discussions on learning in small groups, one is often focused on student activity. Yet, one should not forget the teacher’s role, which is particularly important in cooperative learning that can “be more prescriptive in activities and more directive to students about how to work together in groups” (Veldman & Kostons, 2019, p. 77) than collaborative learning. In cooperative learning, the teacher’s task is to observe, guide, and support the learning process in groups, but also to withhold help when it is not needed (Adl-Amini & Voeller, 2021). Van Leeuwen and Janssen (2019) point out that teachers should let students know that help is available, but they should give them control over their own learning. In other words, the feedback given by teachers during cooperative learning should not refer only to the task or the task-solving process, but above all to the meta-level of cooperation. This is in accordance with the conclusion reached by Hattie and Timperley (2007), who say that the “feedback aimed to move students from task to processing and then from processing to regulation is most effective” (p. 91). For teachers to be able to intervene appropriately during cooperative learning, they must first familiarize themselves with the current status of the group discussion (Pauli & Reussner, 2000, as cited in Adl-Amini & Voeller, 2021). This is not an easy task because “teachers need to monitor several groups at the same time, provide support concerning task content as well as strategies for collaboration, and need to decide whether it is necessary to intervene, and if so, what kind of intervention is most suitable” (van Leeuwen & Janssen, 2019, p. 72). However, cooperative learning requires teachers to occasionally help students solve tasks which the students cannot solve themselves, and this, according to van de Pol, Volman, and Beishuizen (2010), represents scaffolding. Scaffolding has three key features: contingency (based upon student responses), fading (it should disappear over time), and the transfer of responsibility for the task at hand on students (van de Pol et al., 2010).

Classrooms are dynamic and complex environments with multiple factors which influence the way in which teaching and learning take place. Active learning to be used in biology classes posits the teacher as only a leader who facilitates the learning process (Kranzfelder et al., 2020). During classroom or field lessons in biology, it is important to create an environment that promotes cognitively stimulating interaction and communication between the teacher and students. Materials and equipment play an essential role in enabling such a stimulating environment and effective teaching of biology. Using equipment in biology classes helps students learn new information in an effective, lasting, and meaningful way. It also creates an active and entertaining classroom environment.

1 In the said meta-analysis, more individualistic cultures “such as the USA and a few countries in Europe were considered Western cultures” (Kyndt et al., 2013). It is worth noting that the Republic of Croatia is a predominantly individualistic country (Rajh et al., 2016).
Educational equipment cannot be viewed independently of other elements of the teaching and learning processes. Therefore, it is not possible to mention a single piece of equipment that can be used in all teaching and learning situations. In using equipment in biology classes, students can learn not only by listening, but also by watching, doing, experimenting, and researching. The knowledge gained in this way will be permanent and used in creating solutions for the problems students face in everyday life. The use of equipment in biology classes is very effective in acquiring cognitive, affective, and psychomotor skills of students. Especially during laboratory work, affective and psychomotor benefits are emphasized. To achieve the effective implementation of biology lessons, it is therefore important to emphasize laboratory exercises so that students can improve their experimental skills (Sayan & Mertoğlu, 2020).

In the last 20 years, new methods have been introduced into education, including biology teaching. Akmalova and Qizi (2022) divide these into five groups:
1. Practice, experimental method (experimentation, practice; participation in the process of training, labor, and production).
2. Demonstration method (student observation and internship).
3. The method of verbal expression (explanation; exchange of views; report; discussion; etc.).
4. Work with the book (review quickly; write a statement; writing an abstract; etc.).
5. Video method (computer exercises; work on the Internet; preparation and screening of educational films; multimedia presentations; etc.).

Although Kranzfelder et al. (2020) revealed that biology teachers spend the majority of time guiding student learning through active learning activities, and less time on presentation activities. The analysis of the participants’ communication approaches in the classroom shows that they mostly used the authoritative discourse to teach biology content, rather than the dialogic discourse. Additionally, they found a strong positive correlation between biology teachers who guide student learning and authoritative, interactive approaches, suggesting that the teachers mostly ask students to recall facts or basic concepts rather than co-construct knowledge.

3 Methodology

This case study aims to provide insight into how biology is taught in the Croatian educational context, based on classroom observations and interviews with teachers. A case study involves an in-depth investigation of people, events, and processes that are thoroughly examined using a variety of methods and implies extensive data collection (Creswell, 2012; Thomas, 2011). We chose Thomas’s (2011) case study typology as it seemed most appropriate for this research. This is an instrumental case study that seeks to understand and interpret biology teaching in a particular context (Thomas, 2011). This case study describes and explains the events by relying on qualitative and quantitative data analyses (Yin, 2011).

3.1 Participants

The research involved six female teachers working in the seventh grades of various primary schools in eastern Croatia. The sample was deliberately and purposefully selected to explore real, dynamic situations and other factors of the teaching process. All participants are excellent teachers; i.e., they have the status of a teacher mentor and/or teacher advisor. More precisely, it is a homogeneous sample whose homogeneity is reflected in the similar characteristics of the participants, such as the subject, which in this case is common to all, and the mentioned status. Therefore, female teachers do not belong to a general population sample (Thomas, 2011).

3.2 Data Collection and Analysis

In order to obtain a more complete picture of the research problem, we used triangulation, i.e., the combination of different data sources, research methods, and instruments: interview, systematic observation of classes, and the presence of the researcher who followed the changes, because the researcher is a key instrument in qualitative research (Patton, 2015; Yin, 2009). Systematic observation of classes was achieved by recording with a digital video camera and mobile device. The videos were used for subsequent analysis of the lessons. Class observation and recordings were made in the presence of a researcher who did not participate in the activities of the teaching process. The recorded lessons lasted ninety minutes on average, except for a few which lasted 45 minutes. The researchers avoided recording lessons during which exams, student presentations, or special group activities such as project works took place. A total of twelve sample lessons were observed and recorded. The first cycle of class observations was

The data were analyzed with the help of COPUS (Smith, Jones, Gilbert, & Wieman, 2013), after obtaining the authors’ consent. “The COPUS protocol allows observers... to reliably characterize how faculty and students spend their time in the classroom” (Smith, Vinson, Smith, Lewin, & Stetzer, 2014, p. 625). The protocol lists 13 student activities and 12 teacher activities. Each activity observed in a two-minute time interval is recorded, regardless of its duration. The visual representation of COPUS results gives an insight into the frequency of students’ and teachers’ activities observed. Observation by using the protocol was carried out by two researchers, independently of each other. Trying to compare inter-rater reliability, we calculated Cohen’s kappa scores for each recording separately and for all recorded classes together (Cohen, 1960).

To be able to calculate Cohen’s Kappa for two raters, we determined using MS Excel a) how many times both observers put a check in the same box, b) neither of them put a check in the same box, c) the first observer put a check in the box while the second did not and d) the second observer put a check in the box while the first did not (Table 1). Then, using the formula

$$\kappa = \frac{p_o - p_e}{1 - p_e},$$

Here, we calculated the kappa score for every lesson recording included in this work, which is 0.85. This, according to Landis and Koch (1977), represents an almost perfect agreement between two observers.

An interview was conducted with each teacher in January/February 2020. The audio recordings and interview transcripts remain stored on the researchers’ computer. They used an open-ended standardized interview with the questions constructed and designed for the needs of the research. According to Patton (2015), this type of qualitative interview “consists of a set of questions carefully worded and arranged with the intention of taking each respondent through the same sequence and asking each respondent the same questions with essentially the same words” (p. 645). Each participant was given the opportunity to respond in their words, and no pre-written responses were offered (Patton, 2015). The interviews contained a number of questions, some of which are related to teaching. Here are several questions the answers to which are included in this article:

**Question 1:** Describe the teaching methods you use in your teaching. Which of these methods do you think enhance the quality of student learning?

**Question 2:** Do you use group activities in your teaching? If yes, in what way?

**Question 3:** Do you give students feedback during class? If yes, in what way?

**Ethical Considerations:** Before conducting the research, participants were acquainted with its aim and purpose. Written consent for recording the classes was obtained from the teachers, principals of all six schools, as well as the children’s parents. Teachers’ names remained anonymous to ensure the privacy and confidentiality of the data. Labels were used instead of names to distinguish each research participant. The mentioning of the names of the institutions in which the study was conducted was avoided. Due to the anonymity of the data, the recordings of the classes are not available on public channels or anywhere online.

### 4 Results and Discussion

By using the COPUS protocol for quantifying student activity during biology lessons, the researchers have found that students spend the majority of time listening to the teacher’s presentations, i.e., lectures and/or information presentations. More precisely, listening to the instructor had an average relative representation of 34% (Figure 1). Next to listening, the most common student activity was answering the teacher's questions (18%). This study found that teachers asked mostly closed-ended questions which students usually answered with yes or no, that is, with very short answers. For instance, Teacher 2 asked “How does oxygen get to each cell in our body?” The student answered: “Through the
bloodstream.” Therefore, although the student could have given a more complex answer which would include a more complex explanation of the process of carrying oxygen to the cells in the body, and which would imply divergent ways of thinking and perhaps encouraged other students’ questions, their curiosity, and the development of critical thinking, the student gave a short and simple answer. Hence, the conventional approach to learning prevents the development of divergent thinking necessary for task-solving. In connection to that, Susantara and Myartawan (2020) note that the use of different questioning skills and divergent questions makes the teaching process proactive and encourages students to develop critical thinking skills that are crucial for living in the twenty-first century.

Moreover, working groups as one of the activities which include worksheets and other group work account for 26% of the entire teaching process. This suggests that elements of cooperative learning are nevertheless included in the teaching process. Teachers use cooperative learning in class because they recognize its multiple benefits. They believe that in this way, students understand the learning content and the rules of cooperation more easily and deeply, and that they learn to take responsibility as a team for the success or failure in learning (question 1):

I think it’s very important. I find cooperative learning very useful because they really learn a lot from each other. They can work well with each other and really understand, not just the materials but how to behave and how to interact with each other. (Teacher 4, personal communication, 27.1.2020.)

As with Martins-Loução, Gaio-Oliveira, Barata, and Carvalho (2020), along with critical thinking and problem solving, effective communication, and innovation, cooperation has been identified as an important skill which allows students to improve their understanding of science.

Cooperative learning is connected with presentation, i.e., with the oral explanation of what has been learned, which accounts for 8% of student activity. Such a presentation was often accompanied by posters which students made on their own, models created during practical work, or drawings. When it comes to practical activities, teachers prefer them in their work (question 2):

I think that the use of practical activities, research methods in teaching, the use of research-based teaching improves the quality of students’ learning. Because they are not just passive observers who get everything done for them, they have to make an effort and complete the task independently, help each other, and study the problem to achieve educational outcomes. (Teacher 5, personal communication, 3.2.2020.)

Students usually like to participate in work and practical work. They like to connect what they are learning to daily life and situations/topics they encounter and/or are concerned with, and I try to incorporate such topics and activities into their work. (Teacher 3, personal communication, 23.1.2020.)

When students think independently about something or when the teacher poses a specific problem for which students need to find a solution, this represents individual thinking or problem-solving, which accounts for 8% of the entire teaching process. For this reason, it is important
to give students a chance to generate ideas on the teaching content and learning process to encourage their reflective thinking (Üstün, 2012).

Based on the analysis of student activity throughout the teaching process, a lack of student questions and class discussions (3%) has been determined. Accordingly, a low percentage of teachers’ answers to students’ questions (2%) is present. This indicates a relatively traditional teaching process. Student questions, especially those at a higher cognitive level, can stimulate conceptual thinking, which leads to improved learning. The process of asking questions is an important part of teaching and learning since it allows teachers to monitor students’ progress in learning and understanding, as well as encourages thought-provoking discussions that are essential for active learning (Musingafi & Muranda, 2014). Aflalo (2021) also considers the importance of student questions. She finds that student questions contribute to the reduction of exam anxiety, question formulation skills, or productive cooperative learning. Therefore, he recommends that teachers allow students to generate questions in groups and to solve and evaluate the questions posed by their peers. Interaction and cooperative learning provide significant cognitive and metacognitive benefits. Generating questions encourages students to master the teaching content, while peer assessment encourages them to reflect on individual learning. It is possible to create more space for student discussion by varying the types of questions students use to express themselves during class discussions. Thereby, question types related to students’ cognitive activity (e.g., challenging, legitimate, and evidential) can enable students to demonstrate a higher level of reasoning (Soysal & Soysal, 2022).

Figure 2 shows three teacher activities which include teacher explanation or presentation of the teaching content, whether verbally, in writing, or through audiovisual means. These are lecturing (Lec), writing (RtW), and showing or conducting a demo, experiment, simulation, video, or animation (D/V).

As in Shi, Peng, Yang, and MacLeod (2018), our study results also indicate the traditional presentation-based teaching (15%) with the use of projectors to display multimedia resources to students, such as video clips and various types of educational information, or writing notes on the board (9%), as well as demonstrating and simulating biological processes by using video (3%). Consequently, 27% of teacher activity in class comprises the presentation of teaching content. Tanner (2013) asserts that the prevalence of presentation as a teaching approach leads to a lack of variation, which results in the alienation and exclusion of students from learning activities. Instead, the use of different active learning strategies may be crucial for individual students to make multiple associations between various concepts and deepen their understanding of the learning content.

Regarding individual activities, the biology teacher’s moving around the classroom is the most represented activity (MG, 26%). It includes directing the work of students, that is, leading their cooperative or individual

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**Figure 2:** Percentage of teacher activity.
activities. Granted, since group activities with worksheets and other group activities comprise a total of 26% of student activity, this percentage coincides almost fully with the percentage of the teacher’s moving around the classroom to supervise and coordinate the students’ independent work.

In addition to that, 23% of the teaching process is spent on giving feedback to students about their work. Direct feedback is used when teachers ask students a question or specify an activity to work on and then monitor what the students did or how their work developed. While doing so, it is important for teachers to understand the different types of feedback in relation to student learning. Based on the students’ answers, the teacher should be able to identify the gap between their current level and the target level of knowledge and skills, and implement a meaningful intervention to reduce this gap (Jiang, 2020). Teachers evaluate their own feedback to students as good (question 3):

Students receive feedback in class and comments in the e-register through peer assessment. I use peer assessment when writing the feedback. Students like to participate in the assessment and are good at making good suggestions to improve their work. (Teacher 5, personal communication, 3.2.2020.)

There are criteria for assessing their work (...) I make notes about their work since as of recently everything has to be recorded in the E-register. I used to write everything on a piece of paper and hand it to them, but now they have all the feedback in the E-register. So, both the parents and the students can see what they still need to work on. (Teacher 1, personal communication, 22.1.2020.)

Students receive regular feedback on their work. The feedback is sometimes oral and other times it is written. Sometimes it is given during the activity, and sometimes at the end of the activity. (Teacher 3, personal communication, 23.1.2020.)

When it comes to feedback, I usually tell them what they did well and what they should work on, what they should study or practice more. (Teacher 4, personal communication, 27.1.2020.)

Although the sample used in this study is not representative, only a group of distinguished biology teachers, these results can contribute to the understanding of results achieved by the Croatian students in the international PISA study. Namely, since 2006, when the Republic of Croatia was included in the study, a trend of increasingly poor results in scientific literacy has been observed (Figure 3). “Considering the average result in scientific literacy, one can conclude that the average Croatian student is at Level 2 of scientific literacy, while the average student from OECD countries is at Level 3” (Markočić Dekanić, Gregurović, Batur, & Fulgosi, 2019, p. 185). Level 2 is considered to be the basic level in science.

Teachers’ questions in class had an average representation of 17%, making them one of the most frequently used methods when it comes to teacher activities. Concerning that, a shortcoming has been observed regarding the type of questions that teachers ask the students. These are largely simple questions which do not encourage the development of higher cognitive levels in students. Nevertheless, stimulating questions posed by teachers were also observed. Although there were only a few such questions, they encouraged the students to think. To illustrate, Teacher 3 asked the following: “Which of these two organisms (a frog or a mouse) will have a better efficiency with energy supply?” A student answered: “A mouse, because it has a four-chamber heart and a constant temperature.” This shows that, if posed correctly, a good question can be an excellent tool to initiate the research process, to address curiosity, and to try and reach the answer. In connection to that, Vale (2013) concludes that research employed to answer a question often results in further questions that delve deeper into any given phenomenon. Poorly formulated questions can limit the students’ creative thinking. Similar to Tofade, Elsner, and Haines (2013), this study finds that teachers most often ask lower-order, convergent questions that rely on students’ factual recall of prior knowledge rather than asking higher-order, divergent questions that promote [creativity,] deep thinking, requiring students to analyze and evaluate concepts.

In addition, this study has noted a low percentage of administration (3%), which refers to situations when the teacher is handing out worksheets for group or individual work to students and giving them information about homework.

Figure 3: Averages for 15 years PISA science scale: overall science for International Average (OECD) and Croatia (https://pisadataexplorer.oecd.org/ide/idepisa/report.aspx).
5 Conclusion

Classrooms are dynamic and complex environments which encompass class activities and teaching methods that play an important role in students’ learning. The overall classroom dynamics, which include students’ motivation, their interest in actively participating in class, students’ relationships with each other, and relationships with the teacher are the basic conditions for successful learning. In a student-centered approach to learning, teachers and students play an equally active role in the learning process. The teacher’s primary role is to teach and facilitate student learning as well as the overall understanding of learning content. Thereby, it is important to choose teaching methods that align with learning objectives. A successful application of teaching methods enables students to acquire the learning content more successfully.

Regarding biology teaching in the Croatian education system, the results of the present study show that students have a predominantly passive role. In other words, students mainly listen to the teacher and/or take notes, and answer the questions teachers ask. Although group activities and individual student work were observed on the recordings, one can conclude that the elements of traditional teaching prevail, within which the teachers present the teaching content and ask questions.

The underrepresentation of student questions and teachers’ answers to these questions, and the total absence of class discussions indicate that teaching is insufficiently focused on student interests and activities. The process of asking questions is an essential part of teaching since it allows teachers to monitor the students’ competency and understanding, as well as to increase the number of discussions that encourage students to make connections and draw conclusions. Furthermore, questions initiated by students improve their cognitive learning levels as the students analyze information and articulate their thoughts. Therefore, the authors of this study suggest teachers to organize teaching activities in ways that will encourage students to ask questions, because the effective use of questions stimulates curiosity and interest as well as motivates students to deepen their existing knowledge.

6 Limitations

The results of this study are limited in scope (six female teachers) and cannot be generalized. The fact that this study is aimed at primary science teachers who have the status of mentors or advisors does not diminish its value and the possibility of its application in other subject areas and with teachers of different profiles and age groups.

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