



Nearpod as a tool for increasing students' motivation for learning chemistry

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ABSTRACT

The Nearpod software application was implemented in chemistry teaching, thus keeping in touch with current technology appropriate for its use in the education. This is the first study in our country focusing on the usage of the Nearpod as an e-module-based learning media aimed to increasing students' motivation in chemistry classes, through their engagement during the lesson and active participation. The total sample consisted of 244 9th grade students and 7 teachers from 7 primary schools. This research was based on data collection by modified SMTSL and IMI questionnaires and individual interviews with students and teachers. The data were analyzed and the mean, standard deviation and Cronbach' alpha reliability coefficient were calculated, which revealed acceptable internal consistency for all subscales. Data obtained from the APQ-N instrument showed that most of the students found this activity enjoyable and interesting, and felt that it was important for their success and progress, but it also enabled them to achieve better results and improve their attention during the online classes. SMTSL-N questionnaire revealed that the students had medium motivation toward chemistry leaning overall. Independent t-tests results stated that there is no significant difference between male and female students' mean scores. The results obtained in this study, including the interview data as well, indicated that Nearpod-based activities positively influenced students' motivation in learning chemistry. Nearpod has a great potential to be applied during the face-to-face teaching as a hybrid model in the future, thus making teaching more interesting and less monotonous.



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1. Introduction

Taking into account all changes that are happening in modern society, it can be seen that changes in the field of education are inevitable. Compared to the traditional, modern education has set itself many different objectives. The development of technology not only enables teachers, but also obligates them to implement new digital tools during the educational process allowing students to keep in touch nowadays. In other words, teachers are required to enable students to develop their own potential and thus respond to the needs of modern society. Because of that, in contemporary teaching it is necessary to introduce novel student-centered activities that will attempt to keep students' attention and increase their motivation to learn. Plenty of Information Communication Technology (ICT) tools and web-based platforms provide an interactive learning class and Nearpod is one of the most significant, and at the same time offering engagement of the students [1]. Switching from a traditional teaching model into more interactive lessons with the implementation of new technologies, requires not only knowledge about the content [2], but also possessing some other skills (ICT,

researching, making selection, etc.) by the teachers. According to [3] using Nearpod in lectures concerning energy and change is applicable for implementing in elementary school students. There is no previous research in which implementation of Nearpod for students of 9th grade in Exothermic and endothermic reactions topic is studied. Providing evidence for formative assessment and students' engagement during the classes is an advantage and therefore an additional reason for our choice to use the Nearpod [4]. Therefore, the goals of this study were to apply a new and innovative approach in chemistry teaching to increase the engagement and motivation of 9th grade students in studying the Exothermic and endothermic reactions topic, improving their communication skills, encouraging creative, critical and logical thinking, and improving the ability to solve problems. Furthermore, the purpose of this research was to examine the students' opinions about the implemented activities in the classes, while encouraging their active participation in the classes and mutual collaboration. Besides helping the students to master the teaching content in a more interesting way, Nearpod can also be used to stimulate their competitive spirit.

2. Method

2.1. Research Design

The research consisted of delivering lessons related to the last topic of the chemistry curriculum for the ninth grade, Exothermic and endothermic reactions topic. The period of realization of these activities was April-May 2021. Considering the fact that the teaching in the 2020/2021 school year took place online, the Nearpod activities were prepared and implemented with the help of MS Teams. This research was divided into several phases; (1) preparatory phase; (2) implementation of the lessons using Nearpod activities; (3) distribution of Activity Perception Questionnaire for Nearpod activities (APQ-N); (4) distribution of Students' motivation toward science learning questionnaire (SMTSL-N); (5) conducting interviews with students and teachers; (6) analyzing interviews and preparing transcripts; (7) analysis of the obtained data using SPSS Statistics 26 software package.

2.2. Research Sample

In order to examine whether the application of the Nearpod activities leads to an increase of the engagement and the motivation in 9th grade students, various activities were carried out using this tool. The research was conducted in five primary schools from cities in various regions in the Republic of Macedonia and it involved 244 9th grade students who attended classes in different languages of instruction, i.e., Macedonian and Turkish.

2.3. Research Instruments

For the purposes of this research, a combination of quantitative and qualitative data collection techniques was used and two kinds of instruments were implemented: two different questionnaires in which students expressed their opinions regarding the conducted Nearpod activities, and individual interviews with students and teachers. Using both kinds of methods lead to the improvement of the reliability and validity of the results by means of triangulation [5], [6]. The quantitative data were collected using two questionnaires: Students' motivation toward science learning (SMTSL) [7] and Intrinsic motivation inventory (IMI) [8]. Both questionnaires were modified for this research i.e., in all items the word science was replaced with the word chemistry (abbreviations SMTSL-N and APQ-N are used for the applied questionnaires in this research). The SMTSL questionnaire is Likert type questionnaire that contains 35 items, divided into six categories and they are related to the students' motivation to study science. This questionnaire is well known in the literature and has been used in several studies to examine the students' motivation to study science [9], biology [10], Greek [11], Albanian [12], physics [13], project-based learning [14], etc. The participants of our research were asked to give their opinion in each offered statement. In that way they expressed the degree of agreement with a certain statement by choosing one of the offered options (1-5), as follows; (1) if (s)he does not agree with the statement at all; (2) if (s)he disagrees with the statement; (3) if (s)he does not have an opinion/idea about the statement; (4) if (s)he agrees with the statement, and; (5) if (s)he completely agrees with the statement.

The IMI questionnaire is also a Likert type questionnaire and was used to assess students' opinions and experiences related to certain activities conducted in the classroom. For each of the statements, the respondent needed to indicate to what extent (s)he agrees with it, using the scale from 1, meaning

the respondent does not agree with the statement at all to 7, meaning that (s)he completely agrees with the statement. The instrument assesses the interest/enjoyment of the students, the perceived competence, the effort, but also the importance of the activity, the value/usefulness, the felt pressure/tension and the perceived choice when performing a given activity. Additionally, a 7th subscale has been added to tap the experiences of relatedness. This questionnaire has been used in research in various fields, such as: inquiry-based learning [15], sport [16], information and communication technology [17], psychological health [18], biology [19], first language and mathematics learning [20], etc. For the purposes of our research the APQ-N instrument was used, which was constructed using item from four subscales (interest/enjoyment, value/usefulness, effort/importance, and pressure/tension) of the IMI questionnaire and contained a total of 23 items. The purpose of this study was not only to review the student opinions on the statements in the two questionnaires, but also to get an in-depth insight into their thinking by interviews as an appropriate technique, which have been successfully used as data collection technique in educational research [21], [22]. In this study, 24 semi-structured interviews were conducted: 17 with the students who participated in the research and 7 with their chemistry teachers. Each interview lasted not more than 20 minutes and they took place online via Zoom. The interviews were audio-recorded and transcripts were made for each individual discussion. The interviews were carried out according to the design proposed by Kvale [23]. They consisted of three phases: the briefing phase, the main phase and the debriefing phase. In the main phase students were asked questions (in an open-ended format) according to an interview guide prepared beforehand.

2.4. Procedure and Data Analysis

For the purpose of this study, the SMTSL-N questionnaire and the four subscales (interest/enjoyment, value/usefulness, effort/importance, and pressure/tension) from the IMI questionnaire were translated from English to Macedonian. Five university professors experienced in educational research from two faculties were engaged in the translation procedure. Afterwards, these five versions of the two questionnaires were compared and any disagreements were resolved. The translated questionnaires were prepared in Google Forms and were administered to students after completing the classes with the Nearpod activities. They filled them out individually and anonymously during the last 5-7 minutes of the class. Students were told that the questionnaire would not affect their grade and that there were no correct or incorrect answers. The obtained results from both questionnaires were analyzed using the software package SPSS Statistic 26. During the individual interviews, mutual respect and confidentiality was observed. The participants (students and teachers) were interviewed without coercion and with their prior consent. They were carefully explained that the interview discussions would be used for research purposes only and that all information would be kept confidential. For that reason, each student/teacher was assigned a code (S1, S2 etc.; T1, T2, etc.) in the data analysis process. All interviews were conducted in Macedonian, so the excerpts quoted in this paper were translated into English.

3. Results and Discussion

3.1. Quantitative Data Analysis

Taking into account the obtained results for all scales, in order to examine the internal consistency, the data were analyzed and the mean, standard deviation and Cronbach' alpha reliability coefficient were calculated (Table 1). To score the APQ-N instrument, the following procedure was done. First, reversed scores were calculated for the items in which an (R) is shown after them. To do this, the item response value was subtracted from 8 and the resulting number was used as the item score. After that, subscale scores were calculated by averaging across all of the items in a particular subscale and were used in the further analyses.

Table 1. Means, standard deviations and Cronbach's alpha reliability coefficient for APQ-N instrument

Scale	Number of items		APQ-N	
			M	SD
Interest/ Enjoyment	6		5.92	1.50
Value/ Usefulness	8		5.85	1.45
Effort/ Importance	5		4.94	1.94
Pressure/ Tension	4		2.24	4.62
Total	23		5.04	1.75
				Cronbach's alpha
				.841

Table 1 shows the means, the standard deviations and the Cronbach' alpha reliability coefficient for the four subscales of the APQ-N questionnaire. Cronbach's alpha provides a measure of the scales' internal consistency taking into account scores of all the items for each subscale. Regarding the internal consistency, Cronbach's alpha coefficients revealed acceptable internal consistency for all four subscales (from 0.580 to 0.926) following the cutoff criteria of Cohen [24]. For the whole APQ-N instrument the Cronbach' alpha reliability coefficient was 0.841, having in mind that the value/usefulness subscale is very highly reliable. From the obtained data of the APQ-N instrument, it can be seen that most of the 9th grade students found the Nearpod activity fun, enjoyable and interesting. The means for the first two subscales were relatively high (5.92 for interest/enjoyment and 5.85 for value/usefulness subscale). It can be concluded that the students felt that the Nearpod activity was important for their success and progress, but it also enabled them to achieve better results and improve their attention during the class. This activity affected the engagement and motivation of students in processing new teaching content, but also encouraged their competitive spirit. Compared to the previous two subscales, a lower value (4.94) was obtained for the items of the effort/importance subscale. These items referred to the students' estimation on how much effort they put into the Nearpod activity. Based on the obtained results, it could be assumed that the applied activities were not too difficult to master and the students successfully faced them. The mean for the last subscale (pressure/tension) was 2.24. From this value it can be concluded that the students were not nervous in class, but relaxed even though they came across this activity for the first time. Additionally, a comparison of the males and females mean scores on the four subscales for the APQ-N questionnaire was performed. The total number of students in chemistry classes was 244, but 145 students (57 males and 88 females) filled the APQ-N questionnaire. Independent *t*-tests were carried out to find out whether there was a significant difference between males and females mean scores. Results are given in **Table 2**.

Table 2. Comparison of the males and females mean scores on the four subscales for APQ-N instrument

Variables	Groups	APQ-N				
		N	M	SD	t	p
Interest/ Enjoyment	m	528	5.51	1.631	-6.531	0.000
	f	342	6.18	1.351		
Value/ Usefulness	m	456	5.40	1.615	-8.844	0.000
	f	704	6.15	1.256		
Effort/ Importance	m	285	4.54	2.020	-4.448	0.000
	f	440	5.19	1.853		
Pressure/Tension	m	228	2.25	1.773	0.085	0.932
	f	352	2.23	1.732		
APQ-N	m	1311	4.69	2.104	-0.396	0.000
	f	2024	5.27	2.093		

From the **Table 2** it can be concluded that there are no significant differences, except one, between the males and females mean scores at a significance level of 0.05. The data showed that girls and boys had, more or less, the same opinions about the usefulness and importance of conducted activities, and about their interest and enjoyment during the classes. They believed that these activities would help them in gaining new knowledge and skills and in their further education, in general. The only difference can be notice regarding the pressure they felt while realization of such novel activities for them. Macedonian students' motivation towards chemistry was estimated based on the mean of their scores for each subscale and for the whole SMTSL-N questionnaire. According to Cavaş's classification system [25], a high level of motivation includes means between 4.41 and 5.00, a medium level of motivation includes means between 4.40 and 3.39, and a low level of motivation includes means lower than 3.38. **Table 3** shows that the students had medium motivation toward chemistry leaning (4.01) overall. The mean for each subscale were considered medium as well, except for the Performance goal scale where their motivation was low ($3.17 < 3.38$).

The internal consistencies of the six subscales of the SMTSL-N were estimated to be generally satisfactory since Cronbach's alpha reliability coefficient ranged between 0.806 and 0.879, having value of 0.901 for the whole instrument. In addition, a comparison of the males and females mean scores of the six categories for the SMTSL-N questionnaire was performed (**Table 4**). The total number of students which filled this questionnaire was 119 (47 males and 72 females). The same

procedure was repeated as before, i.e., independent *t*-tests were performed to find out if there is a significant difference between the mean scores of boys and girls.

Table 3. Means, standard deviations and Cronbach's alpha reliability coefficient for SMTSL-N instrument

Scale	Number of items	SMTSL-N		
		M	SD	Cronbach's alpha
Self-efficacy	7	4.00	1.16	.819
Active learning strategies	8	4.32	0.89	.879
Science learning value	5	4.12	0.98	.832
Performance goal	4	3.17	1.52	.825
Achievement goal	5	4.26	0.97	.806
Learning environment stimulation	6	3.87	1.19	.822
Total	35	4.01	1.16	.901

From Table 4 there is no significant difference between male and female students' mean scores for all six categories, and for the whole instrument as well. It seems that boys and girls were equally motivated to learn chemistry during these classes.

Table 4. Comparison of the males and females mean scores of the six categories for the SMTSL-N questionnaire

Variables	Groups	APQ-N				
		N	M	SD	t	p
Self-efficacy	m	329	3.69	1.223	-6.231	0.000
	f	504	4.20	1.066		
Active learning strategies	m	376	4.10	0.926	-6.209	0.000
	f	576	4.46	0.839		
Science learning value	m	235	3.95	1.077	-3.399	0.001
	f	360	4.22	0.891		
Performance goal	m	188	2.97	1.475	-2.321	0.021
	f	288	3.30	1.533		
Achievement goal	m	235	4.07	0.995	-3.876	0.000
	f	360	4.38	0.931		
Learning environment stimulation	m	282	3.73	1.207	-2.450	0.015
	f	432	3.96	1.168		
SMTSL-N	m	1645	3.80	1.188	-9.453	0.000
	f	2520	4.14	1.116		

3.2. Qualitative Data Analysis

Individual interviews have been successfully used as data collection instruments in educational studies when looking for in-depth explanations. In this research the interviews with students and teachers were recorded using the Zoom recorder option and they were transcribed in Microsoft Word. In qualitative studies, researchers need to establish their trustworthiness and that of the data being presented, so instead of names, codes were used to protect participants' identities. All transcripts were thoroughly read and carefully reviewed line by line while assigning codes to emergent concepts. These transcripts were used to examine the students' and teachers' opinions or experiences regarding the conducted activities.

1) Interviews with Teachers

Seven teachers from different cities in the Republic of Macedonia participated in our research. The teachers were interviewed a few days after the classes, in order to examine their opinion regarding the conducted Nearpod activities. An interview guide was prepared beforehand, but more questions emerged during discussion depending on their answers. In this part, the analysis of teachers' responses to questions is given, stating representative participants' quotes as illustration.

Q1. What motivated you to become a chemistry teacher?

Six out of seven of the respondents answered that they were motivated to become teachers by their chemistry teachers in primary and/or secondary school. It is quite obvious that the main motivator that

helps students love chemistry is their chemistry teacher. The following excerpts show some of the teachers' answers to the first question.

T1: "My love for chemistry dates back to my primary school chemistry teacher. I have known since then that I would become a chemistry teacher."

T2: "My high school teacher was my main motivation for becoming a chemistry teacher."

T5: "The motivation to become a chemistry teacher comes from my high school chemistry teacher. Obviously, motivational teachers motivate students to become teachers."

To this question, one of the respondents answered that his love for natural sciences, especially chemistry, encouraged him to become a chemistry teacher (T3).

Q2. What kind of methods and techniques have you used in your chemistry classes?

For this question, six of the seven interviewers answered that the most used methods and techniques are: Know-Want to know-Learned (KWL) chart, brainstorming, performing experiments, PPT presentations and videos, and working in groups or pairs accompanied by a discussion at the end of the class. The techniques and teaching methods mentioned by the surveyed teachers are the most used ones in teaching in our country. Only one of the respondents (T7) answered that she prefers learning through research or learning with the help of new and innovative techniques, emphasizing that she is "constantly trying to explore new approaches to learning chemistry in order to make classes more fun for my students."

Q3. How do you motivate your students in chemistry classes?

Diverse and very interesting answers were given to this question. Some of the teachers responded that their students are more motivated when they are actively involved during the whole class and when the teacher connects the new teaching content with the students' daily life. Other interviewers stressed the praises and rewards as key motivational factors. One of the teachers answered that the students are motivated when educational games are used during the classes, so it appears that students, regardless of their age, want to learn through play. The following excerpts show some of the teachers' answers to this question.

T2: "I really want to thank my students when they do something good. I think the teacher's smile is enough initial motivation for the students and the teacher should praise his students."

T4: "Students are very motivated when the teacher gives them positive feedback regardless of whether the answer is evaluated or not."

Q4. How do you keep students' attention?

From the answers to this question, it can be seen that most teachers have different approaches in keeping their students' attention. Some of them said that performing various experiments and interactive teaching keeps the students' attention, although teachers prefer combined teaching in which students are actively involved. More than half of the respondents think that the application of various activities such as watching videos with Mr. Bean or pictures of different phenomena, PPT presentations related to the teaching content, or listening to the song about the Periodic Table keeps the students' attention. One of the respondents answered that her students want to discuss during the classes and that in such a way everyone is actively involved, and she manages to keep their attention.

Q5. How much does experimental work affect students' activity and motivation?

Considering the fact that chemistry is an experimental science in which the experiment is an integral part of its study, six of seven teachers agreed that experimental work greatly affects students' activity and motivation. The following excerpts show that most of the teachers share their opinion about this question.

T3: "I think that experimental work has a great impact on students' activation and motivation because it interests them and they want to explore more deeply."

T6: "In my opinion the experimental work mostly affects the students' activation and motivation because in the classes when experiments are performed, all students want to be included in the class and see what is happening."

Only one of the interviewed teachers thinks that everything depends on the nature of the students, i.e., that if the student is not interested in learning chemistry (s)he will not be affected by any other activity.

T7: *"There are students who love chemistry and will be more motivated if the experimental work is applied frequently. But there are students who do not like chemistry at all and whatever we do, we will not motivate them."*

Q6. Briefly describe your ideal chemistry class!

Almost all teachers thought differently about their ideal chemistry class. Some of them said that they imagine their ideal chemistry class in a chemical laboratory where they will be able to realize their ideas. Some believed that they will reach their ideal chemistry class when they receive feedback from students and when all students are actively involved in the class regardless of their abilities. Teachers also believed that in order to achieve this, students need to discuss more during the lessons and thus develop their logical thinking.

Q7. In your opinion, how successful were Nearpod activities in realization of the Exothermic and Endothermic Reactions topic?

Teachers gave very similar answers, i.e., all teachers said that the classes were realized very well and that their students enjoyed performing the Nearpod activities. One of the main goals of our research was to examine the opinion of students and teachers about the implemented activities and the answers to this question showed that both target groups (teachers and students) enjoyed these classes. Below are some excerpts from interviews.

T1: *"The classes were very successful and I saw that the students were enjoying the class. All the activities were great and I think the Nearpod tool is perfect for teaching if the teacher wants to use it."*

T3: *"I am fascinated by the lessons you realized, but also the students enjoyed the activities and they told me that after the class."*

T4: *"The classes were more than successful and I liked the tool very much. In general, all the lessons were wonderful, and the student' attention was focused exactly where it was needed."*

Q8. How often would you use this tool in the future and how much do you think the students enjoyed during these classes?

From the answers to this question, we can conclude that all the teachers liked the Nearpod tool and that many of them after finishing the classes tried to create their own activity. Although their belief is that they have not been very successful in creating the lessons, they are committed to use this tool more often in the future. All respondents said that after the classes the most of their students gave very positive comments about the conducted activities. Of course, we should keep in mind that not all students enjoyed chemistry classes even though a new and innovative tool has been used.

T4: *"After your classes I talked to my students and I did not hear any negative comments about the Nearpod activities. I think that the students' comments were your best evaluator of the success of the classes."*

Q9. If you had the opportunity in the future, what would you change in chemistry classes and how much do you think the application of new innovative and creative teaching methods will increase the level of motivation of students in studying chemistry?

To the last question, the respondents gave several different answers regarding what they think should be changed in the chemistry teaching. Some teachers believed that the application of new and innovative methods in teaching chemistry will encourage students to love chemistry, but they also thought that it will help them to have a significant change in their knowledge. Two of the surveyed teachers expressed their opinion of combined teaching, in which new methods will be applied, but at the same time the experiment will be included as the main didactic tool in chemistry teaching. Given that many schools in our country do not have chemical laboratories at all, one of the suggestions of the surveyed teachers was to use applications with virtual laboratories, as it can be seen by the following:

T6: "Everything new is interesting especially for the students of this age. I think there should be applications with virtual labs that students can use."

2) Interviews with Students

Similarly, semi-structured interviews were conducted with students as well. When selecting students for interview, care was taken to ensure participation of students from each class. Furthermore, attention was paid to their achievements, i.e. low-, medium- and high-achievers were included in the interviewing process. Students were not forced to give an interview and were allowed to withdraw if they wanted.

Q1. Briefly describe your chemistry lessons and do you prefer to study online or face-to-face?

Many of the students answered that in chemistry classes the teacher is usually guided by the textbook or PPT presentations and videos. Some of the surveyed students answered that they often perform experiments during chemistry classes and they think that in this way they can master the teaching content more easily. Due to the situation with the coronavirus, schools were forced to teach online. That is why all the students answered that it is more convenient to go to school with physical presence because they think that this will make it easier for them to master the teaching content.

S1: "I prefer to go to school because that way it is much easier for me to learn the lessons."

S3: "Of course it is better when we are at school because we are much more motivated and we learn the lessons faster."

Q2. What affects your motivation for learning chemistry and how much the teacher influences your motivation?

The students gave different answers to the second question, but most of them said that the teacher is the main motivator who encourages them to love chemistry. Some of them said that in addition to the teacher, they get motivation from the experimental part of the chemistry because they are interested in it, as well as getting good grades on tests. Two of the surveyed students answered that they love the natural sciences, especially chemistry and that they want to upgrade their knowledge.

Q3. What do you like the most about chemistry classes?

Almost all students gave the same answer to this question i.e., they said that they like the classes in which they had the opportunity to perform different activities and to be actively involved with all students regardless of their abilities. The following are excerpts from their answers to the third question.

S1: "I like the most the classes in which we have the opportunity to perform experiments or the classes in which we play an educational game."

S10: "I like it the most when we perform experiments or when the teacher comes up with some interesting activities for us."

Only one of the surveyed students answered that he likes tests and oral examinations because that way he tests his knowledge (S16).

Q4. What kind of activities keep your attention?

From the answers received to this question, it is obvious that performing experiments or watching a video of an experiment keeps their attention the most. Several students responded that learning a new lesson through a variety of activities, such as the Nearpod activities keeps their attention. Another student expressed his point of view that he is more focused on the lessons when working in a group or in pairs with his classmates.

Q5. In which class do you think you mastered the material more, traditional or the one where Nearpod is used?

Two respondents thought that they can learn more easily through a typical lecture, while three of them preferred a combination of traditional lectures and Nearpod activities in order not to get bored with a kind of lecture. In other students' opinion, learning with the Nearpod tool is helpful in easier learning of the lessons. This made them actively involved in the lesson and encouraged them to be

more attentive, but also encouraged their competitive spirit in answering questions during the activities. The following excerpts are evidence of this.

- S2: *"I think it is easier for me to learn when I am also actively involved in the class."*
- S6: *"I find it easier to learn in the classes conducted with the Nearpod because at the end of each lesson we had some activities, so that motivated me to be more careful during the class in order to be able to answer the questions in the activity."*
- S3: *"I think I can learn easier in the classes when we use the Nearpod tool because we learned through games."*

Q6. Were the Nearpod activities successful in keeping your attention?

All students were unanimous to this question and agreed that the Nearpod activities were very interesting and useful for their progress and success. It is obvious from their answers that they enjoyed these classes and that this activity helped them in learning chemistry. Some of their answers to this question are given below.

- S1: *"It was very interesting that we learned the lessons in such a way because we were all actively involved in the class."*
- S6: *"It was very interesting for me because it was the first time, we learned like this."*
- S14: *"These activities managed to keep my attention because we learned through games."*

Q7. If you had the opportunity to choose what the lesson would be like, what would you choose and what do you think needs to change in chemistry classes to make you more motivated?

The students gave their opinion on what should be changed in chemistry classes so that they are more motivated and more willing to study chemistry. Three students believed that nothing should change in chemistry classes and that it depends on them how much they want to study chemistry. Some of them thought that the way of reviewing the teaching contents should be changed, i.e. it should be designed through games so they do not feel pressure when they answer the questions. Three of the respondents highlighted the necessity of more experimental work, which enables them to master the concepts more easily. Most of the interviewed students said that different activities, such as the Nearpod ones, should be applied to increase motivation and participation during classes, thus providing greater interest in learning chemistry. Below are some of their answers to the last question.

- S16: *"I would like students to be more involved in such activities and thus I think everyone would be more interested in learning chemistry."*
- S3: *"I sincerely believe that the application of such activities in all subjects will keep the attention of all students."*
- S10: *"I think we should use this tool more often because it makes our learning much easier."*

4. Conclusion

This research was conducted during the 2020/2021 school year, when teaching took place online due to the covid-pandemic. It was focused on the implementation of an innovative pedagogical approach to teach chemistry by using the Nearpod tool. The research was conducted on a total sample of 244 students during April-May 2021. Students' opinions regarding the applied activities were collected by the SMTSL-N and the APQ-N questionnaire (which was constructed using items from the Intrinsic Motivation Inventory questionnaire). The research results showed that by using the Nearpod, students were more engaged during the lesson and actively participated in the activities. These activities have been shown to successfully retain students' attention, encourage their engagement in the class, and increase their motivation to learn. They seemed to be motivated to work and satisfied with the realization of the classes. Therefore, this approach significantly affects the improvement of teaching, especially during remote teaching because enables teachers to follow and assess activity of each student in the class. Additionally, problems with internet connections may influence the quality of the realizations of the activities. In the future, Nearpod can be applied during the face-to-face teaching as a hybrid model, thus making teaching more interesting and less monotonous.

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Declarations

- Author contribution** : A.B. and M.S. conceived the original idea. A.N., A.B. and K.R. were responsible for data collection. A.N. carried out the interviews. A.N. and M.S. performed the computations and wrote the manuscript with support from K.R and A.B. M.S. supervised the project.
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