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Self-Regulation and Formative Assessment Format Interrelation in Mining Engineering ESP Course

Ekaterina V. Vinogradova [a], Elvira R. Skornyakova [a, *]

[a] Department of Foreign Languages, Saint Petersburg Mining University, Saint Petersburg, Russian Federation

Abstract

The paper considers the issues of the interrelation between obtaining the self-regulation skill and the format of the formative assessment which represents an effective tool of educational process involving comprehensive processing of the material and further feedback. The participants of the research were first and second-year engineering students of the mineral resources specializations in St. Petersburg Mining University. Paper-based and online assessment methods were used in control and experimental groups accordingly during the autumn term 2021 which entails five to seven formative tests, depending on the number of modules in the ESP course. The gathered data were manually put into the SPSS software and analyzed statistically with the output of ANOVA test, Cronbach's Alpha reliability test and Pearson correlation test with identification of p-value.

The purpose of the study was to determine whether there exists a correlation between the formative assessment format and the acquisition of some non-technical skills in the ESP course such as self-regulation. The results of the formative assessment as well as the results of the self-regulation questionnaire proved to be statistically effective and revealed uneven distribution. The interpretation of the results showed that although the experimental group performed better during the online formative assessment, their self-regulation skill was not formed as profoundly as that of the control group students whose formative assessment was in pen-and-paper format.

Keywords: self-regulation, engineering education, paper-based format, online format, formative assessment, ESP.

* Corresponding author
E-mail addresses: Vinogradova_EV2@pers.spmi.ru (E.V. Vinogradova), Skornyakova_ER@pers.spmi.ru (E.R. Skornyakova)

1. Introduction

Since "mineral resource complex is one of the factors of sustainable development of the country" (Khrustaleva et al., 2021: 417), engineering education in the mineral sector should be paid special attention as a pending aspect of technological progress. A sustainable approach to the successful engineering education process entails alignment between all the components of the curriculum (Gutierrez-Bucheli et al., 2022). In order to ensure sustainable development of the global energy sector, "it is necessary to have an in-depth knowledge of the search for and implementation of the advanced technologies" (Litvinenko et al., 2020: 435), which is impossible without continuous enhancement of mining engineering education. As Avsec S. and Savec V. put it, future engineering specialists should also be ready for innovative behaviour which is "important for keeping up-to-date with the rapidly changing social and natural environments" (Avsec, Savec, 2019: 30).

"Implementation of interdisciplinary connections, when training bachelors and masters" in engineering majors is of high importance since both general and special disciplines evolve students' ability "to think systematically and independently" and master in solving professional tasks (Goldobina et al., 2020: 803). In Saint-Petersburg Mining University "there are continuous efforts to advance students' competence through well-designed and motivating assignments" (Skornyakova, Vinogradova, 2021: 241). In their strive to enhance the quality of engineering education, teachers of Mining University substantially introduce experimental technologies and novel methods, for example the "use of modern augmented reality (AR) technologies" (Voronina et al., 2019: 2). However, apart from training their professional skills, the engineers in technoscience, geoscience in particular, need to develop efficient thinking ability and self-control, "soft skills, including communication and cooperation skills, problem-solving, conflict resolution", etc. (Mikeshin, 2020: 22). Furthermore, to gain proficiency, "a specialist must also possess certain personal characteristics that would allow him or her to remain competitive", as well as develop general competences (Kharlamova, 2019: 1709).

Along with such contemporary approaches in mining specialists training as "wide application of modern educational technologies", "academic mobility", there is also an important concept of "global focus of training, i.e. graduates are prepared to work worldwide" (Kretschmann et al., 2020: 248), which entails ability to communicate in the foreign language. While teaching the ESP course to future engineers it is necessary to apply advanced learning technologies which not only help "to develop and improve all the aspects of foreign language competence for professional interaction" but also enhance the professional competence (Murzo, Chuvileva, 2021: 146).

Having a good command of a foreign language is crucial for future engineers (Inozemtseva, 2017), particularly engineers of the raw materials industry, if they want to be competitive in the global labour market. Pushmina S. and Karter E. assert that "… high-skilled engineering workforce with proficient knowledge of foreign languages is in demand in a globalised world with knowledge-based economies" (Pushmina, Karter, 2021: 150).

According to the Federal State Education Standard of the Russian Federation future engineering specialists are to acquire a number of general competences which can be mastered in the course of second language learning. Along with general competence development, during the ESP course the educators also form "intercultural and professional competence" (Gagarina, 2020: 9). As we teach future engineering specialists we need to "analyze professional goals in the curricula, to develop students' competencies in order to adapt or relate expertise needed for future job with the graduates' competence assessment" (Sishchuk et al., 2020: 804). The quality of students' professional education significantly depends on ability to think critically and apply various "competences, including the competence of self-education and self-development" (Shestakova et al., 2022).

In the view of the aforesaid, it is obvious that the issues of mastering a foreign language and general competences fostering have become pending in the educational process around the world and in Saint-Petersburg Mining University as well. Therefore, it is of vital importance that soon-to-be engineers are fully engaged in different types of assessment, pleased with the results of online and paper-based tests, adequately provided with feedback identifying their strengths and weaknesses. Assessment of the foreign language mastering performance is highly connected with "the general scope of technical education … in an engineering professional context" (Rus, 2019: 369).

The formative assessment method is considered as a means of collaboration between the student and the educator (Hansen, 2020) which helps not only to assess the current results of the students' academic performance but also to detect the shortcomings of the course and to help adapt it to the students' needs. Formative assessment produces substantial effect on "motivational beliefs and behaviors involved in the self-regulation" (Granberg et al., 2021: 8). In the current conditions of quickly developing ICT educational technologies, computer-based formative assessment is considered to be a "powerful instructional tool" (Sullivan et al., 2021: 11).

It is widely acknowledged that assessment plays a pivotal role in a continuous education process which is used as a constructive feedback to highlight students' academic performance and teaching efficacy (Rus, 2019). Different forms of assessment in classroom help reach the desired standard of learning (Baird et al., 2017).

There is a theory according to which assessment is divided into two types: formative and summative assessment. The first one being an educational strategy aimed at detection of the flaws and academic gaps in the process of the programme acquisition. It guides the educational process and defines "the direction in which teaching and learning should go" (Cheng, Fox, 2017: 5). Formative assessment is a tool for the educator to help navigate the students' knowledge gaining in progress and promote student learning (Gotwals, Cisterna, 2022). The summative assessment purpose is to evaluate whether the knowledge has been acquired by the student and to what extent. Thus, formative assessment can be described as assessment for learning, while summative one is assessment of learning (Cheng, Fox, 2017).

Formative assessment provides useful feedback for university teachers who need a comprehensive knowledge about assessment practices to carefully follow students' progress (Andersson et al., 2019; Veugen et al., 2021).

There has been "an abrupt shift to virtual classrooms caused by coronavirus spread" (Osipovskaya et al., 2021: 764), hence there has also been an evident and accelerated transition from pen-and-paper to computer assessment, especially when it refers to summative assessment (Perry et al., 2022). However, transition from paper-based to online formative assessment is also gaining popularity (Kuriakose, Luwes, 2016). One can find a majority of online assessment techniques, e.g. using clickers (Kuriakose, Luwes, 2016), software programs (Pezzino, 2018), different designs of computer-based tests (Nguyen et al., 2017). Researchers and educators indicate that the formative assessment using ICT improves students' performance (Wilson et al., 2011; Elzainy et al., 2020). However, it is necessary to take into consideration the factors affecting online tests accomplishment, such as different external factors, environmental setting and even students' mood (Kaur et al., 2021). Formative feedback conducted through "online assessments help students to better judge their academic performance and level of knowledge" (Kühbeck et al., 2019: 8).

Formative assessment has been admitted to be an effective strategy in enhancing English learner's capability for self-regulation (Xiao, Yang, 2019).

So it is necessary to focus on the self-regulation competence in terms of foreign language learning in the higher education system. There is a number of interpretations of this term. Thus, in psychology self-regulation is considered as "the internal and/or transactional processes, enabling a person to conduct goal-directed activities over time and across changing circumstances" (Ozhiganova, 2018: 256). This term can be further narrowed down to relation between self-regulation as a psychological issue and its crucial outcomes such as educational accomplishments and academic performance (McClelland et al., 2018). Currently self-regulation is often considered as "one of the factors associated with the educational process" (Bylieva et al., 2021: 2). Self-regulation as an aspect of educational strategy entails different sophisticated metacognitive, motivational and behavioral learning policies (Wang, Zhan, 2020). La Ode Nggawu defines a self-regulated learner as a student who is capable of gaining knowledge, is motivated and has volition for effective and independent learning (Nggawu et al., 2018).

Students' academic skills and competences are gained through cognitive and behavioral abilities (McClelland et al., 2018). Students of the up-to-date educational engineering programmes are to obtain among other skills the so-called self-control competence. We opt to broaden the term to the self-regulation capacity since the two are related and interconnected. The Zimmerman's self-regulated learning model which suggests "four developmental levels: observation, emulation, self-control and self-regulation" (Zimmerman, 2000: 19) was implemented by Granberg, Palm and

Palmberg in their research which showed that formative assessment substantially affects self-regulated learning (Granberg et al., 2021).

Within the SRlang scale ("Self-Regulatory Control Scale for Language Learning"), Wen-Ta Tseng outlines five major factors that allow measuring self-regulation: commitment factor, metacognitive factor, satiation factor, emotion factor, environment factor (Tseng et al., 2017: 534-535). A number of researchers feature six aspects of self-regulation of the English learners in the Internet medium: goal setting, time management, task strategies, environment structuring, help seeking, self-evaluation (Zheng et al., 2018; Yilmaz, 2022).

In the view of the abovementioned, the authors have detected the major aspects of self-regulation that are crucial for the engineering students in the mineral sector that can be mastered through formative assessment during foreign language learning (but not restricted to it). These are the following five aspects: time-management (ability to allocate enough time for preparation and fulfillment of every task, ability not to get distracted by any outer factors, etc.), double-checking during the test (consciousness and understanding the importance of self-checking), control of one's emotional state (ability to control nervousness and tension that arises prior and during the test), ability to verify and correct one's mistakes (feedback carried out after the test is completed, ability to find one's "gaps" in knowledge and eliminate them), help seeking (ability to withstand the temptation to cheat, seek help with peers, use the Internet and other sources and so on).

Since it is proved that there is "relationship between learners' self-regulations and their learning strategies in a foreign language learning setting" (Erdogan, 2018: 1483), the authors of the current paper attempted to scrutinize whether the method of formative assessment during ESP course can influence the self-regulation skill of the engineering students and, more specifically, whether the format (paper-based traditional assessment vs. online assessment) is relevant.

The focus of the present study is the interrelation of students' self-regulation capacity and the formative assessment while accomplishing paper-based and online tests.

The authors have opted for a blended assessment approach where the use of online testing system has been integrated with more traditional forms of assessment. The aim of the research is to trace the patterns in ESP students' self-regulation competence acquisition with respect to their academic performance in the conditions of different format – online vs. paper-based testing. In the view of this, the research questions can be formulated as follows:

- Will the results of the formative assessment be different in conventional pen-and-paper format and in online format?
- Will the self-regulation capacity be developed evenly in cases when the formative assessment is conducted in pen-and-paper format and in online format?
- Is there any pattern and hence correlation between the format of formative assessment and the development of the self-regulation in students?

The study has been conducted to verify the following hypotheses.

(1) Null hypothesis – There is no significant difference between engineering students' results when undergoing paper-based and online formative tests.

Alternative hypothesis – There is a significant difference between engineering students' results when undergoing paper-based and online formative tests.

(2) Null hypothesis – There is no significant difference between engineering students' self-regulation skill development when undergoing paper-based and online formative tests.

Alternative hypothesis – There is a significant difference between engineering students' self-regulation skill development when undergoing paper-based and online formative tests.

2. Materials and methods

Students of Saint-Petersburg Mining University, Russia, learn the discipline "Foreign language (English)" during two academic years when they are first- and second-year students. During the first term of 2021/2022 academic year the authors of this research introduced with their students an experimental system of formative assessment in online format. The educational programme of the foreign language discipline in Saint-Petersburg Mining University consists of several blocks (units) covering vocabulary and grammar topics necessary to shape the sustainable communicative competence which entails listening, reading, speaking and writing skills in the foreign language. As well as the communicative competence, the students are supposed to acquire

self-regulation capacity that entails the skills of time-management, double-checking, control of one's emotional state, ability to verify and correct one's mistakes and seeking help.

At the end of every module of the educational programme (from 5 to 7 modules, depending on the specialization and faculty) the students undergo a formative assessment in the form of a test with obligatory feedback and detailed elaboration of the blind sides detected during the test. Thus, the acquisition of the material tends to be more profound and the educator gains information about what topics seem to be more difficult and need to be dealt with again.

However, the format of formative assessment might also influence the educational process and results, so it was decided to verify if there is significant correlation between the format of the assessment and its result.

The educational process in Saint-Petersburg Mining University was full-time, i.e. took place on the university premises in the classrooms. Total number of students that participated in the research amounts to 295 people (see Table 1). Among them 142 were the experimental, or focus, group who were offered to take the regular formative assessment test in the online format. Conversely, the control group amounted to 153 people whose formative assessment entailed no difference from the usual practice of our university, i.e. the students underwent traditional pen-and-paper test as formative assessment.

Table 1. Participants distribution.

	N	Percentage
Experimental group	142	48,1
Control group	153	51,9
Total	295	100,0

Among these students there are 1-st and 2-nd year students of 7 faculties whose specializations are engineers in various spheres connected with the mineral sector: oil and gas faculty, mechanical and machinebuilding faculty, geological faculty, mining faculty, construction faculty, raw material processing faculty, power engineering faculty.

The essence of the experiment was the format of the assessment (paper-based vs. online). Even though content of the tests differed according to the educational programme of every specific faculty, it could not affect the results of the experiment. Thus, the students' gender and the year of study (1-st or 2-nd) were irrelevant in the current study.

It is necessary to note that between the first and the latest assessments there was a number of other tests as well – in the experiment group there were 5 to 7 more tests in online format conducted individually by students at home and in control group there were 5 to 7 tests carried out in paper-based in-class format. This allows us to assume that experimental group underwent the experimental formative assessment in a sufficient scope in order to come up with representative performance distinct from the one by the control group.

After the experimental period, the students were offered a questionnaire to detect the degree of self-regulation capacity acquisition in two groups. Since the aim of the questionnaire was to detect how profoundly the students gained the skill of self-regulation, the authors formed the questions basing on the major aspects of self-regulation determined above: time-management, double-checking during the test, control of the emotional state, ability to verify and correct one's mistakes, help seeking. The corresponding questions together with the results of both groups are represented in figures 2-6. The responses were measured on a 5-point Likert-scale ('1' meaning 'definitely agree', '2' – 'rather agree', '3' – 'undecided', '4' – 'rather disagree', '5' – 'definitely disagree').

As a tool of online formative assessment carried out for the experiment, we used two online platforms: customized web-portal of Saint-Petersburg Mining University for organizational purposes – lk.spmi.ru (with restricted access gained only by the students and employees of the university) and free multifunctional online service for learning and testing onlinetestpad.com (with no restrictions). Online assessment system implies substantial work of teacher at the stage of test compilation, but does not involve the participation of teacher during the test itself or at the stage of checking the results, since it is done automatically.

It should also be stated that the learning process itself was carried out in the offline format, i.e. traditional full-time in-class education of the engineering specializations of the mineral sector. The formative assessment of the educational process was conducted online for the experiment group and in class with the help of paper-based tests for the control group.

One of the most important issues is to elicit what exactly is measured by the test. We based our tests (both for the experimental and for the control groups) on the subject educational programme of each specialization devised by our university. According to the programme, the students master their foreign language communication skills through acquiring the knowledge of grammar and vocabulary. Grammatical topics do not differ much, but still depend on the students' initial language level and, correspondingly, the class rank. Vocabulary aspect of the 1st year students of all the faculties covers general topics necessary for communication, while 2nd year students' vocabulary aspect covers professional topics and includes specialized terminology. It is written test (and not oral examination or open-answer questions) that was chosen as the assessment method since it is one of the most popular, not time-consuming and at the same time representative methods of assessment that is apprehensible for interpreting the results.

The tests devised for the online assessment were adapted due to the fact that online testing system has restricted scope of tasks in comparison with paper-based verified by the teacher. This is why the in-class tests were also adapted for the purpose of objectiveness: the creative, open-answer questions were excluded in order to make the assessment unambiguous and unbiased. All the formative tests in both groups included 40 questions with 20 items dedicated to grammar and 20 items dedicated to vocabulary – the maximum score in every test was 40 points. The grading system in Saint-Petersburg Mining University stipulates four-point scale: "Excellent", "Good", "Satisfactory" and "Failed" (in the Russian grading system this scale equals to grades "5", "4", "3", "2" correspondingly). The "Failed" grade implies unsatisfactory result that needs to be improved, otherwise the student is expelled. In our tests, the score distribution was calculated as follows: 85 % and higher – "Excellent", 60 % to 84 % – "Good", 40 % to 59 % – "Satisfactory", 39 % and less – the test is considered as failed.

3. Results

Statistical analysis

At the beginning of the experiment (first formative assessment test at the beginning of the term) and at the end of experiment (the last formative test at the end of the term), the results were gathered and compared in the spreadsheet form with the help of special software – Statistical Package for the Social Sciences (SPSS). Furthermore, the students were also interviewed in order to collect their opinion and attitude towards the aspects of self-regulation capacity that were supposed to be gained. The answers of the questionnaire in the experimental and control groups were also compared with the help of SPSS software and verified for statistical significance and relevance.

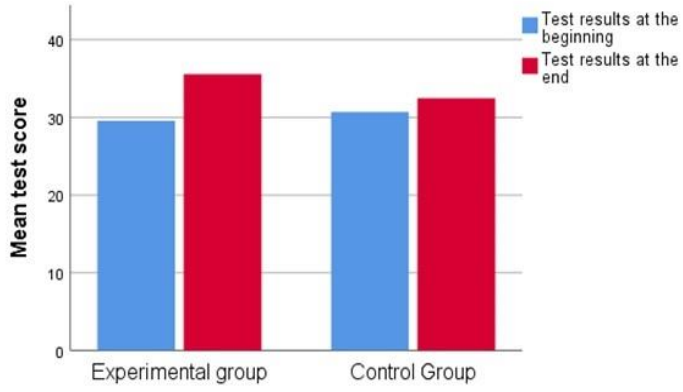

Fig. 1. Mean test grades at the initial step and at the final stage of the study

The gathered results were processed manually and typed into the SPSS software for Windows (64-bit version) within two months. After that the computational opportunities of the software were used, namely the correlation test (with Pearson correlation and research significance output),

the reliability test (with Cronbach's Alpha output), ANOVA test (with F-ratio output; the assumptions of homogeneity and normality were complied with).

The results of the formative online test conducted in the experimental group and of the formative paper-based test taken by the control group are depicted in Table 2 (distribution of grades between the groups at the initial and final stages of the study) and Figure 1 (mean academic performance in two groups at the initial step and at the final stage represented in score scale).

Table 2. Academic performance at the initial step and at the final stage of the study

Group		First_test_grade	Latest_test_grade
Experimental group	Mean	4.01	4.68
	N	142	142
	Standard deviation	.636	.496
Control Group	Mean	4.19	4.26
	N	153	153
	Standard deviation	.604	.696
Total	Mean	4.10	4.46
	N	295	295
	Standard deviation	.625	.643

It can be concluded that the experimental group performed much better during the formative assessment at the end of experiment while test results of the control group at the end of the experiment do not differ greatly from the ones they had at the beginning. The initial conditions for the both groups were practically the same – the mean of the groups' results was about 30 points. It should be noted that the test score of the control group cannot be defined as negative or unsatisfactory. The educational process in the group conveyed the same methods and educational technologies. Nevertheless, the formative tests of the experimental group can be defined as excellent. It was observed that the more tests had been taken by the experimental group online, the better score they had achieved in general.

Table 3. Pearson correlation in terms of formative assessment performance in the experimental and control groups

		Group	First_test_points	Latest_test_points
Group	Pearson correlation	1	.115*	-.303**
	Sign. (2-tailed)		.049	.000
	N	295	295	295
First_test_points	Pearson correlation	.115*	1	.654**
	Sign. (2-tailed)	.049		.000
	N	295	295	295
Latest_test_points	Pearson correlation	-.303**	.654**	1
	Sign. (2-tailed)	.000	.000	
	N	295	295	295

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

The correlation analysis of the formative assessment results implemented via SPSS programme indicates that the correlation between the two groups during the first assessment is weak (0.115*), while the correlation between the groups during the latest assessment is more relevant, i.e. -0.003**. Interpreting these results, we can assert that at the beginning of the experiment the results of the groups were relatively equal. However, at the final stage of the

experiment period, experimental group scored better during the online formative assessment than the control group whose results have not changed much from those they showed during the first formative test. Therefore, the null hypothesis of the first issue brought up to consideration can be rejected since it was proved that the experimental group showed better performance during the formative assessment than the control group.

Further, it is necessary to consider the second issue raised in this research regarding the self-regulation competence that the students are to acquire. In Figures 2-6, one can see the distribution of the answers to the questions that were asked both in the experimental and control group. The questions were formulated in a way that positive answers would designate the respondent's determination to sustainable self-regulation while the negative answers bear evidence of the respondent's lack of self-regulation or its inconsistent development.

Scrutinizing the charts on the left, it can be noted that the majority of the students from the experimental group, namely two thirds, tend to answer "Rather disagree" and "Definitely disagree" when they were answering the questions relating the aspects that altogether are parts of the self-regulation competence. Only about a third of the respondents in the experimental group answered "Rather agree" and "Definitely agree", which offers an opportunity to assert that their self-regulation competence has significantly formed.

On the contrary, the pie charts on the right depict that more than half (up to three fifths) of the control group students are apt to the answers "Rather agree" and "Definitely agree", which verifies that their self-regulation competence has developed in a sustainable way.

Fig. 2. Time-management factor

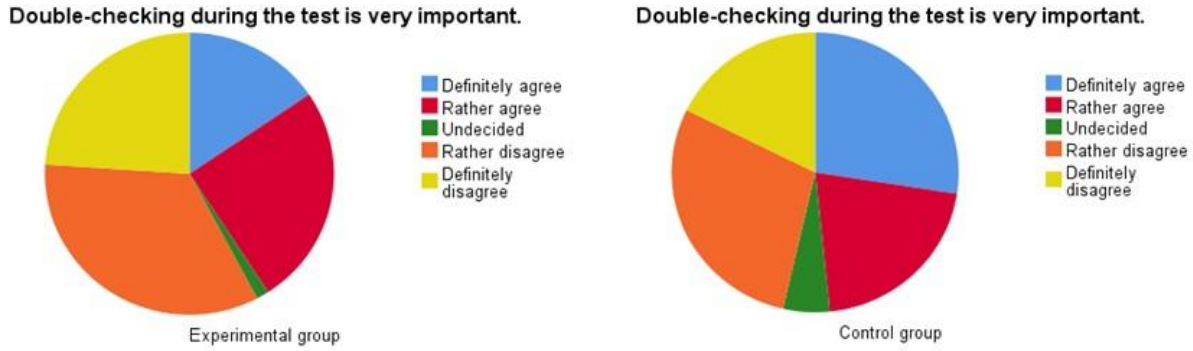

Fig. 3. Double-checking factor

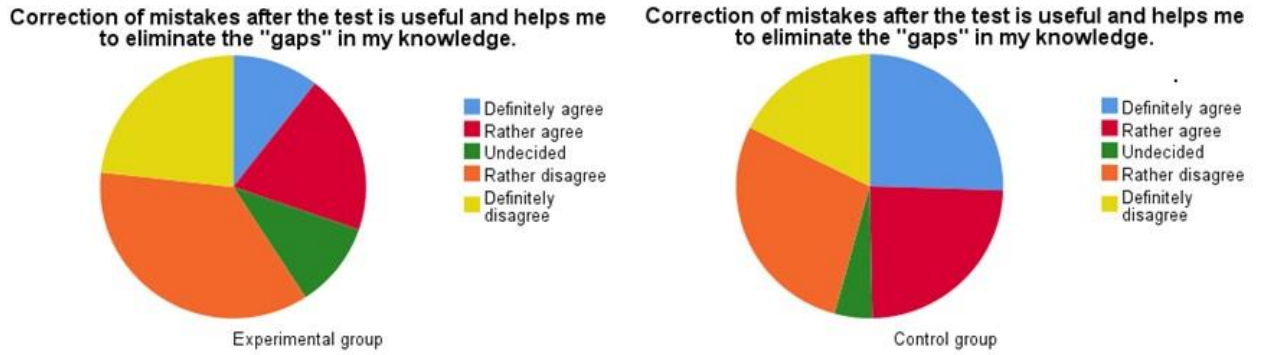

Fig. 4. The factor of ability to verify and correct one's mistakes

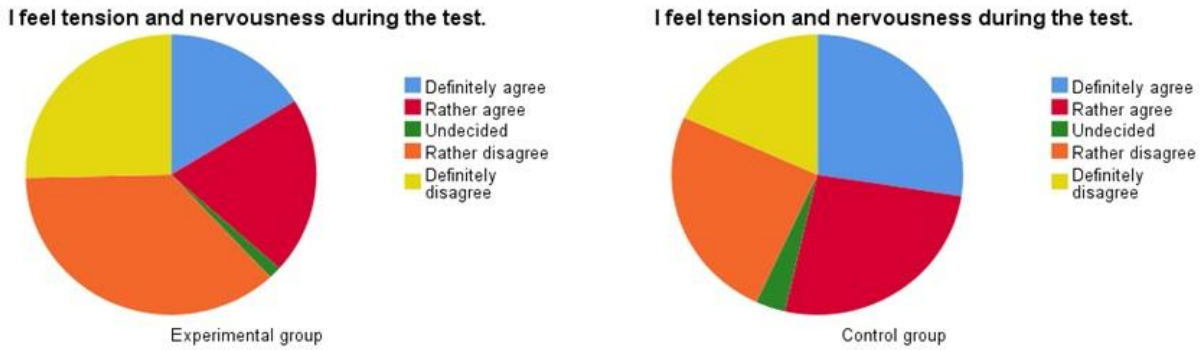

Fig. 5. Emotional state factor

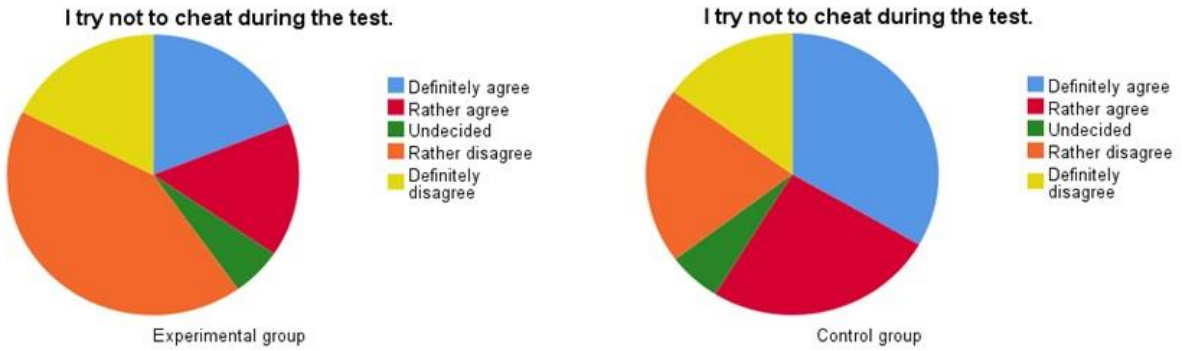

Fig. 6. Help seeking factor

As it has already been stated, statistical analysis for the current research was carried out via SPSS software. Table 4 shows the results of the ANOVA test.

The ANOVA test proved the efficiency of the research conducted: The level of self-regulation differs significantly between the control and experimental groups due to the fact that F-ratio (1.293) equals from 4.254 to 15.031 and the p-value varies from 0.000 to 0.040. These results give us opportunity to reject the null hypothesis number two and assert that there is uneven formation of self-regulation competence between the experimental group and the control group during the formative assessment. Hence, let us consider the results of statistical analysis in terms of correlation data.

Table 4. Results of the ANOVA test regarding the self-regulation competence representation

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
My skill of controlling the time allocated for the test has improved as compared to the first test	Between groups	9.817	1	9.817	4.254	.040
	Within groups	676.061	293	2.307		
	Total	685.878	294			
Double-checking during the test is very important.	Between groups	10.146	1	10.146	4.582	.033
	Within groups	648.756	293	2.214		
	Total	658.902	294			
Correction of mistakes after the test is useful and helps me to eliminate the "gaps" in my knowledge.	Between groups	20.933	1	20.933	10.425	.001
	Within groups	588.368	293	2.008		
	Total	609.302	294			
I feel tension and nervousness during the test.	Between groups	21.567	1	21.567	9.689	.002
	Within groups	652.209	293	2.226		
	Total	673.776	294			
I try not to cheat during the test.	Between groups	31.861	1	31.861	15.031	.000
	Within groups	621.088	293	2.120		
	Total	652.949	294			

The statistical analysis acknowledges that there is a certain correlation (from -.120* to -.221**) between the groups and the answers to the questions (See Table 4). Thus, in group 2 (control) the answers tend to decrease, i.e. they are mostly 1 or 2; while in group 1 (experimental) the answers tend to increase, i.e. they are mostly 4 or 5. It means that group 2 answered positively to the questions related to their self-regulation. Group 1 mostly answered negatively to the questions revealing their self-regulation skill. These facts imply that group 2 has acquired a more sustainable self-regulation competence in comparison with group 1.

Table 5. Pearson correlation in terms of self-regulation performance in the experimental and control groups

		Group	My skill of controlling the time allocated for the test has improved as compared to the first test	Double-checking during the test is very important.	Correction of mistakes after the test is useful and helps me to eliminate the "gaps" in my knowledge.	I feel tension and nervousness during the test.	I try not to cheat during the test.
Group	Pearson correlation	1	-.120*	-.124*	-.185**	-.179**	-.221**
	Sign. (2-tailed)		.040	.033	.001	.002	.000
	N	295	295	295	295	295	295

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

The observed result can be reported as statistically significant since the p-values of the variables are 0.040, 0.033, 0.001, 0.002 and 0.000 (see Table 5).

So the null hypothesis of the second issue can be rejected. The self-regulation competence differs depending on the group. According to the results of the conducted research and statistical analysis, the experimental group showed poorer self-regulation than the control group.

Table 6. Reliability statistics of the self-regulation questionnaire results.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.714	.715	5

It is necessary to point out that according to the Cronbach's Alpha method, the research results of the self-regulation representation of the students in two groups are statistically reliable (see Table 6). Since the Cronbach's Alpha is above 0.7, the statistics results are considered to be reliable and consistent.

4. Discussion

Further are the possible reasons of the results described above in order to continue the experiment in the right direction. So let us deal with every parameter separately.

The first question related time management skill. The survey displays that most students who underwent the formative assessment through online testing feel that their time management skill has not improved. Online test contains a timer in the corner of the webpage, which, as turns out, does not contribute to individual control of the time. Furthermore, the online format of education entails such a disadvantage as higher temptation to get distracted from the educational process for the Internet provides with easy access to a variety of entertainment activities such as social networks, games, videos, etc. (Bylieva et al., 2021).

The second question was regarding the double-checking one's answers during the test. The students whose formative assessment was in the online format were not prone to verify their answers for the second time. Probably the reason is that every question is on a separate webpage, after clicking "Next" button there is no volition to come back to fulfilled tasks (Frolova et al., 2021).

The third question revealed the attitude to the correction of mistakes that had been made during the formative assessment. The feedback aspect proves to be a little more effective when the student and the teacher interact during the correction of mistakes process in the classroom rather than within the conditions of delayed-response communication in the Internet format (Janke et al., 2021).

The fourth – emotional state of the students proved to be mostly imperturbable during the online test. On the one hand, this might lead to cold-minded perception of the assessment process and contributed to better concentration and knowledge extraction. On the other hand, negative emotions and anxiety are inseparable part of educational process (Schildkamp et al., 2020) and it is necessary to learn to take control of oneself in nervous situation. In this light comfortable and tensionless atmosphere during the test does not contribute to the sustainable development of self-regulation competence.

The fifth question revealed the help seeking factor. The ability to refer to the Internet source of peer source is undoubtedly higher in case of online format and tendency of getting better grades in case of online assessment has been pointed out by other researchers (Jin et al., 2021; Golden, Kohlbeck, 2020).

Taking into account the abovementioned, immersion in the online format needs a gradual approach and a "blended learning model as a rational choice" (Bulkani et al., 2022: 118).

5. Limitations

It was noted that the students of such specializations as geography, physics and chemistry show greater performance in critical thinking than students of humanitarian specialization (Frolova et al., 2021), which confers the possibility to limit our research to the engineering specialization of mineral sector. The research was conducted in an engineering university of mineral sector and is restricted to the students of a number of specializations. The research method of opinion poll might be partly subjective, so some allowance might be engaged during perceiving the results of this research.

6. Conclusion

1. The results of the formative assessment proved to be different in conventional pen-and-paper format and in online format. The research results validated better academic performance during formative assessment with the students who underwent it in the online format. Better performance of the experimental group (in relation to the test score) was not unexpected and it might be caused by the more comfortable conditions with less stressful factors than in the classroom. Moreover, the students practically admitted temptation to cheat if they work on the test in computer-assisted format with immediate access to the Internet.

2. It was established that self-regulation capacity had developed unevenly in cases of the formative assessment conducted in pen-and-paper format and in online format. The experimental group of students who conducted online formative assessment assignments did not obtain a sustainable self-regulation skill which is supposed to be formed among other methods through their preparation, implementation and feedback on the formative assessment.

Self-regulation, being one of the core skills for the engineering students, proved to be better obtained by the students whose formative assessment during ESP course was conducted in the paper-based format.

3. As to the reasons of the detected correlation, it is probable to conclude that offline education needs offline formative assessment. Blended education which entails more equal distribution between formats might be effective in terms of self-regulation. However, traditional offline course breeds better mastering of self-regulation skill when the formative assessment is conducted in paper-based in-class format.

Self-regulation performance also might be influenced by the fact that the experiment was carried out among the students of engineering specialties in the mineral sector. Lately the need for foreign communication has been decreasing among Russian engineering students so as the motivation of these students to study the foreign language in the light of current conditions. Since self-regulation is inseparably connected with motivation, it would be reasonable to continue the research in terms of motivational aspect of the posed issue.

Summing up, it should be pointed out that traditional educational format that has been implemented in Saint-Petersburg Mining University proved to be more effective in terms of acquiring self-regulation capacity and in terms of depicting the trustworthy formative assessment results among future engineers of mineral sector. Transition to e-learning should be soft, gradual and balanced not to undermine the existing practice of traditional educational methods that have been elaborated during several decades and even centuries.

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