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Improving the Informatics Competencies Through Assessment for Learning

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Abstract—This paper presents the impact of the assessment for learning on students' Informatics competencies. The paper has described the usage, advantages and disadvantages of the assessment for learning as self-assessment, peer assessment, and co-assessment. As a result, the survey method was applied to find out the students' opinions about the assessment for learning in general, and the self-assessment, peer assessment and co-assessment in particular.

Keywords—assessment; self-assessment; peer assessment; co-assessment; assessment for learning

I. INTRODUCTION

The educational system in the Republic of Moldova has as its main outcome the development of a system of competencies, including knowledge, skills, attitudes and values, which allow for a person's active participation in social and economic life, and are based on the curricula of the educational disciplines. The education purposes to train the next key competencies¹: (1) communication in the Romanian language, (2) communication in the native language, (3) communication in foreign languages, (4) skills in mathematics, science and technology, (5) digital skills, (6) capacity to learn how to learn, (7) social and civic competencies, (8) entrepreneurship and spirit of initiative competencies, (9) competencies of cultural expression and conscience of cultural values.

Therefore, the curriculum² for the Informatics discipline is focused on both key competencies and discipline-specific competencies. According to it, the high school education includes the next specific competencies:

1. The use of tools with digital action in order to improve the efficiency of learning and work processes, showing innovative approaches and practical spirit.

2. Interacting with members of virtual communities for learning and work purposes, showing interest in active learning, research and collaboration, respecting the ethics of virtual environments.
3. Promotion in digital environments of personal and collective elaborations and achievements, proving ingenuity, team spirit and conviction.
4. Development of graphic, audio and video digital products, demonstrating creativity and respect for national and universal cultural values.
5. Scientific perception of the role and impact of information technology phenomena in contemporary society, showing critical and positive thinking in the connection of different fields of study, activity and human values.
6. Processing the data of experiments in the field of real sciences and socio-human ones, showing critical thinking, clarity and correctness.
7. Algorithmization of analysis, synthesis and problem-solving methods, demonstrating creativity and perseverance.
8. Implementation of algorithms in programming environments, showing focus and resilience.
9. Exploring problem situations by modelling, planning and performing virtual experiments in digital environments, demonstrating analytical spirit, clarity and conciseness.

High school education in Moldova consists of three academic years: 10th grade, 11th grade and 12th grade. For each academic year, the Informatics discipline is organized into compulsory modules and optional modules. At the beginning of each academic year, the teaching staff will guide the students to select one of the proposed modules for choosing, taking into account the digital equipment and software products, necessary for studying the chosen module. Thus, the selected module becomes a mandatory one. The Table I shows for each high school level the compulsory learning units and the units that

¹ Education Code of The Republic of Moldova No. 152 dated July 17, 2014. https://mecc.gov.md/sites/default/files/education_code_final_version_0.pdf

² National Curriculum for Informatics Discipline, Grades X-XII, 2019. https://mecc.gov.md/sites/default/files/informatica_curriculum_liceu_rom.pdf

students need to choose one from. The learning units aim to achieve the competencies designed for the established learning unit and, respectively, aim to achieve the specific competencies of the discipline, as well as the key competencies.

TABLE I. COMPULSORY AND OPTIONAL UNITS

The compulsory and optional units for grade 10
The compulsory learning units: 1. Methods of describing natural languages and formal languages. 2. Vocabulary and syntax of a high-level programming language (HLPL). 3. The concept of data. Simple data types. 4. The concept of action. The instructions of HLPL.
The optional units: 1. Web design. 2. Computer Graphics. 3. Digital photography.
The compulsory and optional units for grade 11
The compulsory learning units: 1. Types of structured data. 2. The information. 3. Arithmetic bases of the calculation technique. 4. Boolean algebra. 5. Logic circuits. 6. Computers and networks.
The optional units: 1. Audio-video processing techniques. 2. Visual programming. 3. Hypertext markup languages.
The compulsory and optional units for grade 12
The compulsory learning units: 1. Subprograms. 2. Programming techniques. 3. Numerical modeling and computation. 4. Database.
The optional units: 1. Advanced processing of information from databases. 2. Experimental Methods in the Humanities. 3. Web programming. 4. Dynamic data structures.

The teachers have the freedom and responsibility to capitalize on significant contexts, methods, tools and techniques for the development of designed competencies in a personalized way according to the specifics of the students' class, the available resources, the number of academic hours allocated, etc. During the entire teaching-learning-evaluation process, the teacher connects the didactic approach of training and developing specific competencies to the development and consolidation of key competencies. Therefore, to improve Informatics competencies, an instructional design was applied focused on assessment for learning. It incorporated the assessment of the tasks done from the teacher and student perspectives. Such a framework was adapted to institutional contexts and students' needs. Whereas, a holistic approach was required in order to tackle general issues, for instance, the purpose and adequacy of

assessment, its design and its impact on supporting students to become more self-managing in their own learning. Thus, assessment for learning (A4L) is an approach that helps students to become more involved in the learning process, develop judgement skills, and assess the student's progress during the learning and teaching process. The Cambridge Assessment International Education define the concept of the (A4L as "an approach to teaching and learning that creates feedback which is then used to improve students' performance" [1]. According to Carless, the A4L is "a crucial driver of student learning and that well-implemented assessment processes provide positive prospects for meaningful learning, whereas flawed assessment risks leading student learning in unproductive directions" [2, p. 3]. Black considers that assessment for learning is "any assessment for which the first priority in its design and practice is to serve the purpose of promoting students' learning" [3, p. 10,]. Thus, A4L is a way to improve the educational process for both students and teachers. The teachers have to plan tasks that help students to understand their actual own outcomes level, where they want to be in their learning, what the achievements to be gained are, and how to achieve them.

II. METHODOLOGY

This experiment was applied to the Informatics lessons in the lyceum "Spiru Haret" from Chisinau, the Republic of Moldova. The purpose of this experiment was to improve self-learning skills, ensure active engagement in deep learning, enhance students' reflection on their learning and increase the students' Informatics competencies.

Firstly, to enhance student's achievements, the following active learning techniques were used: one-sentence summary, think-pair-share, one or five-minute paper, problem-based learning, case studies, jigsaw, misconception check, classroom opinion polls, infographic, pass the problem, jeopardy etc., thus encouraging the interactions between students and teacher, emphasizing time on task, developing reciprocity and cooperation among students, and respecting diverse ways of learning.

Secondly, for planning the steps of activities and assessments to achieve the goals, the students' motivation was taken into account, i.e. what they hoped to gain from those activities, facilities for study, knowledge, skills, attitudes and their learning style. Thus, the teacher had to design and redesign instantly the lesson approach or teaching-learning strategies when necessary.

Finally, yet importantly, this experiment promoted an assessment culture, ensuring students' involvement in setting the evaluation criteria and objectives. The A4L helped students to recognize their weaknesses and

strengths, and to work on areas that needed improvement. Therefore, the next assessment methods have been implemented: self-assessment, peer assessment, and co-assessment.

A. *Self-assessment*

Self-assessment is a powerful learning strategy, which facilitates self-directed learning by students and enhances reflective learning. It allows students to reflect on their own work about what they have done well and what they could do better next time, and answer a few questions given by the teacher that would include both knowledge and feeling questions [4, p.153]. Therefore, they will be able to set new learnings goals for achievement.

Hence, it is important to discuss with students and to hold information sessions in order to “promote understanding, negotiate and decide upon assessment criteria, and to clarify the required standards and learning outcomes” [5, p.4]. In order to do this effectively, time has to be set aside for such activities at the expense of in-class content. The students have to know the criteria that need to be considered in their work for identifying success, which will result in deeper learning. The criteria may be designed by both the teacher and the students.

After the self-assessment task, the students have to answer the following questions: What are the things I learned? What is the most important thing I learned? What was the hardest part of the task? What was the easiest part of the task? What questions do I still have? What success did I achieve? What will I do differently next time? These questions will help students enhance learning and achieve better academic performance, remove misconceptions, and identify improvements whilst recognizing what they have done well yet.

The advantages of self-assessment are as follows: increase student engagement, improve learning results, improve motivation and encourage students to seek help in case of failure, develop self-judgment skills, and improve honest and critical reflection. This approach shows students that they are able to increase their achievements through their own efforts. It is also useful in preparing students for future professional development and life-long learning, increasing skills and competencies, including the capacity to be assessors of learning, not just knowledge.

However, this approach has also disadvantages. One of them would be the case when the assessment criteria are not clearly formulated and may be misunderstood by some students. There would be a risk that students would evaluate themselves incorrectly.

Another risk is that the student may not be honest with them and may over-assess their own achievements. The consuming time is also a detriment for students. They might not approve of this approach because of the

extra time used to self-assess. This disagreement will be until they realize the effectiveness of this method on their own learning, afterward, they will realize that the performance doesn't depend on the number of done tasks but on their quality.

B. *Peer assessment*

Peer assessment is a student-centred approach that allows students to increase their working speed and improve critical reflection on the work of their peers. According to Topping, peer assessment is “an arrangement for learners to consider and specify the level, value, or quality of a product or performance of other equal-status learners, then learn further by giving elaborated feedback to and discussing their appraisals with those who were assessed to achieve a negotiated agreed outcome” [6, p. 1]. The students assess each other's achievements according to a set of performance criteria related to a learning goal and provide suggestion feedback on the quality of their peers' work. The peer may not agree with all of these ideas, though some cooperation based on improvement is to be expected. Peer review also helps students to identify their own strengths and weaknesses.

Similar to any other approach, peer assessment has advantages and disadvantages. The advantages are as follows: develop lifelong assessment skills to students by providing feedback on their work to each other; improve a higher understanding of assessment criteria; fortify students' responsibility for making constructive assessment judgement and descriptive feedback; encourage learning from each other's work; increase the students' cooperation; reduce the time and workload for teachers.

Next, the disadvantages of this approach will be pointed out. One of the weaknesses would be the students' inaccurate assessment of their peers' work. Therefore, fairness is not maintained. Even if the evaluation criteria will be well established, there will be students who will not assess critically for various reasons, either their friendship relationship or peer pressure, they do not have the necessary level of cognitive ability to evaluate, or they are not experienced in assessing each other. Another weakness is the learner's inability to meet deadlines. In the implementation of the peer assessment approach, the limit setting is one of the most important requirements otherwise, success cannot be ensured.

C. *Co-assessment*

Co-assessment is a collaborative assessment approach to collecting data on students' performances. It leads to deeper learning, enhances learning skills and stimulates to attain the needed competencies. Dochy emphasizes the term co-assessment as a collaborative assessment and cooperative assessment [7, p.17]. It can be any

combination of self-assessment, peer assessment and assessment by the teacher, depending on the planned activity. In the co-assessment, the students and the teacher set the success criteria together. The teacher has to encourage a more democratic classroom and furthermore has to improve students' responsibility, taking a decision, leadership, communication, and conflict management. In this experiment, the co-teaching groups consisted of a small number of students. The groups were limited to three or four students. The co-assessment was done by all the students, including the teacher using performance criteria. For assessment, the Mentimeter platform was used, as it collects and processes the students' feedback or grades given to the assessed work instantly and they are displayed immediately on the teacher's computer. What is more, the feedback can be instantly shown to the whole class using the smartboard to discuss the assessed task. Therefore, every student would enhance their knowledge based on the feedback that everyone provides. The students may appreciate their classmates' work with a grade, however, the final decision belongs to the teacher.

The main advantages of the co-assessment are as follows: involvement of all the students in the given assessment task; active engagement in deep learning; encouraging learning from their classmates' feedback; learning through different teaching styles; promoting constructive assessment and descriptive feedback; increasing the students' collaboration and cooperation, creating friendships; creating a democratic classroom; greater intrinsic motivation, and developing enterprising competencies.

Similar to any other approach, co-assessment also has some disadvantages. A weakness of the co-assessment in the online format is that students need to have a connection to the internet and at least one smartphone/computer for each one. Another weakness is the increased risk of not maintaining fairness in the assessment of a student's work due to their friendships. The different speeds of assessment due to the varied work skills of students is also a disadvantage of co-assessment – students with a higher level of performance will assess/work faster than students with a lower level of performance, thus these students will get bored. If the evaluation is done in an oral format and the students have to argue the feedback provided, shy introvert students may struggle. The oral forms of assessment are also important and, according to Burlacu [8, p.70], these require an evaluation no less rigorous than the written tests/tasks.

According to Race [9, p.85], nothing affects students more than assessment, therefore involving students in self-assessment, peer assessment and co-assessment can let them in to the assessment culture and involve them more

closely in their learning and its evaluation, and this one would help them to understand really what is required of them.

III. RESULTS

As a result, in order to contextualize the findings regarding A4L, the survey method was used. The information was obtained on students' views about the value and importance of A4L in general, and about self-assessment, peer assessment and co-assessment in particular. Therefore, a survey has been conducted with the 186-targeted students. It contains 18 questions (see Table II) in order to establish the students' opinions regarding the A4L and which type of assessment is most embraced by the students.

TABLE II. SURVEYED QUESTIONS

No	The surveyed question
1	Was self-assessment a useful assessment tool to achieve better academic performance?
2	Was peer assessment a useful assessment tool to achieve better academic performance?
3	Was co-assessment a useful assessment tool to achieve better academic performance?
4	Did self-assessment help you to set new learning goals for achievement?
5	Did peer assessment help you to set new learning goals for achievement?
6	Did co-assessment help you to set new learning goals for achievement?
7	Did self-assessment help you to remove misunderstanding?
8	Did peer assessment help you to remove misunderstanding?
9	Did co-assessment help you to remove misunderstanding?
10	Did self-assessment help you to develop your own assessment judgement skills?
11	Did peer assessment help you to develop your own assessment judgement skills?
12	Did co-assessment help you to develop your own assessment judgement skills?
13	Did peer assessment help you to cooperate and collaborate efficiently with your classmates?
14	Did co-assessment help you to cooperate and collaborate efficiently with your classmates?
15	Did peer assessment help you to become more responsible in providing feedback?
16	Did co-assessment help you to become more responsible in providing feedback?
17	Was the set of assessment performance criteria clearly formulated?
18	Did you maintain fairness in the assessment of the classmates' work?

The questionnaire was created to collect the opinions of the students, anonymously and voluntarily, in order to identify the strengths and weaknesses of the A4L. A five-point scale was used to answer all questions, with one being the lowest score and five being the highest score (one point for strong disagreement, two points for disagreement, three points – for weak agreement, four

points – for agreement, and five points for strong agreement). After collecting the data, the results of the survey show that the majority of students displayed a positive view of assessing for learning.

The graphic processing (see Figures 1 - 8) of the survey results led to the following conclusions:

1. Most students confirm that A4L is a useful assessment tool to achieve better academic performance (see Figure 1), giving the highest score (5 points) to peer assessment (54.84%), followed by self-assessment (34.95%), and co-assessment (24.73%).

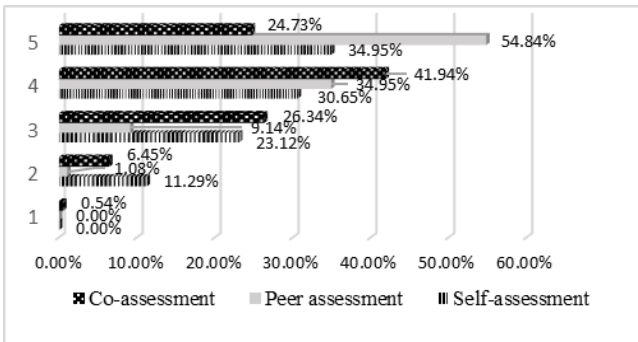


Figure 1. The students' answers in % for the following survey question: Was self-assessment/peer assessment/co-assessment a useful assessment tool to achieve better academic performance?

2. For the setting new learning goals for achievement, the results show that students are more supported by self-assessment with 56.45 %, followed by co-assessment (43.01%), and peer assessment (32.80%) (see Figure 2).

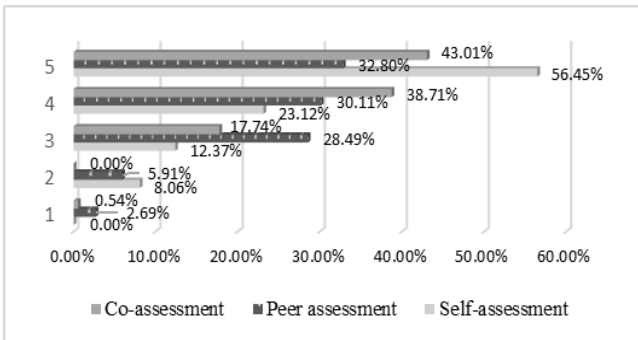


Figure 2. The students' answers in % for the following survey question: Did self-assessment/peer assessment/co-assessment help you to set new learning goals for achievement?

3. To determine the lack of learning and remove misunderstandings, the highest given percentage (48.92%) belongs to peer assessment according to students' results (see Figure 3).

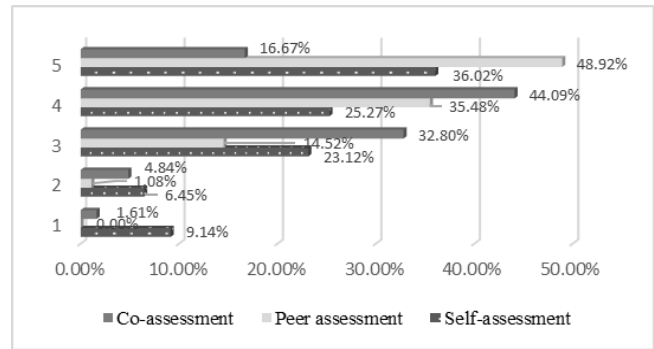


Figure 3. The students' answers in % for the question: Did self-assessment/peer assessment/co-assessment help you to remove misunderstanding?

4. The questionnaire results also show that co-assessment helps more students to develop their assessment judgement skills and to deal a constructive feedback, conferring a percentage of 60.22 (see Figure 4).

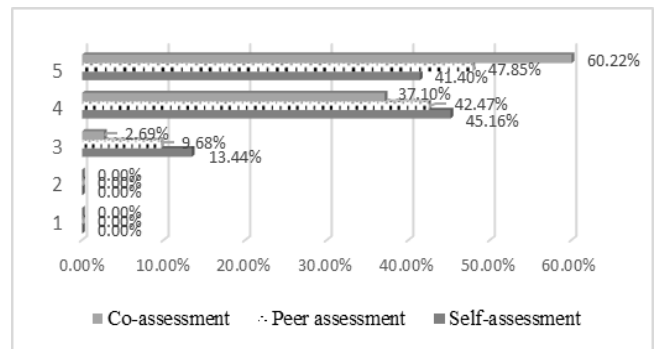


Figure 4. The students' answers in % for the question: Did self-assessment/peer assessment/co-assessment help you to develop your own assessment judgement skills?

5. About the efficient cooperation with their classmates, both the co-assessment (64.52%) and the peer assessment gained high score (58.06%), with a difference of 6.46% (see Figure 5).

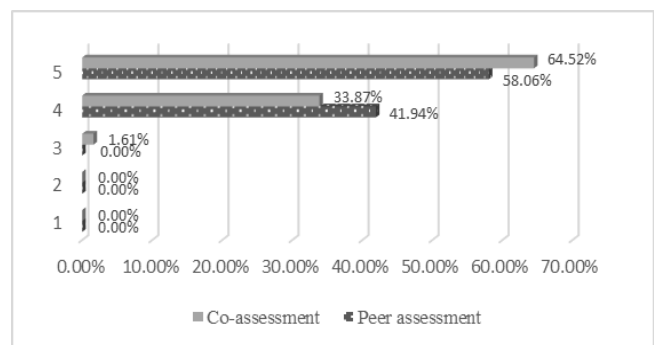


Figure 5. The students' answers in % for the question: Did peer assessment/co-assessment help you to cooperate efficiently with your classmates?

6. The students show through their survey answers (52.15 %) that they are more responsible in providing feedback when it is used co-assessment approach, offering the highest values, five points (see Figure 6).

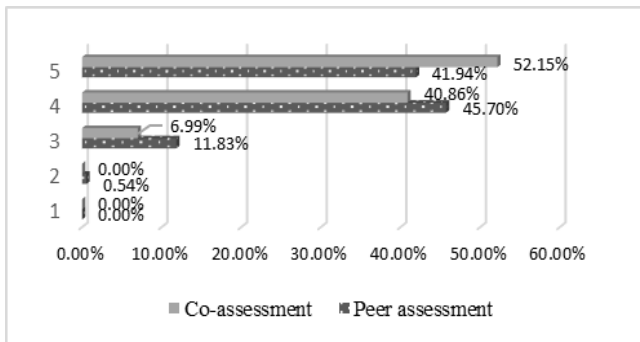


Figure 6. The students' answers in % for the following survey question: Did peer assessment/co-assessment help you to become more responsible in providing feedback?

7. To the survey question about the assessment performance criteria if they were clearly formulated, 2.69 % of students selected the lowest score (one point) and the 58.06 % of students selected the highest score (five points) (see Figure 7). This 2.69 % of students is assumed to be the students with lower-performing level that do not yet have the knowledge base to assess accurately and to understand well the assessment criteria. The findings are assumed because the survey was anonymous and voluntary.

8. Figure 7 interprets the data about the students maintaining fairness in the assessment of their classmates' work. It could be seen that never chose one and two points for it, three point was selected by 1.61 % of students, four points – 18.82 %, and the highest score was selected by large percentage of students, 79.57 %.

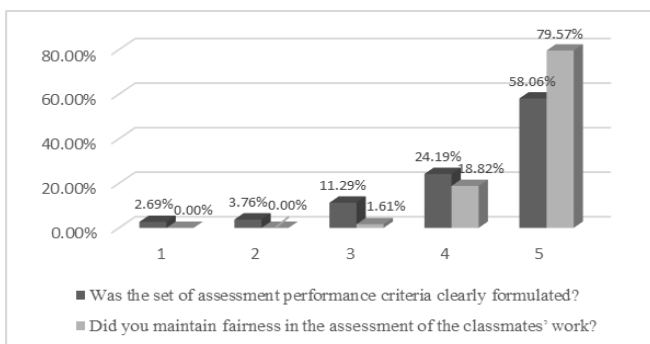


Figure 7. The students' answers in % for the survey questions.

The experiment results show that each type of assessment for learning contributes to improving the teaching-learning process depending on students' preferences. The lower-achieving students tend to need support to reflect on their learning and they often have to benefit from guidelines or instructions that they can follow. Higher-performing students tend to assess and give feedback more rapidly than lower-performing students therefore differentiated tasks have to be given.

IV. CONCLUSION

All assessments described in this paper are conducted with the goal of improving learning, involving discernment and occur best when students are accustomed to the assessment process, and when they receive and apply improvement suggestion feedback from both the teacher and their classmate. In all aspects of these assessments, students need to comprehend what is their level of current performance and how to improve their outcomes. Students' understanding of assessment criteria is an important point of reference for the success of self-assessment, peer assessment and co-assessment.

REFERENCES

- [1] Cambridge Assessment International Education. *What is assessment for learning?* (<https://cambridge-community.org.uk/professional-development/gswafl/index.html>)
- [2] D. Carless, S. M. Bridges, C. K. Y. Chan, and R. Glofcheski, "Scaling up Assessment for Learning in Higher Education," *The Enabling Power of Assessment*, Vol. 5, Springer Nature Singapore Pte Ltd., 2017, 227 p. ISBN-13: 978-9811030451. (DOI: 10.1007/978-981-10-3045-1_1).
- [3] P. Black, C. Harrison, C. Lee, B. Marshall, and D. Wiliam, "Working inside the black box: Assessment for learning in the classroom," *Phi Delta Kappan*, Vol. 86(1), 2004, pp. 8–21. (<https://doi.org/10.1177/003172170408600105>)
- [4] P. Race, S. Brown and B. Smith, *500 Tips on Assessment*, 2nd ed., New York: Routledge, 2005, 184 p. ISBN-13: 978-0415342797
- [5] M. Wride, "Guide to self-assessment", *Academic Practice*, University of Dublin Trinity College, 2017, 13 p. (<https://www.tcd.ie/academicpractice/resources/assessment/selfassessment.php>)
- [6] K. J. Topping, *Using Peer Assessment to Inspire Reflection and Learning*, New York: Routledge, 2018, 166 p. ISBN-13: 978-0815367659.
- [7] F. Dochy, M. R. Segers, D. Sluijsmans, "The use of self-, peer- and co- assessment in higher education: A review," *Studies in Higher Education*, Vol. 24(3), 1999, pp.331-350. (<https://doi.org/10.1080/03075079912331379935>)
- [8] N. Burlacu, "Aspects of evaluation of students' activity in the seminar classes: problems and solutions," *Journal of Social Sciences*, Vol. IV (4), Technical University of Moldova (Publishing House), 2021, pp.63-74. 133 p. ISSN 2587-3490. eISSN 2587-3504. ([https://doi.org/10.52326/jss.utm.2021.4\(4\).07](https://doi.org/10.52326/jss.utm.2021.4(4).07))
- [9] P. Race, *The lecturer's toolkit: a practical guide to assessment, learning and teaching*, 3rd ed., New York: Routledge, 2007, 248 p. ISBN-13: 978-0415403825. ISBN-10: 0415403820.