

Application of the One-Parameter Rasch Model to Quality Education Through Evaluation and Survey Analysis

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Abstract – The present study aims to analyze and compare the attitudes of the learners about the way of teaching and assessment in higher education institutions, created after the pandemic situation that had covered the whole world. The accompanying materials used, which are necessary for learning the material during the learning process, regardless of whether they are present or online, are also classified. The way of teaching and testing, the encouragement of learners to participate fully in the educational process at all times, and the use and implementation of digital resources to help and support the learning material are also analyzed. The group of learners was surveyed at an interval of 1 year about their preferences for face-to-face or online forms of teaching, learning, and assessment of acquired knowledge, skills, and competences using the same survey, with the first survey conducted during the pandemic and the second after its completion. The results obtained from the survey were analyzed using the one-parameter model of Georg Rasch, and for even greater credibility of the conducted survey, comparability of the results of the two control questions that are present in the survey itself is provided.

Keywords – Face to face, online, one-parameter Rasch model, teaching, testing, audio-visual aids, digital learning materials, cloud resources.

1. Introduction

Individuals from many walks of life have been impacted by the COVID-19 pandemic worldwide. It had an unparalleled effect [1], making people feel very insecure, limiting their freedom of movement, and stopping everything [2]. Individuals discovered that they were quickly moving towards a new world that called for new actions. Even if the closing of many institutions, including educational ones, helped to reinforce social distancing measures, education and training suffered greatly as a result [3].

Before the pandemic, the face-to-face form of training or so-called "traditional face-to-face training" was mainly applied. With all the wonderful advancements in technology during and after the pandemic, as long as one has a connection to the Internet, they may take classes and obtain degrees or certificates more readily than they could virtually anywhere on the globe.

For online learning, learning effectiveness is a crucial subject. Many educators, particularly in higher education, who are interested in boosting and widening student learning outcomes have popularized it [4]. Online courses give students the flexibility they need if they have a full-time job, a family and kids, are taking care of a sick relative, or are going through any other life changes that would make going to college an additional complication in their lives. They can set their schedules and proceed through the courses at their own pace when they take online programs. For all online courses, there is a weekly deadline for all assignments and assessments. This gives students the freedom to finish their tasks at their own pace during that week, enabling them to study and absorb information in the best possible way.

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The adaptability of online learning enables students to complete courses at a speed that works for them, regardless of how quickly or slowly they study.

It would be beneficial to investigate how elements of the pandemic's online learning could be incorporated into the way that education is now delivered. The use of technology in the classroom, cutting-edge and smart technologies [5], [6], [7], [8], [9] novel teaching strategies, and the perspectives and experiences of students are all significant factors to consider in order to address how students view learning, teaching, assessment, and interactions with peers and teachers in both face-to-face and virtual learning environments. However, not much focus is placed on what transpires following the outbreak or on how students feel and consider going back to in-person instruction. To improve face-to-face learning by contextually tailoring it to their needs, the current study focuses on identifying the aspects of online learning that students preferred during the pandemic, namely learning, teaching, assessment, and interaction with teachers and colleagues.

2. Setting up the Experimental Layout

While e-learning is not new, each university has chosen unique tactics regarding its mission, institutional strategy, structure, activities, organization, and functioning. This is despite the fact that the education system is centralized [10]. Both educators and learners have grown accustomed to the "Virtual Classroom" [11], which is essentially online learning environment built on Moodle that has been used for distance learning since 1998. During the pandemic, this platform and others assisted in the shift to online instruction for all courses. Three types of contact are commonly described in online learning: teacher-student, learner-learner, and learning content-learner.

Students also mention the disadvantages of online learning, with health and mental health issues being arguably the most significant. Online learning has an impact on academic achievement as well. Students also mentioned the quality of online learning [13], information overload [12], and the inability to modify the course structure to fit the format as issues with online teaching. Compared to students learning in person, students are not happy with how instructors modify the course material when they are learning online. Cheating is a problem that is common in online exams; it reduces the meaning of exams for examinees [14], [15].

Numerous studies generally assert that pupils see online contact favorably [16], [17], [18].

Although research indicates that this is not relevant to student satisfaction during online learning [21], teachers were highly upset by the lack of in-person interaction with students. This is because the instructor-learner relationship is crucial in educational environments [20], [21]. One of the possible causes of this alienation may be the fact that students turn off their cameras during practical's and lectures [22], [23], which leads to a "lack of emotional closeness" that is utterly demotivating.

The advantages and disadvantages of online versus face-to-face learning should be thoroughly examined in light of this distinctive approach to education delivery. This study aims to determine whether learners' views of relevance were influenced by fully online or face-to-face instruction, as well as whether it is feasible and efficient to combine in-person and online instruction.

2.1. Description of the Approach

A questionnaire-based survey was used to collect the data, which is a quantitative method of studying social issues [24], [25]. The steps of the research process are as follows: creating the survey questions, identifying the population to be investigated, designing the working instrument and data collection technique, gathering information later on, analyzing the responses, and composing the research report. To evaluate the reliability of the questionnaire items, the Cronbach's alpha coefficient was calculated. A score of greater than 0.9 [26] indicates that the questionnaire items have very good reliability. A modern theory of testing Item Response Theory (IRT) model, specifically the dichotomous/simple model, was used to analyze the survey data. This model deals with a question whose possible answers can be categorized as either correct or incorrect, depending on the quantity. This one-parameter model is also known as the Georg Rasch model. One year later, the same questionnaire was repeated using the same student sample and research methods to paint a complete picture of the research and, in turn, the attitudes regarding online versus face-to-face instruction and evaluation. The majority of the survey's questions, however, are focused on how the learners should be taught and tested. Based on the responses provided to these questions, one could conclude the preferred method of instruction and assessment. However, two control questions about the type of training and testing the trainees prefer have been added to the survey itself for greater credibility — online or face-to-face.

The main theoretical development of the models based on the principle possibility obtained based on the Rasch model is relatively invariant concerning the estimation of the parameters in the models (the readiness of the respondents and the comprehensibility of questions), located in one metric scale and accompanied by the accuracy characteristics of the assessment. The fact that all latent parameter estimates lie on a single metric scale has several important applications. First, it allows, under certain conditions, to unify the results of different versions of the survey. Second, the metric scale allows one to determine how much one object is more overt or not relative to another, rather than simply comparing it on a "much too little" basis. Third, the metric characteristic of the scale allows the use of a wide range of methods of mathematical statistics. Despite all the advantages of the Rasch model, they are valid only in cases of empirical survey data using the measurement model adequately.

The data of the conducted research were collected between September and October 2022 (I stage) and between October and November 2023 (II stages), the students were selected from all years of study and all majors in the Faculty of Mathematics and Informatics at the Konstantin Preslavsky University of Shumen. There were 280 trainees surveyed, with a gender distribution of 55% men and 45% women. The survey was completed online, free of charge, and anonymously, and the respondents had the opportunity to terminate it at any time. The average time required to complete the questionnaire is approximately 15-20 minutes.

Based on the data obtained from the survey, a formalization of the task was carried out for a preferred form of training, testing, and submission of the training material online and face-to-face.

The linguistic variable "form of learning, testing, and presentation of the learning material—face-to-face or online" with a predefined term set of {yes, do not know, no} is subject to evaluation. More easily evaluable criteria are used to represent the linguistic variables.

The following designations are introduced:

D – a finite, discrete set of diagnoses;

$C = \{c_1, c_2, \dots, c_m\}$ – a finite, discrete set of criteria;

$A = ||a_{ij}||, i=1, 2, \dots, n, j=1, 2, \dots, m$ – matrix containing the survey results; $a_{ij} \in L$ is the i -th student's response to the c_j -th criterion;

L – the discrete scale of response values.

When using the linguistic model to evaluate a method of instruction, assessment, and lesson content presentation, the highest level of semantic proximity that can be reached is when it is consider as a diagnostic task of the type (1):

$$\langle C, L, A, D \rangle, \tag{1}$$

By using the following expression: To ascertain the diagnosis $d \in D$ by comparing the answers A to the criteria C established in the scale L .

Formally, this means finding a unique image (2):

$$\Omega: A \rightarrow D \tag{2}$$

of the quantified opinion about the quality of teaching, testing, and delivery of the teaching material A in the set of diagnoses D . To obtain Ω , the Rasch model is applied to dichotomous data [27], [28].

To the accepted values $\{0, 1\}$ of the one-parameter Rasch model for evaluating the format of teaching, testing and delivery for online and face-to-face courses, another value 0.5 was added in the study, which in no way affects the final result.

The Rasch model is designed to respond to survey results. It establishes a relationship between two sets of latent properties associated with survey difficulty learner response reliability and observable survey response outcomes [29]. The Rasch model has an outstanding mathematical property, namely that the parameters themselves are sufficient statistics and the approach meets measurement criteria derived from measurement analysis in the physical sciences [29].

To apply the Rasch model, it is assumed that the learner and the form of learning, testing, and teaching are survey parameters that allow for objective evaluation.

The probability P that a learner with preparation θ will select online instruction over face-to-face instruction b can be represented by the following formula (3), which summarizes the Rasch model.

$$P(\theta) = \frac{\exp \theta}{\exp \theta + \exp b} = \frac{1}{1 + \exp(b - \theta)} \tag{3}$$

The Rasch logistic model is the name given to the resulting ratio. The Rasch model is one-parameter since the formula shows that the likelihood of selecting a specific teaching and testing format depends only on the difference $b - \theta$.

The inquiry criteria regarding learning and assessment method preferences are assessed through the proper use of the Rasch model, which makes it possible to separate survey participants' ratings from subject difficulty ratings and vice versa. The Rasch measurement split parameter prediction function is defined as "independence of task ratings from subjects and subject ratings from task parameters".

Measure the latent variables θ and b , the so-called indicator variables. As such, pre-selected criteria for surveying preferences for teaching and testing formats are accepted. Correct use of the Rasch model requires that the criteria be unambiguous, i.e. to have a single value of {yes, no}, $\{0, 1\}$. In the considered evaluation, 3 linguistic variables are used to evaluate each criterion.

If one element of this term set is 1, then the rest are necessarily 0, which renders this term set meaningless. To avoid this inconvenience, the following scoring system for each element of the term set is used as shown in Table 1.

Table 1. Value-equating scale versus term-set selection

A linguistic variable	Value
No	0
I do not know	0,5
Yes	1

The criteria used for the analysis of the respondents for the preferred form of teaching and testing are the same, with each learner responsible for the online and traditional forms of education:

1. Presents learning material in an orderly and understandable language and clearly explains various ideas and theories. [Face-to-face]/ [Online]
2. Supports more difficult material with examples. [Face-to-face]/ [Online]

3. Feels the students understand it. [Face-to-face]/ [Online]
 4. Stimulates independent thinking and participation in the learning process. [Face-to-face]/ [Online]
 5. The classes are provided with audio-visual means. [Face-to-face]/ [Online]
 6. Developing the knowledge and skills necessary for professionals in this field. [Face-to-face]/ [Online]
 7. Answers students' questions. [Face-to-face]/ [Online]
 8. To what extent does the teacher condense the study time? [Face-to-face]/ [Online]
 9. It gives clear instructions on the requirements and criteria for evaluating students in the discipline. [Face-to-face]/ [Online]
 10. Impartially evaluates. [Face-to-face]/ [Online]
- Control questions:
1. What type of training do you prefer??
 2. What test do you prefer?
- A portion of the analyzed data is shown in Table 2.

Table 2. Sample of the conducted experiment of analysis for the form of learning, testing, and presentation of the learning material (online or traditional)

question Student	1	2	3	4	5	6	7	8	9	10	Primary ball b_i	Ability P_i	$A_i = \text{Ln}(P_i / (1 - (P_i \cdot e)))$ Logit	Evaluation
Student 1	1	1	1	1	1	1	1	1	1	1	10	1.000	6.908	FACE-TO-FACE
Student 2	1	1	1	1	0.5	1	1	1	1	1	9.5	0.950	2.925	FACE-TO-FACE
Student 3	1	1	1	1	1	1	1	1	1	1	10	1.000	6.908	FACE-TO-FACE
Student 4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5	0.500	-0.002	ONLAIN
Student 5	1	0.5	1	1	1	1	1	1	1	1	9.5	0.950	2.925	FACE-TO-FACE
Student 6	1	1	1	1	1	1	1	1	1	1	10	1.000	6.908	FACE-TO-FACE
Student 7	1	1	1	1	1	1	1	1	1	1	10	1.000	6.908	FACE-TO-FACE
:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Student 277	1	1	1	1	0.5	1	1	1	1	1	9.5	0.950	2.925	FACE-TO-FACE
Student 278	1	1	1	1	1	1	1	1	1	1	10	1.000	6.908	FACE-TO-FACE
Student 279	1	0.5	1	1	1	1	1	1	1	1	9.5	0.950	2.925	FACE-TO-FACE
Student 280	1	1	1	1	1	1	1	1	1	1	10	1.000	6.908	FACE-TO-FACE
	271	257.5	271	265	210	265	271	231	271	231				
Ability P	0.968	0.92	0.968	0.946	0.75	0.946	0.968	0.825	0.968	0.825				
Logit	-3.374	-2.425	-3.374	-2.853	-1.095	-2.853	-3.374	-1.545	-3.374	-1.545				

2.2. Methodology of the Experiment

The Rasch model can be implemented using an Excel spreadsheet in the following sequence:

1. The interviewer scores the survey responses against pre-selected criteria in the Linguistic Variables scale, which are then transformed into L-scale values.
2. The total of the marks assigned by rows determines each survey participant's primary score.
3. A calculation is made to determine each survey participant's p_i .
4. Formula (4) establishes a given respondent's first approximation based on his skill:

$$A_i = \ln \left(\frac{P_i}{1 - (P_i - \epsilon)} \right) \tag{4}$$

5. The final choice of the respondents for the form of training is calculated by the linear transformation of A_i in the scale (face-to-face, online). In reality, the values of A_i fall into the interval (-3, 3). With this in mind, the "face-to-face" form of training is set to values exceeding 1.9, as close as possible to the upper limit of the meaningful interval, and all below it to "online."

For inferences made on the basis of the individual questions about which way of teaching and testing would be preferred by the learners, the one-parameter Rasch model was again applied, but this time it worked on columns using formula (5), after which these inferences were compared with the results, as in the two control questions from a survey, as well as from the percentage comparison of the results for each of the respondents, which is a double check of the data and speaks of the reliability of the conclusions of the conducted survey.

$$B_i = \ln \left(\frac{1 - (P_i - \epsilon)}{P_i} \right) \tag{5}$$

2.3. Results Analysis

Before the pandemic, the majority of training was offered entirely in face-to-face form. There are many advantages to the face-to-face format. This mode of teaching provides real-time personal interaction between faculty and students, which in turn can spark innovative questions and conversations. Students have the opportunity to seek clarification or an answer to their questions in their classroom [31]. There is a growing body of evidence to suggest that one-to-one training provides motivation, helps build a sense of community, and provides much-needed encouragement to learners. This also allows educators to pick up on non-verbal cues and make appropriate changes to teaching content and methodology [31], [30].

One of the main difficulties faced by teachers in forced online learning was being able to present their knowledge in a language understandable to the students, to clearly explain and present the basics of the material necessary for learning without having a direct relationship with their students, and to not be able to observe their reactions. For the conduct of any online class, one of the main requirements is the use of audio-visual aids. It is observed that the curves expressing online learning are strictly convex in both stages of the survey (Figure 3), which supports the necessity of using audio-visual means for the actual conduct of online teaching. This is not the case with the face-to-face form of education, where there is an increase in their use in teaching activities, which in turn speaks of clearer and evidence-backed knowledge. Observing even just the two curves representing the present form of education, it is noticed that at the second stage of surveying, the curve overtakes that of the first, which in turn supports the thesis that regardless of the teaching method, the use of audio-visual aids is required. Among the aspects of online teaching that students would also like to encounter in face-to-face teaching activities are digital learning materials published on

the university platform, followed by interesting or interactive presentations and programmed flexibility.

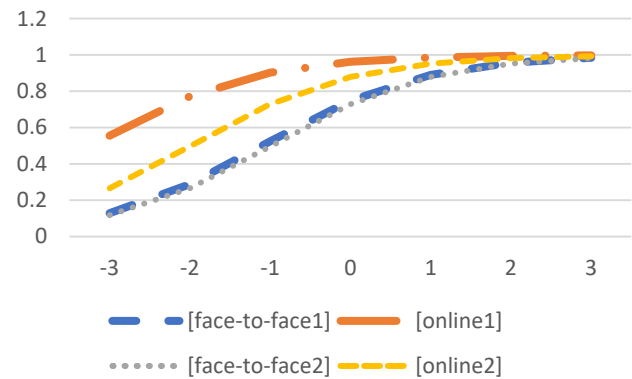


Figure 1. The classes are provided with audio-visual means (I stage, II stage)

Another main question is whether the teacher succeeds in presenting the learning material in an understandable way for the learners and whether there is a difference in the teaching format. Observing the curves in Figure 6, it is clearly noticeable that in the I stage of the study in the present form of education, the teachers presented the information to their students in the most clear and understandable way. In the second stage, a slight decline is noticed, which speaks of getting into a routine and wanting to give more and more to our learners, even if they have not absorbed the previous information presented. Here, the teacher probably relies on the fact that, from the already-conducted online training, the students are used to looking for additional information, learning independently, and absorbing the material from the digital and interactive tools provided to them. In online learning, comparing the two stages, the opposite is noticeable, namely, in the second stage, the orderly and clear presentation of information to the students is strengthened, which is a fact of the accumulated experience and revised teaching materials.

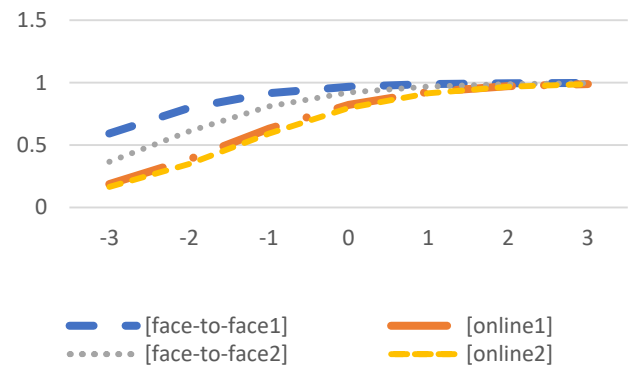


Figure 2. The teacher presents the learning material in an orderly and understandable language and clearly explains the various ideas and theories (I stage, II stage)

In order to reach these conclusions, the following questions from the survey, which are mainly related to the way of teaching and subsequent assessment, are examined in detail.

Another important point in training is whether a teacher knows how to condense his lessons, which in turn improves the preparedness of students. The following diagram (Figure 4) clearly shows that in the first stage of online learning, the teachers tried to use every minute of the online class as much as possible with learning content, even if it reached moments when the students were overwhelmed by information and the inability to analyze and assimilate it. In the second stage of online teaching, a decline is noticed, which would be interpreted as teachers slowing down the pace in order to achieve a greater success rate and understanding by the learners. In the form of face-to-face teaching, no anomalies of the curves are noticed, but on the contrary, they overlap, which can be interpreted as meaning that in the present form of teaching, the learning material is presented smoothly, in portions, adequately absorbed, analyzed, and discussed with learners, which speaks of well-studied learning material.

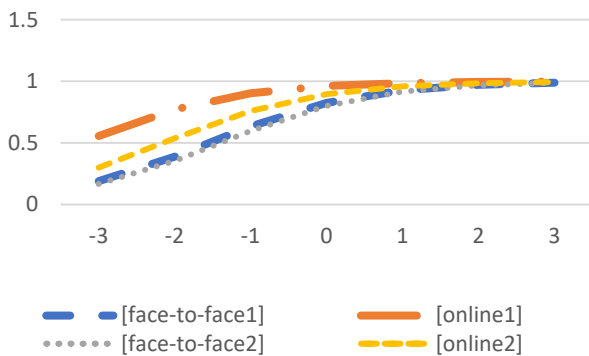


Figure 3. To what extent does the teacher condense the learning time (I stage, II stage)

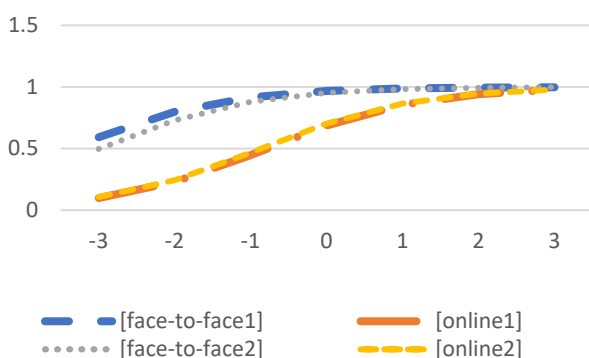


Figure 4. The teacher feels whether the students understand it (I stage, II stage)

Also, of particular importance is whether the teacher feels his students really understand the material, and here a permanent preservation of the values in both stages (Figure 5) is observed, as well

as their slight increase for the online learning and a slight decrease for the face-to-face form. Interpreting the graph, the teacher can read on the faces of his learners whether or not they have mastered the material presented by him, while in online learning, this main factor is almost impossible from the point of view that the majority of learners did not turn on their cameras during teaching, which in turn contributed to some long and monotonous monologues by the teachers.

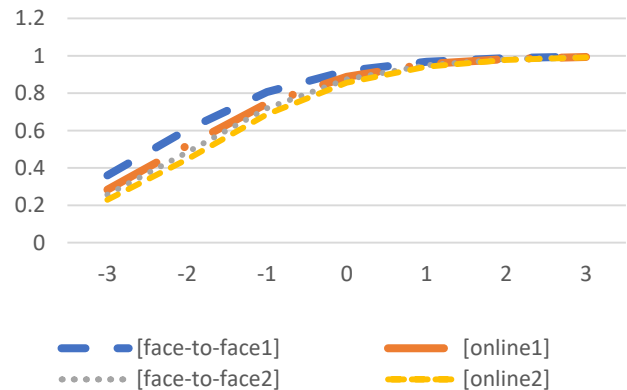


Figure 5. The teacher supports the more difficult material with examples (I stage, II stage)

A stable and persistent trend is observed, regardless of online or traditional learning, first or second stage of inquiry, for teachers to support difficult-to-understand learning material with real-life examples or those that are more easily digestible and understandable by learners. The curves in Figure 5 are strongly convex for all stages and modes of teaching and even overlap, which speaks of educators wanting to impart the necessary knowledge to their learners. A similar interpretation can be made of the curves presented in Figure 6 depicting the erudition of the teachers, namely through the competent answers to the questions that arose during the training, regardless of whether it was face-to-face or online or at what time the survey was conducted. The rise of these indicators speaks of a conscious and increasing qualification of the trainees, i.e., teachers strive to improve the competence of their students.

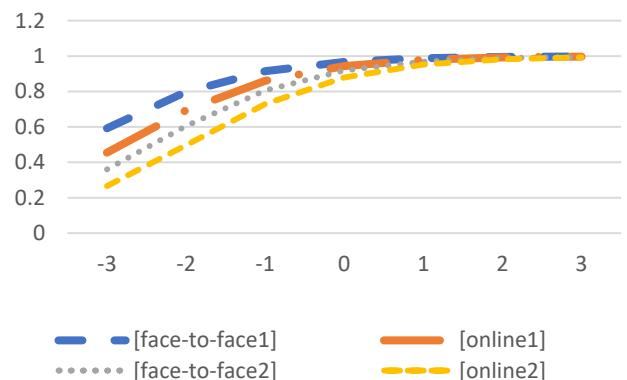


Figure 6. Answers students' questions (I stage, II stage)

For the assimilation and understanding of the taught material, as it became clear, it is of particular importance whether the teacher manages to support the more difficult material with evidentiary examples, answers the questions that arise, and also makes his students independently reach important conclusions, guided by the solution of various case studies and actively participating in the learning process, thus stimulating independent thinking and participation in the learning process. From Figure 7, it is clear that face-to-face communication is preferable to online communication. Teachers always emphasize arguments and reinforce the learning material with examples, yet in face-to-face teaching, it is much easier to have a dialogue and everyone present participates actively, while in the online form of teaching, the learners are passive listeners. In the present form of learning, the teacher makes eye contact with his students, and it is extremely easy, even during a lecture, to consult them, to motivate them to ask, and even to assign them individual or group tasks using cloud technologies [19], with learners becoming direct participants in the learning process and not passive listeners, as is the case mostly with online learning.

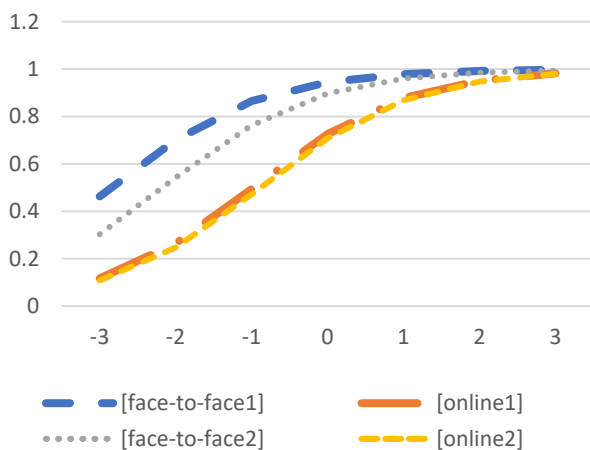


Figure 7. Stimulates independent thinking and participation in the learning process (I stage, II stage)

Another question addressed to the trainees aimed to capture which of the two forms of training (face-to-face or online) was considered the most useful in terms of their professional development. As can be seen in Figure 8, the most responses were provided for face-to-face training in stage two, followed by stage I, followed by online training in both stages, where the characteristic curve has its basic shape.

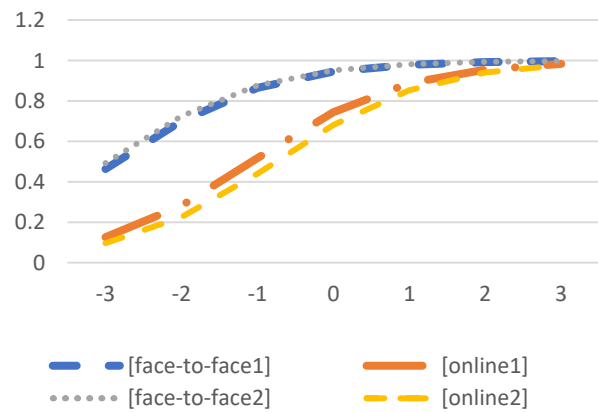


Figure 8. The teacher develops the knowledge and skills needed by the learners in this field (I stage, II stage)

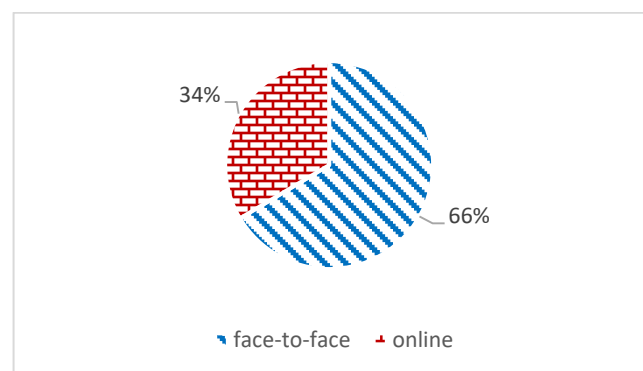


Figure 9. What type of training do you prefer?

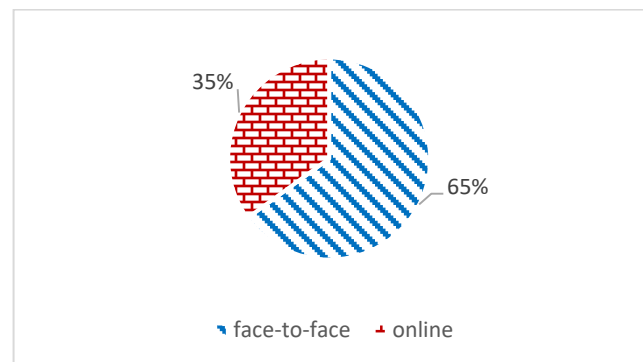


Figure 10. Estimation against the Rasch model according to the answers to the questions

From all the conclusions drawn up to now, the trainees should prefer the present form of training since it gives them the necessary preparation and knowledge in the relevant subject area, and the acquired knowledge and competences are long-lasting. This statement can be confirmed on the one hand by the result of the control question present in the survey, namely that every single respondent chooses which learning method he prefers (Figure 9), and on the other hand by the final result of the formalized determination task of learners' preferences, applying the one-parameter Rasch model (Figure 10).

This result is interesting considering that when asked about the students' preferred form of study, they choose the same. A total of 34% of respondents prefer online training, and 66% prefer traditional training, compared to the results obtained from the formalization of the task, where 35% are for online training and 65% for face-to-face. A difference of 1% can be considered an acceptable error due to the fact that the study was conducted in two stages and, on the other hand, that the method used to evaluate the study is reliable, credible and shows real results.

The other main question addressed in the article is "What test do learners prefer?". It is inevitable that after the teaching of any discipline, it ends with an assessment of the acquired knowledge, skills, and competences of the learners. In the pre-pandemic period, in addition to face-to-face teaching, the exams themselves were conducted face-to-face, and even then, the use of computer-based tests to assess knowledge was not uncommon. During the pandemic, traditional exams in lecture halls have moved to an online format. Computer-based tests were initially the main tool used for assessment and during online examinations, initially consisting of multiple-choice or short-answer questions or essay-based exams that were initially timed for 1–2 hours. Subsequently, other tools were developed that contributed to an objective assessment of the skills and knowledge acquired by the trainees.

Referring to these findings and the answers to the next two survey questions, namely when the knowledge assessment requirements are presented clearly and the assessment criteria are also provided, this leads to an unbiased and objective assessment of the acquired knowledge, skills, and competencies of the learners, which is also supported by the diagrams presented in Figures 11 and 12. It has been noticed that they are identical with respect to their choice of test. The characteristic curves are almost parallel to the abscissa axis, which speaks to some credible answers from students who strive to fully absorb the study material in order to obtain stable knowledge and a high score in the exam.

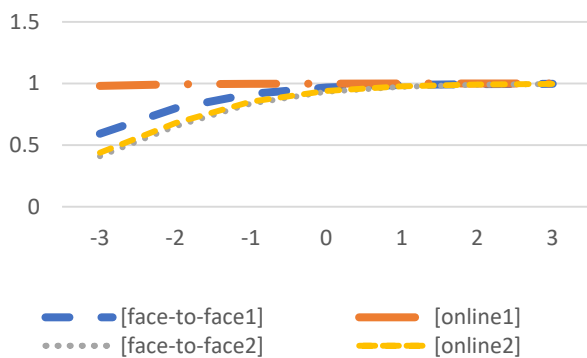


Figure 11. The teacher gives clear instructions on the requirements and criteria for evaluating the students in the course (I stage, II stage)

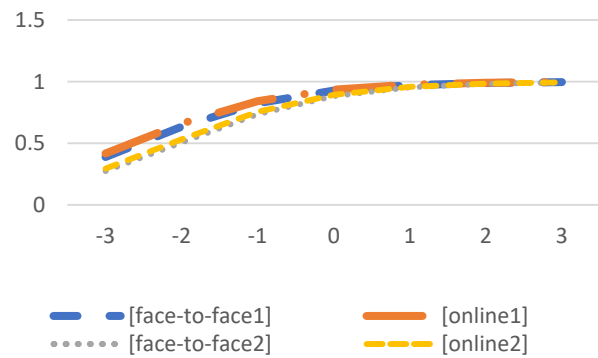


Figure 12. Impartially evaluates (I stage, II stage)

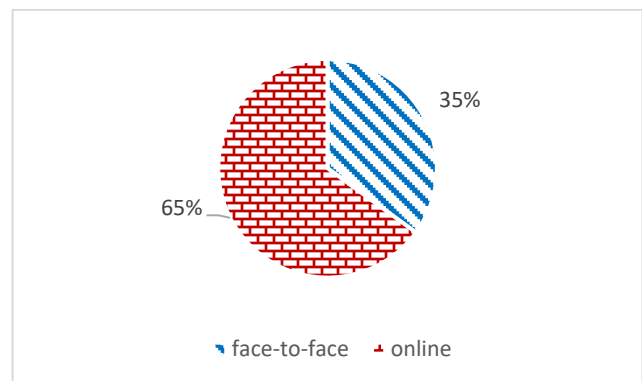


Figure 13. What test do learners prefer? (I stage, II stage)

3. Conclusion

Apart from teachers, students also faced difficulties during online assessment, but nevertheless it is observed (Figure 13) that online testing is the preferred way, even the values are opposite to those for teaching.

Online learning and testing have brought with them flexibility, speed, quick feedback, and the ability to take exams from anywhere. In addition, learners appreciate the fact that they are provided with more resources for preparation. In many cases, assessment is no longer based on knowledge tests but on projects and practical activities. The focus is more on finding solutions, creativity, and putting theoretical knowledge into practice. Taking exams in the comfort of students' own homes has reduced much of the stress of face-to-face exams. Also, the assessment done on the computer has a very strict table, and some students are satisfied with this aspect, even saying that the exams were more objective or fairer.

It is important to note that well-designed online learning is a complex process. In order to create an engaging learning environment and provoke the engagement and interaction of learners during class, educators must carefully plan and design learning strategies and include elements of online educational pedagogies.

When fully online, blended, and hybrid courses become the primary forms of learning offered in a post-pandemic world, educators who know how to blend appropriate, inclusive online learning with deep human connections will have a profound and long-lasting effect on students' academic knowledge. Relationship-focused educators understand that they can thereby help their students reach their maximum academic potential. The transfer of lectures and practical activities from higher education to an online environment requires a rethinking of the teaching strategy and a new concept of teaching-learning-assessment activities. The research points to several aspects emerging from the online educational experience that can be used to improve face-to-face activities and lead to more effective and sustainable education. Teaching should be reduced to a level comprehensible to learners, illustrated and supported by audio-visual examples, using a dialogical form of teaching, not a monologue. It would be effective for the taught discipline to provide learners, in addition to the taught material during the training, with digital learning materials, followed by interesting/interactive presentations and the flexibility of the programmed, as well as discussion and solving of various cases. It should be done in order to stimulate students to experiment with what they have learned by including it in practical tasks, developing applications or concatenating between different subject areas in order to consolidate the material learned.

The pandemic has prepared students and teachers to work remotely, which is crucial for presenting a successful hybrid model of teaching, learning, and assessment. From the conducted survey and the subsequent analysis of the data, the preferred form of teaching is the present traditional form, face-to-face, which is supported by digital learning materials. The teachers must stimulate the learners to participate in discussions, team activities, or group projects using cloud technologies, and the assessment of the acquired knowledge should be carried out remotely, online.

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