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E-LEARNING PLATFORMS AND UNIVERSITY STUDENTS SATISFACTION: A CASE STUDY FROM A BUSINESS ADMINISTRATION DEPARTMENT IN GREECE

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Abstract:
It is clear that in the last few years, E-learning in Greece, as well as abroad, has witnessed significant growth and transformation. With the rapid evolution of technology and the widespread use of platforms, the university student's satisfaction has become a crucial factor in determining the success and innovation of platform operators in the Greek and global markets. The research results show that global students' satisfaction amounted to a high score of 90.79%. The results were analyzed using the MUSA (Multicriteria Satisfaction Analysis) model. MUSA is an ordinal regression model based on the principles of multicriteria decision analysis. Given the analysis of the results, measuring students' satisfaction is a strategic tool for platform efficiency and growth.

Keywords: e-learning, platforms; students' satisfaction; multicriteria analysis

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1. Introduction

In recent decades, distance learning has emerged as a widespread alternative to traditional learning. Technological development has brought about radical changes in education, especially in teaching methods, tools and techniques available to professors and students (Muzammıl *et al.,* 2020). The most important reason for adopting e-learning in higher education is its ability to offer students greater flexibility (Picciano *et al.,* 2010; Ntanos *et al.,* 2023). This flexibility reduces students' commuting time, transportation, dining and clothing costs while allowing them to work.

Various researchers have given numerous definitions of distance education, each focusing on different characteristics. According to a broad definition, distance education is a form of education in which the professor and the students are at a distance in space or even time (Mahmood *et al.*, 2012). Therefore, its main characteristic is that the student learns without the physical presence of the professor. Drouin and Vartanian (2010), in research they conducted with undergraduate students, reported that online students tended to be older, with several hours of work commitments. However, technology helped them participate in lectures, discussions, homework, and exams.

The opportunity offered by distance learning to engage with course material 24 hours a day is remarkable, as it gives students opportunities to discuss and review their work, helping them learn course content with greater flexibility and ease (Crawford-Ferre and Wiest, 2012; Kottara *et al.,* 2024a). Many students have attended online courses, expressing that distance education offers more self-regulated learning and greater satisfaction, as it helps them adapt the educational material according to their needs (Allen and Seaman, 2013).

In addition, synchronous and asynchronous learning platforms as teaching aids are increasingly used by university institutions. In particular, during the COVID-19 pandemic, it became clear that the operation of universities was not interrupted due to the education offered through distance learning using digital educational tools (Olvido *et al.,* 2024).

Asynchronous distance education is a form of education where the professor and the students do not have the capability of direct interaction and communication, as happens in the classroom. However, students can study the content of the courses anytime and anywhere. This form of education provides flexibility in managing the teaching and learning process. More specifically, two-way communication technologies such as email, forums, wiki, and blog do not have space-time limitations. The organization of courses can be done in asynchronous education platforms (Learning Management System - LMS), which provide services for sharing and presenting multimedia material, creating user groups and discussion areas (forum), sending messages and a calendar of important events of the course (Kottara *et al.,* 2024b).

Compared to synchronous education, it is noted that this form of education has a greater degree of adaptability but significantly reduces the personal communication and interaction between the professor and the students.

Synchronous training takes place remotely but in real time with the simultaneous participation of the trainer and the trainees. In this way, the trainer and the trainees interact simultaneously with each other but from different locations where each one is located. Today, the synchronous form of e-learning uses a virtual lecture, a seminar or a meeting using technology and the internet (Holmberg-Wright, 2018).

Indicative advantages of synchronous learning are:

- The immediate feedback,
- The sense of developing a community/group,
- The potential for ongoing incentives,
- The student-centred nature of learning,
- Training is conducted in real time,
- Communication is immediate and in real-time,
- Encouraging student participation,

On the other hand, indicative disadvantages are:

- Programming for a limited duration,
- The limited response time and the scheduled (specific) lecture times.

In synchronous distance education, students' questions can be answered immediately and in real-time, while students can exchange views, discuss and collaborate. In a broader context, it provides more immediate educational support, interaction and feedback.

1.1 Contemporary Distance Learning Platforms in Universities

The COVID-19 pandemic has even affected university education, as the ban on conducting live courses has brought significant changes by adopting distance learning platforms (Almusharraf and Khahro, 2020).

This framework created new conditions and, in the beginning, encountered several obstacles since there was no corresponding readiness on the part of the academic community (Li *et al.,* 2023). A survey by Trust and Whalen (2020) found that the professors who could support the new reality were few as there was not much familiarity with the use of technology (Maatuk *et al.,* 2022).

The digital platform is directly related to a digital environment that uses software. In order to be considered sustainable and effective, an educational platform should offer a high level of interactivity, flexibility, and adaptability, with the possibility of customization to the needs of professors and students. In addition, it is important that it supports the connection of many users simultaneously and allows for the creation of many educational programs and activities, even final exams. Data safety and trust on the platform are important issues that should be addressed while using a platform (Adeniyi *et al.,* 2024).

Universities, for the implementation of synchronous education, provide flexible platforms, such as MS Teams, where access is possible from a desktop, tablet, or smartphone. In all of their essential functions, applications can be shared even among many users. In addition, the professor provides the possibility of chatting with written

text (chat room) and synchronous audio and video management tools as an administrator and the students if necessary (Kottara *et al.,* 2024c).

The synchronous education platform, for example, MS Teams, offers the possibility of recording video conferences and dividing students into groups, enhancing the interaction between them in separate "video conference rooms" to work as a team to solve educational activities.

Also, other indicative capabilities of this platform are the raising hand tool for solving additional questions and e-polling for the professor to activate the students by asking a question from the digital lecture to detect if they have understood the essential elements of the content. However, it is also important to save the notes created during the course during the academic weeks while the professor is given basic control over these functions (Lo and Hew, 2017).

Examples of synchronous education platforms are Webex meetings, Zoom, Microsoft Teams, Google Meet, Skype, and BigBlueButton, and many of them successfully support the flipped classroom. Research has found that combining the blended learning teaching approach (through the flipped classroom) and the aforementioned platforms positively affects knowledge acquisition and student satisfaction (Tanner and Scott, 2015). In general, synchronous education platforms are used not only for e-lectures but also for posting course announcements, sharing digital learning materials and videos, and quizzes to make a brief assessment, review and feedback on the learning material (Zainuddin, 2018).

It has been established in recent years that synchronous education platforms are used to conduct gamification in the flipped class with the main goals of increasing student motivation and satisfaction (Kottara *et al.,* 2024d), while there is a great deal of discussion and reflection on the integration of artificial intelligence in these platforms [Poon *et al.,* 2024; Baker and Spencely, 2020).

1.2 MS Teams Platform

The Microsoft Teams platform is a closed source and has been offered by university institutions, especially since the pandemic crisis. More specifically, MS Teams appeared in 2017 as a valuable part of the suite of digital tools of Microsoft Office 365. It is a fact that it was a digital platform of synchronous and asynchronous communication, which was created at the first level for the collaboration of companies in joint projects (Tan *et al.,* 2022).

However, it shifted to distance education and was used worldwide, meeting the needs of university institutions' professors, students, and administrators.

In the MS Teams platform, all of its digital features, in terms of synchronous education, allow users to communicate in real-time, either individually or in groups, through the sharing of digital files, with the ultimate goal of serving the goals of courses and programs studies (Hlazunova *et al.,* 2024).

At the same time, there is the possibility of sending and receiving text messages with images and other media, giving immediate answers and explanations through

constructive comments and observations, and using technology that students find exciting as it is now part of their daily lives.

In addition, the menu of options and tools in an education-digital team offers important resources, which include publications, files with folder organization, e-class notebook, assignments, grades and a wiki (Hai-Jew, 2020).

The "Assignments" tab is also an important option, as in this field, the creation of assignments and quizzes is allowed by the professors, while in the "More applications" function, students can connect to various educational applications in order to manage projects and visualize their data (Alkhatib and Alainati, 2024).

In this platform, the OneNote class notebook, located in the main menu of each group, is a digital interactive classroom tool that allows professors to save time in terms of posting and editing the educational content of the taught courses, which they can manage more quickly and efficiently (Khlaisang and Songkram, 2019).

The MS Teams platform promotes collaborative and student-centred learning, as students can work on projects and edit their notes in groups in real time and through case studies.

All these features provide a more experiential and engaging experience for 21st-century students who are digital natives and seek synchronous teaching methods as they feel more satisfied in a digital environment (Ke and Kwak, 2013).

1.3. University Students' Satisfaction from E-Learning Platforms

In research, student satisfaction is a widely used indicator that reflects successful learning. It is based on the fact that students express their satisfaction with a course and evaluate the quality of their educational experience (Drosos *et al.,* 2023; Ntanos *et al.*, 2022).

In addition, satisfaction indicates timely and meaningful interaction between students and faculty or that the teaching methods reflect student goals and expectations (Skordoulis *et al.*, 2016; Richardson *et al.*, 2017; Cohen and Baruth, 2017; Puška *et al.,* 2021). Student satisfaction can affect their motivation and attitude in a course (Almusharraf and Khahro, 2020), while in an e-learning environment, it is related to the platforms used by the teaching staff and the way they design the content of the course (Masa'deh *et al.,* 2023). Often, the level of satisfaction of students participating in hybrid learning environments is influenced by their level of engagement with the digital educational content and the activities developed through it (Purwanto and Tawar, 2024).

In research conducted on the investigation of the role of e-learning in university institutions and student satisfaction, a positive correlation was found. Students who have demonstrated advanced digital skills use technology more than those with less advanced digital skills (Sun *et al.,* 2008).

Gashi *et al.* (2024) focused on identifying critical factors affecting students' satisfaction with attending courses through synchronous e-learning during the Covid-19 pandemic. From the findings, it became clear that the adoption of new policies and reforms is necessary in order to continue the possibility of offering distance courses,

enhancing the experience of students during their studies, as they consider online courses to be more exciting with the use of educational platforms available to university institutions.

However, it was previously believed that the fear of using computers is significant and can reduce student satisfaction in contrast to a more recent study by Garris and Fleck (2022), who agree with the research findings of Gashi Zhushi and Krasniqi (2024) and support the dynamics of e-Learning Platforms.

In March 2023, in a study by Giday and Perumal (2024) that examined the assessment of graduate and doctoral students regarding their perceptions of online learning platforms, it was realized that there is a need to improve the design, implementation and effectiveness of e-learning, as it is a cyclical process, which needs constant updating to meet the synchronous needs of students. Equally, an important finding was the positive correlation between their satisfaction.

Furthermore, research nowadays highlights the necessity for using e-learning platforms, such as that of Yalçın and Dennen (2024) with the participation of 1,297 higher education students who were enrolled in fully online courses. In particular, students consider online teaching more flexible than traditional teaching, while their experience moves to optimal levels, and they feel delighted.

An important factor in this is the educational design and the strong presence of satisfaction and self-efficacy. Through an electronic learning environment, students achieve greater participation and involvement and better learning outcomes, which move to higher levels than traditional classrooms and teaching.

2. Materials and Methods

In this research, we are interested in exploring university students' satisfaction with the distance learning procedure. The survey was performed during the first semester of 2024-2025, and a total sample of 329 university students from the University of West Attica in Greece participated. The selection of student satisfaction criteria and subcriteria was guided by an extensive review of the relevant literature.

The satisfaction criteria were carefully chosen based on the robust literature findings concerning student satisfaction while using platforms for synchronous and asynchronous learning.

- The criterion “Platform usability” includes questions on ease of using the platform, ease of access and navigation, and ease of learning.
- The “Platform Efficiency” criterion includes connection speed, loading speed, chat speed and frequency of errors.
- The "Platform Functionality" criterion includes questions about chat options and media-sharing capabilities.
- The "Platform Reliability" criterion includes questions on interactiveness, security image and audio competencies.

- The "Empathy- Trust" criterion includes questions on platform design and interactions between students and their Tutors.

Table 1: Student's Satisfaction Criteria and Sub-criteria

Criteria	**Sub-criteria**
Platform Usability	Ease of Use, Ease of Learning, Ease of Navigation, Ease of Access, Empathy – Trust, Browser compatibility.
Platform Efficiency	Connection Speed, Loading Speed, Chat Speed, White Board Speed, Frequency of Errors.
Platform Functionality	Chat Mode, White Board Mode, Course Partition Mode.
Platform Reliability	Audio, Image, Interactiveness, Security.
Empathy-Trust	Aesthetic Design, Encouraging Students to Participate in the Educational Process, Encouraging Student Interaction, Interaction with the Instructor, and Interaction with Fellow Students.

Data were analyzed using a multicriteria model MUSA and descriptive and inductive statistics using SPSS V.24. Also, Principal components analysis (PCA), reliability analysis, and analysis of variance (ANOVA) were used to examine in detail students' satisfaction. In our survey of a sample of 329 University students, 72.9% were aged between 18 and 22 years old, 23.1% were between 23 and 27 years old, and above the age of 27 were 4% (Table 2). Our survey sample was diverse, with 64.4% female and 35.6% male participants. Around 87% of participants attended the first 8 semesters of their academic program, and 13% exceeded their study beyond the expected. Specifically, students who extended their studies beyond the 8 semesters were 10% male students and 17% female students. Most of the time, students accessed the synchronous-asynchronous E-learning platforms, using 84.5% of their desktops, 12.2% of their smartphones, and 3.3% of their tablets.

Table 2: Sample Profile

Demographics	**Title 1**	**Frequency**	**Percent (%)**
Gender	Males	117	35.6
	Females	212	64.4
Age	18-22	240	72.9
	23-27	76	23.1
	>27	13	4

The satisfaction survey results were based on the multicriteria model MUSA (Multicriteria Satisfaction Analysis). The Multicriteria Satisfaction Analysis (MUSA) method was used to measure students' satisfaction. The method is an ordinal–regression-based approach used to assess a set of collective satisfaction functions so that the global satisfaction criterion becomes as consistent as possible with students' judgments. This method inferred an additive collective value function Y* and a set of partial satisfaction (value) functions Xi*, given the students' satisfaction global satisfaction Y and partial

satisfaction Xi according to the i–th criterion (ordinal scaling). The main research objective was to achieve the maximum consistency between the value function Y* and the students' judgments Y. Based on the modelling of preference disaggregation approach, the ordinal regression equation was termed as follows:

$$\begin{cases} Y^* = \sum_{i=1}^{n} b_i X_i^* \\ \sum_{i=1}^{n} b_i = 1 \end{cases} \quad (1)$$

where,
$\tilde{Y}^*$ represents the estimation of the global value function,
n represents the number of criteria,
bi is a positive weight of the i–th criterion,
σ+ and σ− are the overestimation and the underestimation errors, respectively, and the value functions Y* and Xi are normalized in the interval [0,100].

The global and partial satisfaction Y* and Xi* are monotonic functions normalized in the interval [0,100]. Thus, in order to reduce the size of the mathematical program, removing the monotonicity constraints for Y* and Xi*, the following transformation equations were utilized:

$$\begin{cases} z_m = y^{*m+1} - y^{*m} & \text{for } m = 1,2,\ldots,a-1 \\ w_{ik} = b_i\left(x_i^{*k+1} - x_i^{*k}\right) & \text{for } k = 1,2,\ldots,a_i - 1 \text{ και } i = 1,2,\ldots,n \end{cases} \quad (2)$$

Where,
y*m is the value of the ym satisfaction level,
xi*k is the value of the xik satisfaction level, and
α and αi are the number of global and partial satisfaction levels.

According to the aforementioned definitions and the assumptions, the basic estimation model can be written in alignment with the following linear program formulation:

$$\begin{cases} [\min] F = \sum_{j=1}^{M} \sigma_j^+ + \sigma_j^- \\ \text{under the constraints:} \\ \sum_{i=1}^{n}\sum_{k=1}^{t_{ji}-1} w_{ik} - \sum_{m=1}^{t_j-1} z_m - \sigma_j^+ + \sigma_j^- = 0 \ \forall j = 1,2,\ldots,M \\ \sum_{m=1}^{a-1} z_m = 100 \\ \sum_{i=1}^{n}\sum_{k=1}^{a_j-1} w_{ik} = 100 \\ z_m, w_{ik}, \sigma_j^+, \sigma_j^- \geq 0 \ \forall m,i,k,j \end{cases} \quad (3)$$

where M is the number of customers, n is the number of criteria, and xi*j, y*j are the j–th level on which variables Xi and Y were estimated.

3. Results

We performed a reliability analysis on the five resulting dimensions. We calculated Cronbach's alpha coefficient for the total questionnaire (Cronbach's alpha = 0.984) and for each dimension (Table 3). For the first criterion, "Platform Reliability", Cronbach's alpha coefficient equals 0.937; for the second one, "Platform Efficiency", it is 0.932, whereas for the third one, "Platform Functionality", it is 0.897. Cronbach's alpha coefficient is 0.923 for the criterion "Platform Reliability", and for the "Empathy Trust", Cronbach's alpha coefficient is 0.948. These values are more significant than the lowest acceptable coefficient threshold, which is about 0.7.

Table 3: Student's Satisfaction Dimensions Reliability

Satisfaction Criteria (Dimensions)	Cronbach's alpha
Platform Usability	0.937
Platform Efficiency	0.932
Platform Functionality	0.897
Platform Reliability	0.923
Empathy Trust	0.948

The results of the MUSA method showed that students are totally satisfied with applying platforms at distance learning procedures. Based on Figure 1, the total students' satisfaction amounted to a high score of 90.79%.

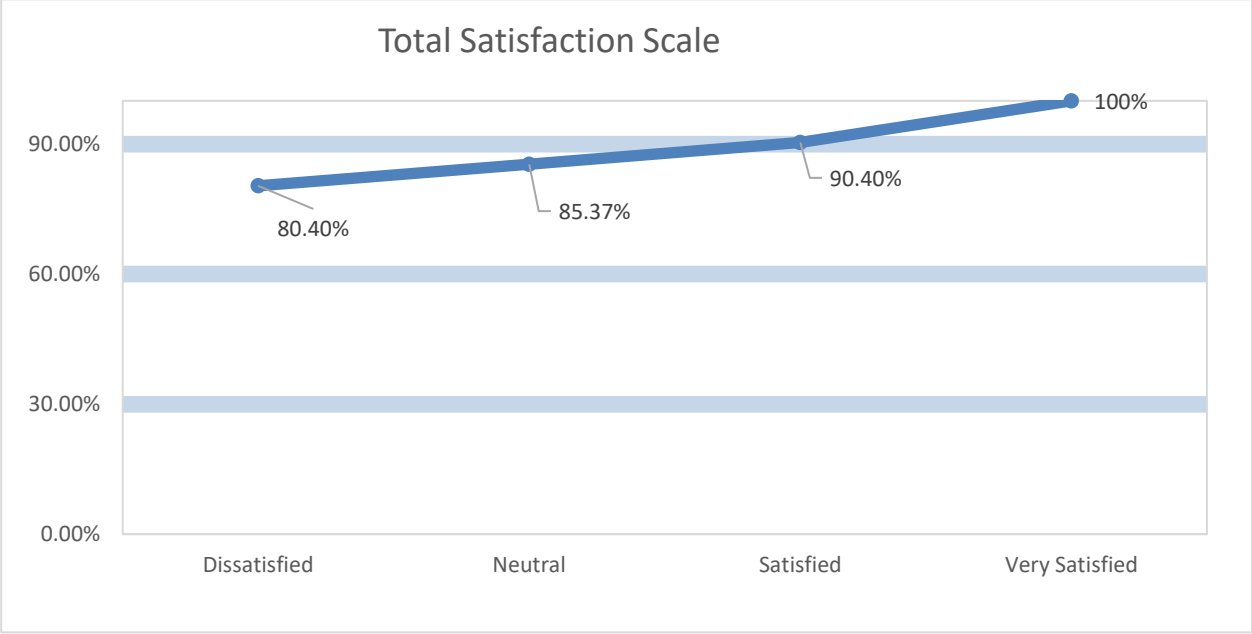

Figure 1: Global Satisfaction Function

Figure 2 shows that all survey criteria showed a reasonably high satisfaction rate. The "Platform Reliability" criterion sustained the highest satisfaction with a percentage of 94.09%, followed by the criterion "Platform Usability" with a 92.85% score. In comparison, students were also very satisfied with the criterion of "Platform Functionality" (92.39%). Finally, the criteria with the lowest satisfaction rates were those of "Empathy-Trust " and "Platform Efficiency", which amounted to 91.31% and 90.49%, respectively.

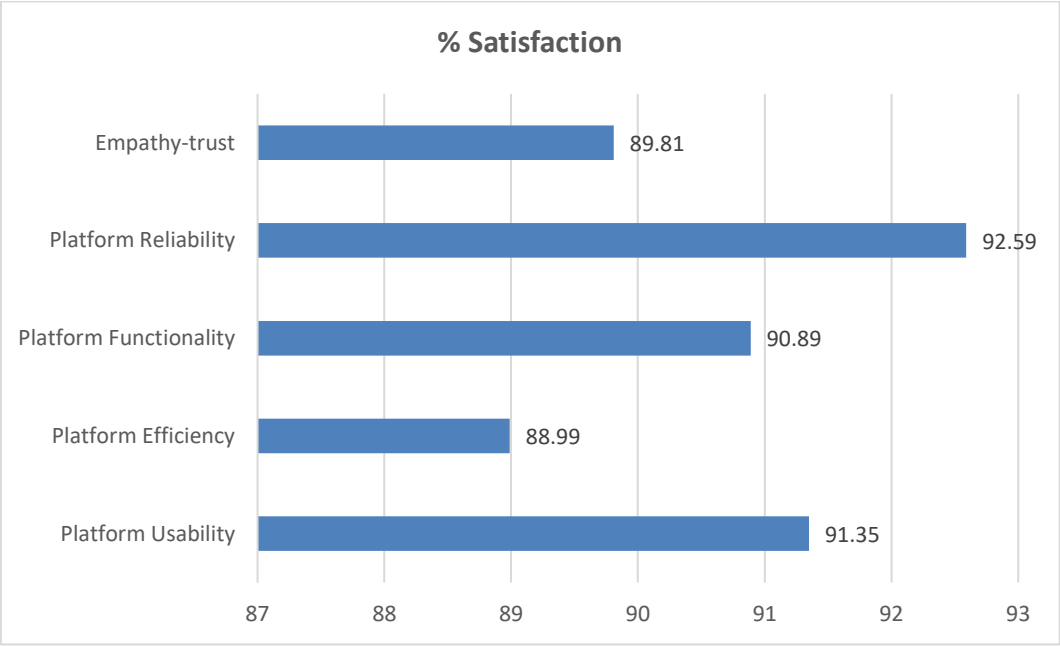

Figure 2: Satisfaction Criteria Weights

The weights of satisfaction criteria on students for the variable “Total Satisfaction" is according to Figure 3, the criterion of “Platform Efficiency” (43.13%) having the most significant weight followed by the criteria of “Platform Usability” (17.5%) the weight of the criterion “Empathy- Trust” is (11.3%), the weight of the criterion “Platform Functionality” is (10.17%) and finally, the weight of the criterion “Platform Reliability” is (10.4%).

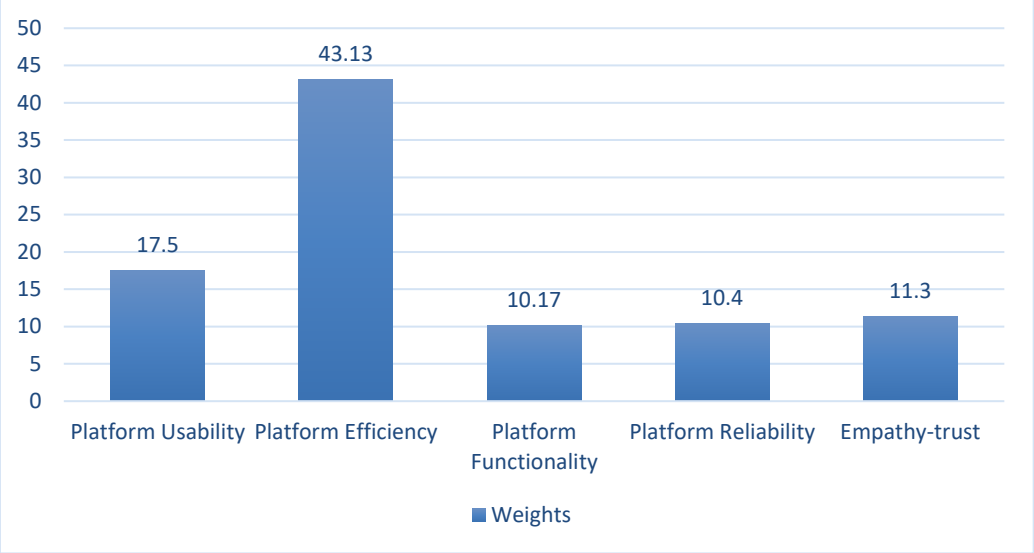

Figure 3: Satisfaction Criteria Weights

Table 4 presents the criteria and the sub-criteria of students' satisfaction using the Platforms for e-learning. According to these, the sub-criterion bearing the highest satisfaction on the "Platform Usability" Criterion is the Ease of Navigation on the Platform (95.96%), the Ease of use of the Platform follows (95.93%), followed by the Browser Compatibility (94.90%). The lowest satisfaction results are from the criterion of Ease of Learning (90.39%).

On the criterion "Platform Efficiency", the sub-criterion of Connection Speed has high satisfaction (96.11%), and the sub-criterion Load Speed follows (93.49%)—the least satisfaction results from the sub-criterion Frequency of Learning (87.4%. At the criterion "Platform Functionality", the sub-criterion Course Partition Mode bears the highest satisfaction to students (95.28%), and the chat mode option follows with satisfaction (91.49%).

The least satisfaction stems from the sub-criterion White Board Mode (90.88%). The last criterion, Empathy -Trust, which is very important for student satisfaction, is the interaction with the Tutor (93.31%) and follows the motive of encouraging students to participate in the educational process (92.19%). The least satisfaction stems from interacting with other students (84.35%).

Table 4: Sub-criteria Weights and Satisfaction Indices

Criteria	Sub-criteria	Average Satisfaction Index (%)	Weight (%)
Platform Usability	Ease of Use	95.93	16.81
	Ease of Learning	90.39	12.26
	Ease of Navigation	95.96	20.30
	Ease of Access	94.59	13.72
	Empathy – Trust	93.63	11.78
	Browser compatibility	94.90	25.13
Platform Efficiency	Connection Speed	96.11	38.00
	Loading Speed	93.49	20.00
	Chat Speed	93.37	14.00
	White Board Speed	91.01	14.00
	Frequency of Errors	87.40	14.00
Platform Functionality	Chat Mode	91.49	16.97
	White Board Mode	90.88	21.83
	Course Partition Mode	95.28	61.19
Empathy-Trust	Aesthetic Design	90.97	13.32
	Encouraging Students Participate in the Educational Process	92.18	23.22
	Encouraging Students Interaction	88.99	13.09
	Interaction with Instructor	93.31	38.42
	Interaction with Fellow Students	84.35	11.96

The action diagram presented in Figure 4 points out that all of the survey criteria showed a reasonably high satisfaction rate. The action area presenting criteria that are highly important and low at performance is empty, indicating that there are no significant criteria that students stand dissatisfied. The "Platform Reliability" criterion stands at the leverage opportunity area, indicating that this criterion may provide a competitive advantage of the e-learning procedure and should be further evolved and promoted.

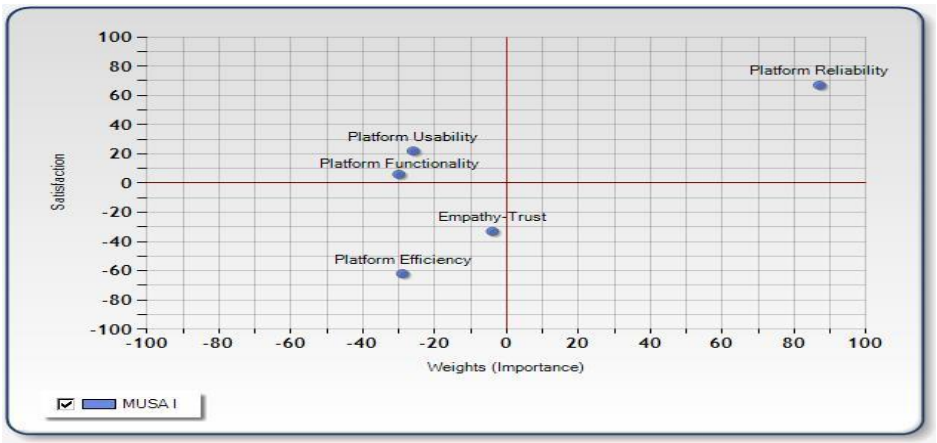

Figure 4: Action Diagram for the Main Satisfaction Criteria

4. Discussion

Last year's international E-learning platforms developed innovative solutions to increase users' satisfaction and performance. In the context of developing innovative solutions, there exists a possible source of innovation, namely:

- Technological Innovation: Distance learning platforms continually strive to introduce technological advancements to enhance their services.
- Digital Transformation: Distance learning platforms use digital transformation to streamline processes, improve efficiency, and enhance customer experiences. By leveraging digital technologies, Distance learning platforms can simplify interactions, reduce costs, and deliver more personalized experiences to users.
- IoT and Connected Services: Distance learning platforms explore innovative applications of the Internet of Things (IoT) by connecting various devices and enabling new services.
- Partnerships and Ecosystems: Distance learning platforms foster innovation through partnerships and collaborations with other stakeholders. It involves partnering with technology companies, content providers, and start-ups to deliver new and unique services. By creating open ecosystems and enabling third-party integrations, distance learning platforms can encourage innovation, expand their service offerings, and provide users with a more comprehensive digital experience.

In the base of our research the main objective of this paper was to examine students' satisfaction with e-learning platforms in Greece in terms of many factors, such as usability, efficiency, functionality, reliability, and empathy trust. The analysis of our questionnaire was based on the MUSA (Multicriteria Satisfaction Analysis) method (Jacquet-Lagreze and Siskos, 1982; Drosos *et al.*, 2020; Drosos *et al.*, 2021).

The main conclusions of our research can be summarized as follows. The Global Satisfaction Index is very high (90.79%). The students are delighted with all the criteria from the e-learning platforms. The highest satisfaction index is attributed to "Platform Reliability" (92,59%) and the lowest one to the criterion of "Platform Efficiency" (88,99%). The high levels of university students' satisfaction with e-learning platforms are confirmed by corresponding surveys carried out in the past. Jiang *et al.* (2021) measured online learning satisfaction in higher education in China during COVID-19. To measure student satisfaction with online platforms, the researchers used criteria such as perceived ease of use, usefulness, and computer self-efficacy (Drosos *et al.*, 2019). The research showed that Chinese university students are delighted with online platforms. Another research study used specific criteria (Level of support, alternative assessment plans, course modality in delivery, instructors' follow-up, gained knowledge and skills, course level of engagement) to evaluate learning experiences and online learning platforms in the Kingdom of Saudi Arabia. The research results showed that university students are satisfied with online platforms. Raspopovic and Jankulovic (2017) analyzed the quality of e-learning systems by measuring student satisfaction. The research showed that

university students were quite satisfied with using e-learning platforms. In their research, Dinh and Nguyen (2020) assessed the level of immediate satisfaction from the use of online course platforms during the COVID-19 pandemic in Vietnam. The university students were not satisfied with the use of e-learning platforms. The research results showed that students had many problems with internet access quality.

On the other hand, several studies have been conducted in recent years where university students' satisfaction results from e-learning platforms have ranged at low levels. Giray (2021) studied undergraduate students' satisfaction with e-learning in Turkey under pandemic conditions, using criteria such as student interaction and collaboration, student autonomy and instructor support. The research showed that perceived satisfaction from e-learning platforms was 2.85 on the 5-point Likert scale. In another research, Rajeh *et al.* (2021) measured the e-learning satisfaction of medical and dental students in Saudi Arabia. The research results showed that university students' satisfaction was at a moderate level of satisfaction (median = 3.5).

Of course, such a framework has limitations since there is no unique and widely accepted methodology for measurements students' satisfaction with e-learning platforms. While the authors carefully chose the appropriate variables, reevaluations are needed to propose a more potent model capable of revealing additional statistically significant relationships, which can be part of future work.

Conflict of Interest Statement

The authors declare no conflicts of interest.

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