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Table of contents

Editorial message

Dear Colleagues,

It is with pleasure to announce the new issue of the Journal of Integrated Information Management (JIIM) publication. JIIM is an international, multidisciplinary, blind peer-reviewed journal that publishes research efforts on all aspects and issues regarding Information Science and Integrated Information Management.

Expressing our commitment to promoting high-quality scientific papers, we present you with the current issue, which contains four articles.

The first paper presents the research that has been made on prediction models using deep learning methods with data retrieved from mimic III database and to identify challenges and possible areas for future research. Literature research was conducted for articles related to MIMIC III and prediction models related to the database published from 2016 to 2021. The most important findings are that prediction algorithms can be very useful in ICU units and that although some algorithms, such as InSight are specialized in specific diseases, others, such as XGBOOST and recurrent neural networks, can be used in a broader area, presenting quite accurate results.

The following paper discusses the opinions and perceptions of undergraduate students in Greek Universities regarding plagiarism. The research method that was used for the survey is quantitative, with the use of questionnaires. A total of 467 questionnaires were collected by students from all Greek Universities and the majority of the scientific fields. The research revealed various valuable findings. It is worth pointing out that the vast majority of the undergraduate students replied that they knew the term plagiarism (98,3%). On the other hand, below half the student population said they had not been trained in academic writing and, consequently, how to avoid plagiarism.

The next paper deals with the difficulties and problems during an Open Online Personalized Learning Environment for Vocational Education and Training implementation phase. The main focus was threefold, namely: a) the evaluation of the deviation in achieving the design objectives, b) the detailed report on the difficulties and problems in the implementation phase, and, finally, c) the possible problems of future uses as the environment operates through the Panhellenic School Network. The article's contribution is that recording the difficulties mediates an assessment of the result, allowing one to observe what has been achieved and improving similar future actions.

The last paper examines Greek citizens' awareness regarding the necessity of transitioning from the traditional medical record to the Electronic Health Record. The research methodology was based on bibliographic and qualitative tools to achieve the above purpose. An interesting finding is that the younger participants with higher education levels had a more positive opinion about the advantages arising from the implementation of Electronic Health.

We aim to make JIIM a reputable scientific communication channel and welcome submissions for upcoming journal issues and proposals for Special Issues. Your proposal should be no more than five pages and include at least an executive summary, a proper justification of why the Special Issue is needed and how it suits the JIIM topics. Special Issues proposals should be sent directly via email to the Assistant Editor-in-chief (dkouis@uniwa.gr).

Finally, we expect your contribution and active support with remarks and points of improvement.

Assistant Professor - Assistant Editor-in-chief
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MIMIC III and its contribution to critical care prediction models

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Abstract:

Purpose *- The present paper attempts to present the research that has been made on prediction models using deep learning methods with data retrieved from mimic III database and to identify challenges and possible areas for future research.*

Methodology *- A literature research was conducted for articles related to MIMIC III and prediction models related to the database published from 2016 to 2021. Also, reviews and papers related to neural networks, machine learning, data mining and implementation and usage of electronic health records (EHR) in ICU were investigated to support findings from mimic III papers.*

Findings *- Prediction algorithms can be very useful in ICU units. Although some algorithms, such as InSight are specialized in specific diseases, others such as XGBOOST and recurrent neural networks can be used in a broader area, presenting quite accurate results.*

Originality *- Usually, reviews categorize research on MIMIC database per disease or per the desired outcome, such as the prediction of length of stay and the final outcome. The current study categorizes the research based on the tools, prediction models, and algorithms used. This way, it is possible to understand better how each method performs to various conditions and desired outcomes.*

Index Terms — MIMIC III, neural networks, random forests, prediction models, Intensive Care Units, big data

I. Introduction

Intensive medicine is a multidisciplinary area of medical sciences which is focused on the prevention, diagnosis and treatment of severe diseases and conditions **[1].** The recent crisis of covid-19 resulted in an overwhelming demand for beds, especially in critical care **[2]**. Therefore, nowadays, there is a necessity for the development of tools that will support the even more difficult task of doctors and support staff to address new challenges that the pandemic brings. It is generally accepted that ICUs produce a large amount of data. Properly using these data could be useful for patients' outcome prediction or the possibility of readmission **[3]**. However, a significant barrier in medical studies is the lack of reproducibility, which incommodes the creation of reliable clinical decision-making tools **[4]**. Towards this direction, a very useful tool for the scientific community is the MIMIC III database. Mimic III is a large database of 26 tables containing data from around 60.000 patients' admissions to the Beth Israel Deaconess Medical Center intensive care unit in Boston, Massachusetts, between 2001 and 2012.

The main categories of data include patient demographics, medications, vital signs, lab results, survival data, length of stay, imaging reports, ICD-9 codes, fluid balance, observation and free text notes from care providers **[5]**. The dataset is freely available, but researchers who wish to use it must complete a recognized course for protecting human research participants and signing a data user agreement. Code is available in MySQL, PostgreSQL and MonetDB. In addition, there are scripts and libraries in Python and R. to facilitate the creation of views from raw data.

II. Method

A. Review Stage

This research paper focuses on publications related to MIMIC III database and techniques whose purpose is the prediction of patients' treatment outcomes or their length of stay in ICU. To use the latest available data, the papers have been filtered by year of publication greater than 2016. After that, they have been categorized by the model they use so that performance measurement of every method is possible when applied to various conditions.

III. Prediction tools

A. Neural Networks

Neural Networks can be divided into five major categories, artificial neural networks (ANN), Back propagation ANN, Recurrent Neural Networks, convolution neural network and Long Short-Term Memory Recurrent Neural Network. From the healthcare perspective, all the categories above are implemented to create prediction models. Researchers argue that better performance of new machine learning methods exists because clinical data and outcomes are non-linear, and technologies such as random forests (RF), support vector machine and ANN are more capable than regression models **[6]**.

Artificial Neural Networks can be used for early prediction of in-hospital mortality for specific conditions. For example, back propagation A.N.N. can be useful in predicting the mortality of patients with acute pancreatitis. Its significant

advantage is that it can detect the disease earlier than other methods (logistic regression, Ranson score, SOFA score), allowing early interventions that could significantly improve clinical outcomes **[7]**. In another study, ANN also shows better mortality prediction concerning acute kidney injury (AKI) over Bayesian networks and logistic regression **[8]**. However, there are differences in machine learning methods applied: For the same disease (AKI), newer studies indicate that random forest has better AUROC and Brier Score than ANN **[9]**.

B. Recurrent and Convolution Neural Networks

Recurrent Neural Networks (RNN) have been proven effective in predicting various outcomes during a patients' treatment in a health care unit. For example, a RNN is being used to predict hospital readmission for lupus patients **[10]** or for the prediction of a medical event (change in patient's health status) by using data from medical notes **[11][12]**.

Towards this direction, researchers try to implement and improve their RNN by applying them in MIMIC III database for a specific disease outcome or in a more generalized way. Furthermore, recurrent neural networks can also be used in real-time to predict severe complications during a patient's stay in critical care. Meyer et al. applied RNN to patients older than 18 years old that underwent major cardiothoracic surgery to predict possible complications after surgeries. Using routinely collected clinical data from MIMIC III without needing manual data processing, the deep learning methods showed accurate predictions immediately after patient admission to the intensive care unit. More specifically, for mortality, the PPV is 0.90 and the sensitivity 0.85; for renal failure 0.87 and 0.94 and for bleeding 0.84 and 0.74, respectively, outperforming standard clinical reference tools.

A similar approach concerning the data gathered can be used to monitor patients' mortality risk. With the use of long short-term memory Recurrent Neural Network and recent general health data of laboratory tests, vital signs and medications from LABEVENTS, CHARTEVENTS and INPUTEVENTS_MV tables as well as from ADMISSIONS and DEATHTIME tables, it is possible to achieve better AUROC and AUPRC scores compared to SAPS II **[13]**.

Another case of RNN usage is its implementation in predicting sepsis. The purpose was to conduct a retrospective analysis of adult patients admitted to the intensive care unit who did not fall under the definition of sepsis at the time of admission but developed it afterwards. Despite the fact that the length of the look-back significantly impacts the classifier's performance, the result shows that a recurrent neural network is superior to InSight –another method of predicting sepsis- in terms of performance. However, further research is necessary to detect sepsis onset for retrospective analysis **[14]** correctly.

Recurrent Neural Networks can also be used in conjunction with random forests to create prediction models for patients with various diagnoses. In such cases, the data must include general characteristics such as admissions, CPT Events, ICU Stays Patients, Procedures ICD, Diagnoses ICD9. The resulting predictive model performs with an accuracy of approximately 80% for long and short stays. However, removing ICU length of stay from the inputs and predicting it for both ICU and hospital in combination with categorized disease conditions would be more beneficial in real life **[15]**. At this point, it is important to note that most prediction models do not fully utilize the information available to locate the parameters that would be useful **[16]**. A resource of valuable information that is often not considered is physicians' clinical text notes **[5]**. With the implementation of deep learning methods (both Recurrent Neural Networks and Convolution Neural Networks) it is possible to achieve high predictive ability in ICD-9 code assignment based on clinical notes **[17]**. With the use of clinical text, it is also possible to predict Medical Codes (ICD) during a patient's stay in ICU. CNN can aggregate information and select the most relevant parts for each possible code **[18]**. Both authors indicate that better manipulation of non-standard writing and a better understanding of the relation between symptoms and diagnosis could improve deep learning models or even the ability to predict diagnosis and treatment codes of patients' future admissions.

C. XGBoost

Extreme Gradient Boosting (XGBoost) is a scalable end-to-end tree-boosting system used by data scientists to address various machine learning challenges by using fewer resources to achieve desired results **[19]**. Compared to other methods, XGBoost shows some interesting findings. Zhu Yibing et al. implemented XGBoost to establish prediction scores on mechanically ventilated patients with the classical severity scores and other features available on the first day of admission of ventilated patients. The model outperformed *K*-nearest neighbors (KNN), logistic regression, bagging, decision tree and random forest methods.

In another study, XGBoost combined with the least absolute shrinkage selection operator (LASSO) and a large variety of clinical data resulted in a good prediction or mortality rate in ICU for patients with heart failure which potentially could contribute to clinical decision-making for patients that belong to this specific category **[20].** XGBoost can also be used for specific diagnosis mortality prediction. It performs better than logistic regression and SAPS II in predicting sepsis-3 mortality for a period of 30 days. As in the previous case, the author claims that more accurate prediction models may be clinically helpful and assist clinicians in tailoring made and precision treatment for patients with sepsis-3 **[21]**.

D. Random forests

Random Forest is an efficient technique that can operate in a fast way over large datasets **[22]**. As presented in chapter B, it has been used in many real-world applications in various fields, including healthcare in combination with the RNN model. However, random forests can be combined with other methods and stand-alone.

Comparisons made with the same predictor variable among the random forest, ANN, support vector machine (SVM) model and customized SAPS II model in predicting in-hospital mortality for ICU patients with Acute Kidney Injuries (AKI) indicate that there is great potential for

implementation of RF model thus allowing rapid clinical intervention **[18]**.

Random forest method can also be useful in detecting patients eligible for discharge by utilizing routinely collected vital signs and lab results of the last 4 hours that meet specific criteria. The prerequisite for this success is to base discharge decisions on historical data of patients that were ready and not ready for discharge. Using this method, machine learning classifiers outperformed the nurse-led discharge (NLD) criteria **[23]**.

E. Auto Triage and InSight

InSight is a machine learning algorithm that detects and predicts sepsis, severe sepsis and septic shock. The algorithm uses fundamental patient data (basic vital signs, peripheral capillary oxygen saturation, Glasgow Coma Score, and age) that can be retrieved from EHR, making it a method that can be integrated into almost every system.

According to several researches, InSight performs well even when there are randomly missing data **[24]**. More than that, InSight outperforms existing sepsis scoring systems in identifying and predicting sepsis-only vital signs data when applied not only to one but to various EHR datasets **[25]**. These results are also confirmed by studies that use data different than MIMIC III, demonstrating a sensitivity of 0.90 (95% CI: 0.89–0.91) and a specificity of 0.81 (95% CI: 0.80–0.82), outperforming existing biomarker detection methods **[26].**

The collection of widely available clinical variables has also been proven useful in other prediction types. An algorithm called AutoTriage uses eight common variables retrieved from EHR to result in patient mortality scores. With the use of 8 common clinical variables (heart rate, pH, pulse pressure, respiration rate, blood oxygen saturation, systolic blood pressure, temperature, and white blood cell count), AutoTriage creates subscores for each one of them alone and in combinations which finally results in a final score **[3].** Apart from this, AutoTriage can also be used for specific condition mortality prediction model. In similar research for patients with alcohol disorder, AutoTriage generates accurate predictions through multi-dimensional analysis outperforming existing systems (MEWS, SOFA, SAPS II) with an Area Under Receiver Operating Characteristic (AUROC) value of 0.934 for 12-h mortality prediction **[27]**. In both cases, AutoTriage improves the accuracy of mortality prediction in the ICU compared to other severity scoring systems in use.

IV. DATA SELECTION

A major issue in implementing prediction models in the health sector and especially in ICU is data selection. Despite the richness of data, concrete knowledge about data that should be used and for what purpose is still missing. The majority of the prediction models are not fully utilizing the information available to locate the parameters that would be usable. In general, researchers try to indicate useful data for their outcomes. As expected, the depth of data selection varies depending on the method used. A significant advantage of InSight and AutoTriage algorithms is using a few common clinical variables such as demographics, heart rate, pH, pulse pressure, and respiration rate that can be easily obtained from EHR **[3] [24][28]**.

On the contrary, in cases that RNN or Boosting Trees are used, more detailed data are required. The selection of data in these cases is dependent on the disease outcome. For example, in prediction models for mechanically ventilated patients, besides demographics and many vital signs, comorbidities and a large set of laboratory variables are needed **[29]**. A similar approach is also used for predicting mortality for patients with acute kidney injury (AKI) in ICU with the help of random forest. For this case, twelve physiological variables, age, type of admission and three underlying disease variables are retrieved from patient data **[9]**. In cases of hospital length of stay prediction, a combination of various diagnoses based on selected general characteristics data from admissions, CPT Events, ICU Stays, Services, Patients Procedures and Diagnoses ICD data are needed **[15]**. However, the time of the data creation may vary. Among other data such as length of stay and demographics **[21]**, data created in the first 24 hours of a patient's admission to the hospital are of extreme usage.

In cases where text notes (unstructured format) from clinical staff are needed, data that exist mainly on the note events table of the MIMIC III database are mined. This data is useful for ICD-9 code assignment from clinical notes using CNN **[18]** and RNN **[17]**.

Finally, in any case of structural data, it is important to mention that MIMIC III holds data from two systems: that of Philips CareVue and the one of MDSoft MetaVision systems. Each requires a different approach **[30]**.

Table 1: Categorization of final purpose and data types per prediction method

Method Used	Purpose	Data used
Convolution Neural Network	ICD assignment based on clinical test, ICD prediction during ICU stay	medical notes, discharge summaries, laboratory tests, vital signs and medications
Recurrent Neural Network	hospital readmission, change of patient's health status, mortality risk, sepsis prediction	Demographics, medical notes, laboratory tests, vital signs and medications, ICD procedures, ICD diagnoses, discharge summaries
Random Forest	mortality for Acute Kidney Injuries (AKI) patients, discharge eligibility	physiological variables, age, type of admission, underlying disease variables, routinely collected vital signs and laboratory results
AutoTriage	patient mortality scores, specific condition mortality prediction	Common clinical variables such as demographics, heart rate, pH, pulse pressure, respiration rate
XGBoost	prediction scores on mechanically ventilated patients, prediction or mortality rate for patients with heart failure and sepsis, specific diagnosis outcome prediction	Demographic data, length of stay in clinic, vital signs, laboratory results, accompanied diseases
InSight	detection and prediction of sepsis, severe sepsis and septic shock,	Common clinical variables such as demographics, heart rate, pH, pulse pressure, respiration rate

V. Future work

Investigating the related papers, it is apparent that the scientific community claims that a big problem concerning the use of machine learning and deep learning methods in medicine, especially in ICUs, is the lack of reproducibility. This is happening due to a variety of reasons. Alistair et al. highlight the need for improvement in models reported results with detailed technical description of data abstraction to facilitate the comparison among them. An effort towards solving this problem is also the development of an open-source pipeline for transforming the raw electronic health record (EHR) data from MIMIC-III database into data structures that are directly usable in common time-series prediction pipelines. At the same time, they are extensible for future research efforts **[31]**.

Another reported issue is that most of the research is being conducted using data from one dataset (one hospital or ICU), possibly including patients of limited demographics and health history. In addition, in some cases, prescriptions, labs and vitals, various treatments and interventions or notes are excluded from the retrieved data **[31]** many times because of the limited timeframe that the research is conducted **[32].** Moreover, nursing notes may present different characteristics because of variations in clinicians, experience, training and working environment, causing the results to be useful only to units where the research is taking place **[33]**.

These three facts, by default, limit the potential of possible generalization of results to other hospitals or EHR systems **[24]**. As expected, to address these problems tests with data from different hospitals and medical centres **[3]** and further external validations to test the generalization need to be acquired **[29]**. Furthermore, future model development should consider more prospectively collected variables to evaluate the association of different clinical and laboratory characteristics, minimize any possible bias **[7]** and shorten prediction horizons about ICU mortality **[32]**.

It is essential to mention that additional work is also required in methods that cope with free text notes, such as discharge summaries that predict the disease in each patient. Research on which words affect the probability of a prediction could improve the relationship between symptoms and diagnosis and consequently improve deep learning models **[17]**. This way, it would be possible to predict treatments and diagnosis codes for future visits. Also, it would greatly benefit the handling of non-standard writing to improve and document the structure of discharge summaries to be implemented in MIMIC III and IV **[18]**.

Another issue the scientific community faces is that some diseases' diagnosis standards are unclear, with sepsis as the most prominent example **[14]**. Consequently, further research is necessary to determine the correct onset detection for cases like sepsis, as it varies depending on the number of accepted interpolations **[5]**.

Finally, even though the machine and deep learning models seem very promising, further research on their performance is required. But even in that case, studies about clinicians' degree of acceptance of prediction methods must take place to evaluate whether they are prominent to new methodologies **[8]**.

VI. Conclusion

The use of machine learning and deep learning methods for predicting outcomes in ICUs could offer great advantages in how they operate and deliver health care services. However, some limitations do not allow the methods that this review analyzed to be broadly adopted.

Probably the most important of those barriers is the lack of interoperability and reproducibility due to various reasons analyzed in the previous chapter. MIMIC III is a significant step towards reproducibility because its data are freely available and because there are data views, open-source libraries and freely available code that support information extraction from the database. However, as many researchers argue, current prediction models should be

tested in various conditions and data. Especially the missing data is the most common issue in machine learning during the analysis of healthcare data **[34]**. To confront this barrier, researchers tend to impute or remove the observation **[35]**. Therefore, the results of prediction models should be compared not only to the latest MIMIC IV but also to other databases such as National Inpatient Sample (NIS) or specific hospital records. In this way, it is possible to clarify whether a model can be widely adopted or is made for particular conditions that may still be useful in real-world conditions. In any case, the adoption of prediction models and their acceptance by the clinical staff as a prerequisite could improve health care in terms of quality, cost and final result.

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Perception of plagiarism among undergraduate students in Greek Universities

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Abstract:

Purpose *- The aim of the research is to discover, mainly, the opinions and perceptions of undergraduate students in Greek Universities regarding plagiarism.*

Design/methodology/approach *- This research attempts to discover not only the opinions and perceptions but also the proposals of undergraduate students in Greek Universities regarding plagiarism. The research method that was used for the survey is quantitative, with the use of questionnaires. A total of 467 questionnaires were collected by students from all Greek Universities and the majority of the scientific fields.*

This research is an attempt to collect data regarding the students' perceptions of the essence and concept of plagiarism, their opinions about the factors that lead students to plagiarize or to plagiarism and the consequences that the Universities where they study impose. In addition, through the questionnaire, students had the opportunity to express their proposals about the methods they think are appropriate for plagiarism to be prevented effectively.

The main objective of this research is to portray the extent of the problem of plagiarism in Greek Universities. Additionally, it aims to contribute to the problem's solution and create the necessary policies and mixture of methods that will lead to the required education for students to avoid plagiarism.

Findings *– The research revealed various valuable findings. It is worth pointing out that the vast majority of the undergraduate students replied that they knew the term plagiarism (98,3%). On the other hand, below half the student population said they had not been trained in academic writing and, consequently, how to avoid plagiarism.*

Originality/value *- The paper presents Greek Universities' undergraduate students' perceptions of plagiarism. Remarkably, the collected data outcome is from all Greek Universities.*

Index Terms — Plagiarism, Perception of plagiarism, Prevention of plagiarism, Higher education, Universities, Undergraduate students.

I. Introduction

It is a fact that plagiarism has been a severe problem in the academic field for many decades. However, which is the definition of plagiarism? There have been many definitions throughout the years. One of the briefest yet comprehensive definitions is: "Plagiarism is conducted when someone uses someone else's work, without referencing the source, in order to gain something" **[1, p. 20]**. The above definition illustrates the central concept of plagiarism and emphasizes the appropriate reference to the original information source.

Plagiarism can be deliberate or intentional when someone uses someone else's work on purpose. It can also be accidental or unintentional when someone makes a reference mistake or does not know how to make an appropriate reference to a source **[2, p. 58]**. We cannot ignore ghostwriting, which is also a type of plagiarism. Another special form of plagiarism is self-plagiarism. This occurs when someone presents their work more than once as original **[3, p. 162]**, **[4]**, **[5, p. 120]**. Without a doubt, there are many forms of plagiarism. Generally, many believe that whatever the reason, the intention or the nature of plagiarism, in any case, it is severe academic misconduct that, on the one hand, leads, in many cases, to the infringement of intellectual property rights and, on the other hand, violates the moral rules and undermines the academic or the scientific integrity **[6, p. 134]**. It is evident that plagiarism is a form of cheating, and as a result, it offends academic integrity.

Many recur to plagiarism because it is easy to do whatever they want to achieve or due to lack of time, personal problems, pressure, or other difficulties. This usually leads to deliberate plagiarism. However, the most common cause of plagiarism, especially the accidental cases, is ignorance, lack of training, and "academic illiteracy". Unfortunately, not many have been trained to avoid plagiarism, to make references correctly and properly, or how to write a paper according to the academic standards **[7, p. 38]**, **[8]**, **[9, p. 175, 177]**, **[10, p. 127]**, **[11, p. 767]**, **[2, pp. 58 – 59]**.

Many believe that, apart from the lack of training, social changes, mass admissions to the Universities and the plethora of papers available lead sometimes, especially students that cannot meet the requirements of their studies, to plagiarism **[12, p. 107]**.

Technology has also a dual impact on the plagiarism phenomenon. On the one hand, it has a positive impact due to plagiarism detection software. The development of such software made plagiarism detection easier, quicker, and more reliable **[13, p. 10]**. On the other hand, the spreading and expansion of the Internet impact the phenomenon negatively because it makes copying and pasting easier and gives access to a huge amount of information sources online **[14, p. 169]**. In addition, the plethora of assignments and

poor time mamagement by students lead to an increased percentage of plagiarism **[15]**.

Plagiarism has been mostly a problem of the scientific and academic community **[10, p. 127]**. In Universities, the number of plagiarism cases has been increasing worldwide, which causes severe damage to their status. According to relevant surveys, the percentage of students plagiarising is very high **[16]**. Remarkably, there is an increase in competition, and consequently, students feel the pressure to succeed in their studies **[17, p. 220]**. Because of this situation, Universities tend to use plagiarism detection software (e.g. Turnitin) and try to educate students to avoid plagiarism and punish cases of deliberate plagiarism **[11, p. 767]**. Needless to say, this is not an easy task.

Greek Universities face a severe problem regarding the spread of plagiarism. Apart from the increasing numbers, each Greek University must decide how to tackle the problem due to the lack of specific legislation regarding plagiarism. In more detail, Greek law deals with plagiarism only regarding copyright infringement. The Greek Universities, through their regulations (e.g., the University of West Attica provides such a regulation), try to prevent and eliminate the problem. They organize seminars where students can be trained to avoid plagiarism. In addition, the professors try to inform their students about plagiarism. Greek Universities use Turnitin, a plagiarism detection software, to detect plagiarism cases. Lastly, the Universities impose punishments, such as grade reduction, failure of the class or even degree revocation. A few years ago, there was a proposition for the Universities to design explicit and strict regulations against plagiarism that would be included in the regulation of studies and would be applied to all Greek Universities.

Apart from the consequences that each University decides, there are legal consequences when plagiarism includes copyright infringement. There are also severe moral consequences for the credibility of a university, student, or scientist when accused of plagiarism. Plagiarism shows a lack of respect for others' work, ethics and moral values. In addition, it also leads to unfair student evaluation and harms the educational process in general **[11, p. 767]**, **[18, p. 197]**.

However, Universities should continually educate and inform students on how to avoid plagiarism, conduct surveys, or write academic assignments according to the rules. Nevertheless, when penalizing plagiarism, each case should be examined separately and thoroughly so that the proper punishment would be imposed **[19, p. 369]**.

II. The Research

The main goal of this research is to discover the opinions and perceptions of undergraduate students at Greek Universities regarding plagiarism. Furthermore, it was essential to showcase the level of training and knowledge of the students, the causes, and consequences, if and how their universities informed them regarding plagiarism. In addition, the research aimed at recording indicative proposals on behalf of the students. The expected responses will lead both to an in-depth view of the magnitude of the problem and to illustrate ways to prevent and conceivably solve or even reduce the problem of plagiarism.

For this research to be conducted, a quantitative method, with the use of questionnaires, was employed. The research was anonymous, and no personal information of the participants was kept. It was conducted online for almost a month, between 8/2/2021 and 10/3/2021. The questionnaires were created using Google Forms, which allowed not only to create and distribute the questionnaire but also to collect, store and process the data without special knowledge or requirements.

The population that the questionnaires addressed were all undergraduate students in Greek Universities. At this point, it is useful to note that there are 26 public Universities in Greece for the time being. The questionnaires were distributed via Facebook groups. The questionnaires were posted in closed Facebook groups of students from every scientific field. This particular distribution method was chosen because it was quick, easy and, as it turned out, effective. The sampling method that was used was nonprobability sampling. With this method, it was possible to address and target a random part of the population since the target group was quite large. An introductory note that made clear to whom the questionnaires were aimed was essential to ensure that the research participants were indeed undergraduate students. Out of approximately 20.000 students that were members of the Facebook groups, 467 questionnaires were answered. The turnout is considered satisfactory, even though the a low participation ratio. Hence, the number of questionnaires (about 500) is more than an adequate sample to approach undergraduate students' perceptions in Greece.

The online distribution of the questionnaires allowed the reach of a geographically spread population quickly. The questionnaire was based on previous similar surveys. Specifically, the survey was designed based on research of the European Union regarding plagiarism **[20]**, the research of Kokkinos and Koulouris **[21]**, and lastly, the Doctoral Dissertation of Avramidou **[22]**. The questionnaire consisted of 22 questions, separated into six categories:

- demographics,
- definition and views on plagiarism,
- causes of plagiarism,
- plagiarism and technological developments,
- consequences,
- prevention and suggestions.

The goal was to prepare a short questionnaire, easy to answer, objective and accessible. Therefore, there were only closed-ended questions, with as many answers as possible and the choice of "Other" when it was necessary. Apart from the introductory note that explained the goal and the target group of the research, an email address was also available where the participants could send any questions. The time that was needed in order for someone to answer was approximately 5 minutes.

The participants were mostly women (71,1%) from all years of studies. Slightly larger participation was noted

from senior students. The most impressive finding of the participants' analysis was that there was participation from every Greek University and scientific field. The University of West Attica and Hellenic Open University greatly participated. As far as the scientific fields are concerned, the students of the social sciences gave the most responses.

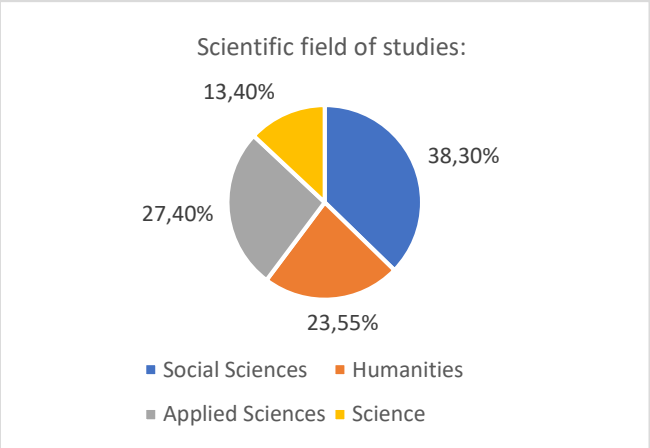
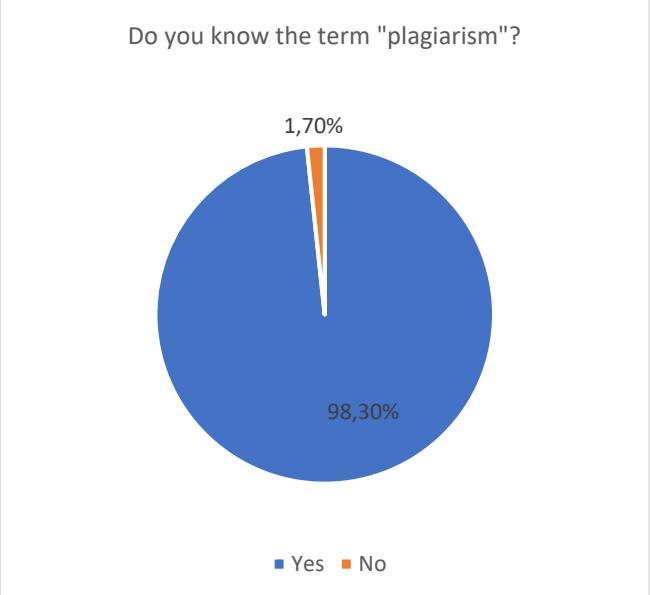


Fig. 1. Scientific field of studies of the participants

The first group of questions -beyond demographics- were about the definition and students' views on plagiarism. Almost all the participants (98.3%) knew the term plagiarism. This is an extremely high percentage, which is very optimistic, but perhaps it is not accurate or true. However, 42,2% of the students said they had not been trained on academic writing or ways to avoid plagiarism.



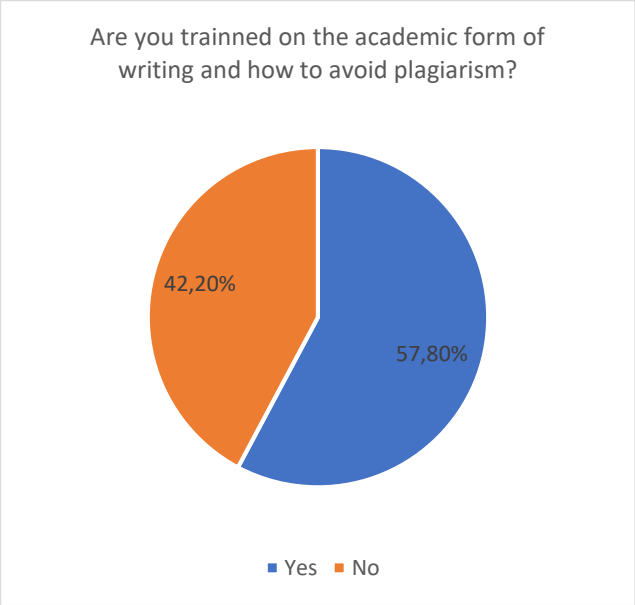


Fig. 2. The two charts show what percentage of the participants know the term "plagiarism" and if they are trained on the subject of academic writing to avoid plagiarism

The next question of the first group (of questions) was about the students' confidence when creating bibliographic references. Most of the participants feel very confident. Concerning the difficulties they face with academic writing, all the possible choices (finding reliable sources, paraphrasing, referencing, understanding bibliographic standards) got many answers. Due to a lack of training and education, the difficulties seem complex and have an essential variety.

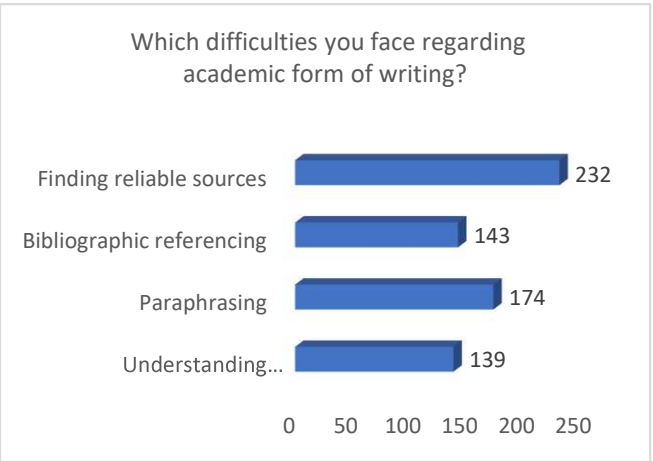


Fig. 3. This diagram shows what difficulties the students face when they are requested to write a scientific paper or when they need to apply the rules of the academic form of writing

The following two questions aimed to deepen the primary reasons for correct referencing and using others' work. Participants think that correct referencing enforces the reliability of their work, and, secondary, they want to avoid plagiarism. Additionally, they use others' work to

strengthen their ideas and arguments and make their work more comprehensive.

In the last question of the first category of the questionnaire, some examples of plagiarism were given to the participants. Some of them were examples of plagiarism, and some were not. The goal of that question was to confirm if the students knew what plagiarism is without using an open-ended question. The answers indicated that students know the plagiarism forms since they chose the correct answers. However, the percentages of the examples of self-plagiarism and ghostwriting had fewer answers than expected.

The next category of the questionnaire was about the causes that lead someone to plagiarism. The group of questions started with a compilation of questions. First, participants were asked if they think they have ever recurred to plagiarism intentionally or unintentionally (Q1). Furthermore, they were asked if they had copied or paraphrased texts without referencing the source (Q2) and if it had come to their notice a case of plagiarism from a fellow student or classmate (Q3). In general, the answers were divided; however, the answer 'I do not know" had been chosen by many, meaning they had doubts, probably due to a lack of training. Although, it is encouraging that intentional plagiarism had a low percentage.

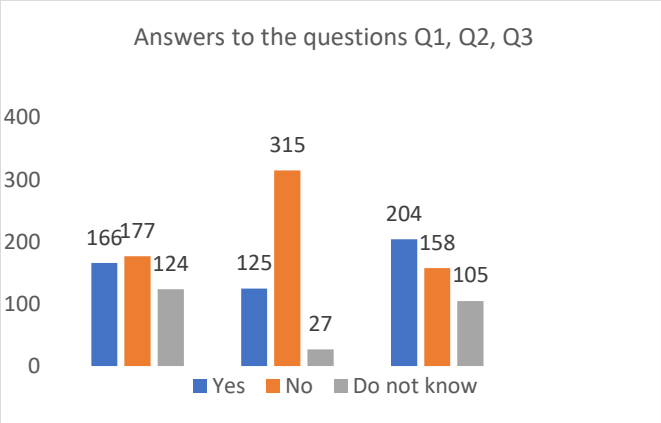


Fig. 4. This diagram is a compilation of questions that aim to illustrate the extent of intentional or unintentional plagiarism among students of Greek Universities

The second question addressed the reasons why someone lapses into plagiarism. The answers were split among all choices, which means that students believe that a combination of causes drives someone to plagiarism. More interesting is the fact that causes that are related to both intentional (lack of time, lack of consequences, easy coping from the Internet, etc.) and unintentional (lack of training, ignorance of paraphrasing, referencing and bibliographic standards, etc.) plagiarism had high percentages. The last question of this category was about the justification of plagiarism. Specifically, participants were asked which excuses are acceptable for someone that commits plagiarism. The majority chose ignorance and lack of intention. However, there were not a few who believed that there was no excuse for plagiarism.

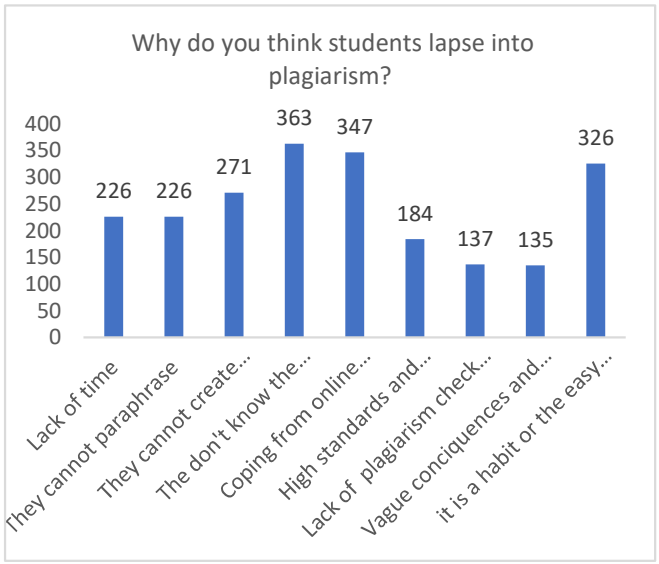


Fig. 5. This chart refers to the reasons why the participants think someone would lapse into plagiarism intentionally or unintentionally

The next section of the questionnaire is about the relationship between plagiarism and technological advances. The section starts with a group of questions that aim to address the level of comprehension of plagiarism via the internet and digital sources. The answers indicated that students understand that using online sources, even with free access, without appropriate referencing is a case of plagiarism, and they can get caught. The last question of this section asked if the students use the plagiarism detection software their University provides. The answers were disappointing, meaning that technology's positive effect remains untapped since plagiarism detection software can be a valuable educational tool.

Regarding the consequences of plagiarism, which was the next section of the questionnaire, students believe that someone who commits plagiarism should be penalized, but they do not know what punishment policy their University enacts.

The next question deepens into the penalties that Greek Universities incurred. Most participants said that getting no grade on the paper is the most common punishment, yet a big percentage does not know the penalties.

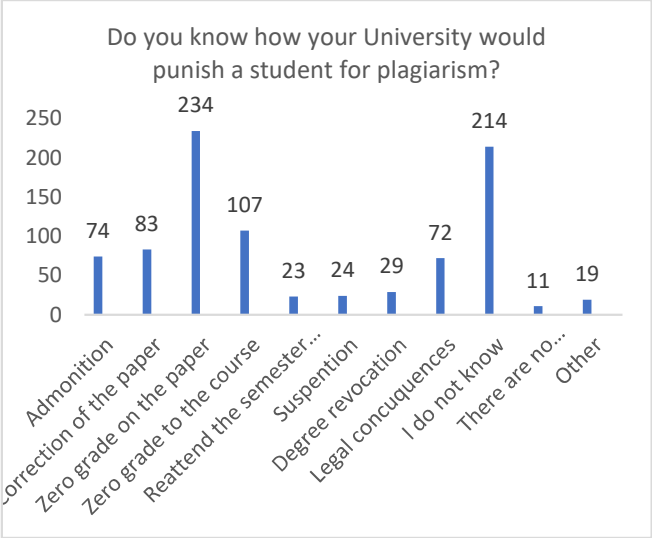


Fig. 6. This chart refers to the punishments that Greek Universities use when a student is caught for plagiarism

The section ends with the moral consequences and consists of a group of questions where participants had to declare whether they agreed with the given statements. From the answers, it was evident that students understood the moral aspect of plagiarism.

The questionnaire concludes with a group of questions regarding preventing plagiarism and students' proposals to deal with the problem. Most participants said that the Universities provide no information material or guidelines.

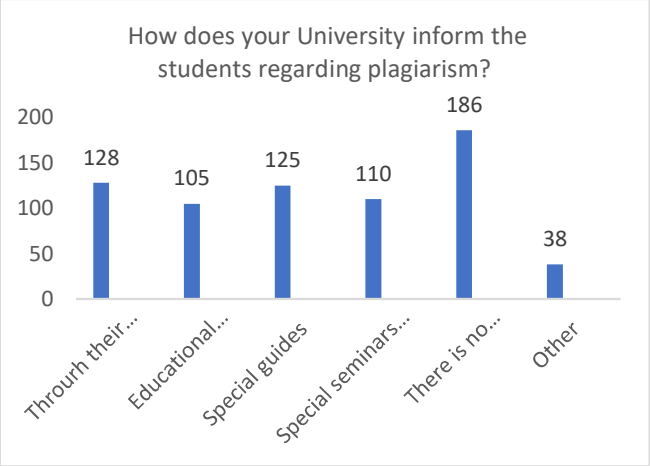


Fig. 7. This chart illustrates the methods the Geek Universities apply to inform and educate students regarding plagiarism

This raises the question of whether there is a lack of material or information. It is very interesting and promising that most participants want to be informed and educated on avoiding plagiarism. Lastly, in the question "What do you propose for the plagiarism cases to be contained?" all choices were selected, which means that various measures and actions are needed to have the best possible results.

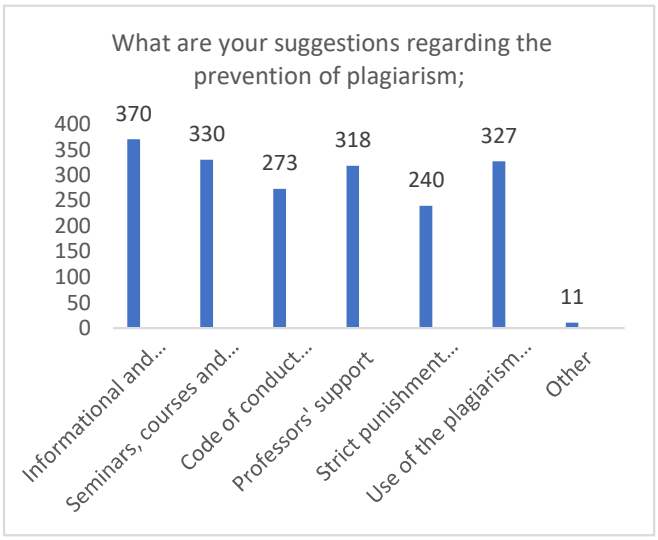


Fig. 8. This chart aims to present the proposals that the students of the Greek Universities made so that the prevention of plagiarism will be improved and more effective

To further examine the results of this research, it was considered useful to combine and compare some of the findings based on the year of study and the scientific field of study. It was noted that almost the same percentage of incoming and senior students are educated on avoiding plagiarism. Furthermore, a considerably higher percentage of seniors (compared to the respective percentage of first-year students) said they have resorted to plagiarism. Regarding the difficulties they face when they must deliver an academic paper, finding qualitative sources and difficulties in paraphrasing are the most important. Lastly, there has been found that the percentage of ignorance regarding the consequences and the information material is more considerable in senior students.

From the comparison based on the scientific field of study, it was found that students of social sciences participated the most and had the highest percentage of training, hence the most awareness and the smaller percentage of plagiarism. On the contrary, students of Natural and Applied sciences participated the least, with the lowest percentage of training and the highest percentage of ignorance regarding the possibility of committing plagiarism. As for the difficulties students of different scientific fields face, paraphrasing, finding reliable sources and understanding bibliographic standards are the most significant.

III. Limitations

It is essential to point out that the survey's results were used for the fulfilment of a Master's Thesis entitled: "University students' perception and proposals regarding plagiarism", which was submitted to the Department of Archival, Library and Information Studies at the University of West Attica. As a result, one major drawback was the lack of time. The duration of the research was one month. However, the responses were sufficient and allowed the export of valuable findings.

Unfortunately, one of the difficulties was that all Greek Universities were closed due to the Covid-19 pandemic. This led to the decision to conduct the research using social networks. Of course, this is a coin with two sides because social networks are ideal for receiving instant responses. Inevitably, the survey was based on the electronic distribution of the questionnaires via the Internet.

IV. Conclusions

In conclusion, the findings of this research show that students at Greek Universities not only know the term but also identify cases of plagiarism, have high levels of confidence when writing an academic paper, and can understand the value of referencing the source. On the other hand, the findings also indicate that the students could not identify self-plagiarism and ghostwriting; they lack training on how to avoid plagiarism and are not sure if they have fallen into the misconduct of plagiarism.

Additionally, it appears that students commit plagiarism mostly unintentionally and the percentage of intentional plagiarism is considerably lower than in past surveys. Regarding the reasons that someone turns to plagiarism, the spread of the Internet, free access to a plethora of sources, easy copy-paste, lack of education, personal reasons and exceptional circumstances have the highest percentages. Moreover, students appear to be uninformed regarding the consequences that their University implies; however, they can understand the moral consequences.

Regarding the acts and material that the Universities use to educate the students, findings show that they use mostly informative guides and educational material on their websites. From brief research on the Universities' websites, it was found that every University provides material to educate students in academic writing and how to avoid plagiarism, although students appeared unaware of that. Lastly, it appears that Universities do not use the educational benefits that plagiarism detection programs can provide since the students do not self-check their papers, except in a few Universities, such as Hellenic Open University or the Aristotle University of Thessaloniki.

Moreover, results show that students are willing to participate in educational programs about plagiarism. In parallel, they stated that a holistic strategy is needed to reduce plagiarism. Actions and measures like the spread of appropriate information and learning material, support from the professors and educators, specific policies and guidelines (e.g., codes of conduct), and preparation and conducting seminars are necessary.

To sum up, on the positive side, the findings indicate that most cases of plagiarism in Greek Universities are unintentional. Additionally, the vast majority of Greek Universities take action to educate and inform their students on academic writing and how to avoid plagiarism. Furthermore, students appear to respect academic and scientific rules and are interested in education concerning plagiarism. However, senior students do not appear more informed than incoming students, so they do not get any more education regarding plagiarism during their studies. Furthermore, even though Universities take action to inform students and have policies on punishing plagiarism, it does not seem that the information and communication policy they use is suitable.

The survey findings lead to the conclusion that the Universities should focus on creating a specific and consistent policy that will include educating the students on academic writing and avoiding plagiarism and the penalties that will impose for plagiarism cases, especially intentional ones. Professors would also play a significant role by educating students, assigning papers that follow the academic rules of writing and encouraging students to use plagiarism detection software. In general, findings indicate that the intentions and actions of the students and the Universities are in the right direction. However, it would be helpful if their planning and communication were more organized.

Finally, it is remarkable that the survey was conducted on undergraduate students. As additional research, It would be interesting to conduct qualitative research on undergraduate students with the method of interviews to explore some findings further. Furthermore, it will be useful to extend the quantitative research not only on postgraduate students but also on faculty and teaching staff.

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Difficulties and Problems in the Implementation Phase of an Open Online Personalized Learning Environment for Vocational Education and Training for the Covid-19 period

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Abstract:

Purpose *- This article was formed in the context of a technical reflection on the difficulties and problems during the implementation phase of an Open Online Personalized Learning Environment for Vocational Education and Training.*

Design / methodology / approach *- The implementation phase took place in the school period 2019 - 2021, and the application development continued in the school period 2020-2021. The main focus of this paper is threefold, namely: a) the evaluation of the deviation in achieving the design objectives, b) the detailed report on the difficulties and problems in the implementation phase, and, finally, c) the possible problems of future uses as the environment operates through the Panhellenic School Network. The online designed environment works with the existing digital infrastructure as a distance learning option. The specific educational material, taken exclusively from the Analytical Curriculum, was designed, and developed based on case studies and best practices so that, after various evaluations, it could be redesigned following the suggestions of students and teachers involved.*

Findings – *The article, recording the difficulties, mediates as an assessment of the result, allows us to observe what has been achieved, and gives us the keys for similar future actions.*

Index Terms — Digital Educational Material, Learning Objects, Online Learning Environments for Technical Specialties, Internet Technologies, Software Technology

I. INTRODUCTION

Sondergeld, Stone, & Kruse **[1]** combine the development in learning with the ability to make decisions considering that the development of each student is linked to a process of gathering useful information for judging alternative decisions. That is, the development of the student acts as a continuous feedback mechanism to improve and perfect his reference system. The process of learning for engineers is essentially reduced to a process of calculating or measuring the quantities that concern them. Such a mechanism could be an Open Online Learning Environment (OOLE) for the electrical engineers of Vocational Education and Training (VET). Open Online Learning Environment appeared in 2008 as an "opening up" movement in education, which was received and implemented mainly by high and higher education institutions **[2]**. At their starting point, they introduced a culture of interconnection, and since 2011 they have gained a widespread expansion through users and supporting Institutions. The subject areas covered by Open Online Learning Environment are mainly related to educational research, but interest has also turned to other fields such as Computer Science, Business Economics, Information Science, Psychology, Engineering, etc. It, therefore, becomes understandable that these OOLE, as massive online open courses, expand to various scientific and research fields **[3]**. This breadth of reference has contributed to the fact that OOLE in the 21st century has already acquired a tradition of Internet Technology (IT) and digital technology structures, which are related to learning and significantly impact students' education. As OOLE has grown exponentially in recent years, they have been internationally at the center of educational and research interest **[4]**. Education visionaries, educational reformers, web environment designers, and web researchers throughout the meta-web 2.0 eras have cataloged the potential of online educational environments and sought to improve those **[5]**. The goals of the improvements relate to both student participation and learning analytics (Learning Analytics), and outcomes related to the expansion of teaching data (Teaching Analytics). However, creating an effective open online learning environment remains an important and complex issue as;

the simplification of user processes is inversely proportional to the complexity of programming such an environment **[6]**. The simpler the user participation processes, the more complex the programming components **[7]**. The consequences concern the even greater mixing of learning environments with the use of online resources, the integration of newer technologies and web tools, and the integration of "face-to-face" communication **[8]**.

With the passage of the 21st century in international scientific conferences, among educators, researchers, and developers-designers of IT, a trend was established worldwide, which concerned the support of personalized learning environments. This trend prominently involved student users as evaluators and advocates of online learning development **[9]**. Technological advances and the widespread development of internet applications have accelerated this trend, and web-based learning has become a primary focus of attention in the field of education **[10]**. The design of a learning environment that operates on the web can be addressed at different levels of education, from kindergarten to middle school, high school to tertiary education, and in different learning areas. Moreover, in recent years, a large proportion of national educational resources has been consumed in expenditures related to the introduction of supportive learning environments in secondary education, particularly software related to VET engineering education **[11]**. Scholars and researchers have recognized the potential of digital environments to improve student engagement in learning and learning outcomes. However, creating an effective learning environment remains a significantly challenging design issue. This happens as the technological evolution of web tools is inversely proportional to the conscious design decisions and mastered simplicity that the student user seeks. To be something simple and maximally compatible with the user, a special design effort must be invested in the modeling so that the asynchronous learning environment becomes effective **[12]**.

In terms of learning expectations, this article focuses on implementing a VET curriculum and, more specifically, on Electrical Engineering. The specific educational material, taken exclusively from the Analytical Study Program (APS), was designed and developed based on similar typical examples, case studies of learning environments and applications of the Sectors and Specialties of Vocational High Schools (EPAL), and best practices so that, after from various evaluations to be redesigned following the suggestions of the students and teachers involved. The learning contexts and boundaries of the specific web environment **[13]** have been defined by the VET curriculum framework for the Sector (Sector of Electrical, Electronic, and Automation Engineering, 2018). The learning content of the application is related to the course on Electrotechnology **[14]**. The thematic content of the article and the type of research and analysis focuses on the context of a technical reflection on the difficulties and problems that appeared in the design, development, and first implementation phases. The implementation phase took place during the 2019 – 2021 school term, and application development continued during the 2020-2021 school term. The orientation of the research took into account the following scientific fields:

- Internet technologies,
- Human-computer interaction,
- Software Technologies,
- Online Learning Environments supported by modern technologies,
- Learning and Teaching during the pandemic.

This research is based on the metadata captured from the application results and is included in the papers that deal with practical reports on the construction of online educational environments during the pandemic. The main focus of this paper is threefold, namely: a) the evaluation of the deviation in achieving the design goals, b) the detailed report on the difficulties and problems in the implementation phase, and finally, c) the possible problems of future use as the environment operates through the Panhellenic School Network (PSN). The article, recording the difficulties, mediates as an assessment of the final result, allows us to monitor what has been achieved, and gives us the keys for similar future actions. The article's structure is divided into four parts in addition to the introduction. The parts are

a) The methodological assessment of the implementation,

b) The difficulties and problems in the implementation phase,

c) The potential problems of future uses, and finally,

d) The conclusions.

II. Methodological assessment of the implementation

The evaluation methodology of this web application (http://kotsifakos.mysch.gr/elenap/#/) follows the recognized standards of educational software evaluations **[15]**. Our application environment specifically and effectively leverages multimedia to consolidate learning and enhance teaching **[16]** of Electrical Engineering by placing it in authentic and meaningful contexts. The interfaces with the proposed videos are designed according to the principles of educational software, mostly used in classroom environments with adolescents **[17]**. Oriented instruction in a web-based personalized environment approaches and represents a pedagogical effort that hopes to help students actively and consciously engage in authentic learning by placing directions and orientation instructions for realistic problem-solving in their learning domain **[18]**.

The application interface (Figure 1) presents categories of technical problems for the calculation of real applicable quantities (e.g., voltage or resistance calculation). In addition to developing general digital literacy skills, the application helps students acquire attitudes and behaviors that contribute effectively to solving real-world problems and consolidate specific electrical engineering concepts and principles. The added educational value of the application

lies in the fact that it leaves a deep impact on the student's educational horizon which contributes to thinking effectively, consciously, and decisively about the calculation of simple or more complex quantities (e.g., Kirchhoff's Laws) **[19]**. The application tangibly demonstrates effective design principles for developing technical knowledge and exemplifies the Technological Engineers in Action with Web Educational Software Action Research.

Fig. 1. The web interface of the application – Login

For the organization of this online application, we took into account the learning behavior patterns of VET students both in terms of the learning subject of Electrical Engineering **[20]** and in the orientation of solving problems related to this field **[21]**. Because of this effort, the need arose for the continuous improvement of the learning standards of technical education and the search for authentic learning and knowledge of the subject **[22]**. It is a given that due to the vertical development of Technology, Information and Communication Technology (ICT) in our days, education cannot remain unaffected. Nevertheless, scientific interest is focused on how modelling, design, and implementation adapt to learning environments and the outcomes that ultimately emerge. Often exceeding the expectations of researchers, the results not only approach the interest of the students to participate, but they perform to a greater extent than expected.

The methodology of this paper is embedded in the research strategy for the educational use of open online resources **[23]**, utilizes the tools of technology, and seeks effective learning of the curriculum of the Vocational High School (VHS) through the use of a personalized online learning environment. The interest in this research lies in the approach to knowledge about the learning subject of Electrical Engineering. Regardless of the familiarity of today's generation of students with the use of the computer, the treatment of ICT and the Internet as learning tools for extracting and disseminating knowledge should not be taken for granted. One needs to become an 'expert' in a learning environment and be oriented to be able to benefit from learning from it **[24]**. In the middle of the Learning Process (LP) is the technique of 'fenced' use of online material to enrich learning for a critical technical learning subject of the Electrical Engineering Specialty.

The presentation of the design philosophy focused on the pedagogical standards and learning models of VET as applied to the Electrical Specialties. The orientation to the Electrical Engineering course was chosen due to the criticality of its material as a learning subject for the development of Electrical Engineering in the Specialty. From the point of view of the educational use of online construction, we believe that teachers should know, on the one hand, the methods of building OOLE and, on the other hand, the difficulties and problems they will face if they try to enrich their teaching practices in similar ways and to seek the utilization of a broader "meta-web 2.0" orientation for the teaching of their subject. The environment we have designed and proposed works with existing digital infrastructures as another distance education option. This educational material, the introductory module of Electrotechnics, was designed and developed during the pilot implementation based on case studies and best practices so that after several evaluations, it could be redesigned following the students' and teachers' suggestions.

III. Difficulties and Problems in the Implementation Phase

Difficulties and problems in the implementation phase of the ongoing development of the Internet technologies and the vast range of applications in the technological field, finding reliable tools, linking them, but also the ongoing intensive study to optimize design are mandatory and are part of research and time to be devoted by the teacher, the developer or the team to implement their plans. This is to be seen as a front, as this is how we have functioned during the implementation phase. In this transition period, we have dealt with four problem areas with relative success.

- The first area concerned the responsiveness of the application to the browser. In particular, the different choices of browsers had different responses for various presentation characteristics (in colors, features, etc.).
- The second problem concerned the connection and management of the Database (DB), (Firebase).
- The third problem area was the limitation in usage time. Ensuring the extension of its usage time was considered a severe issue as the timeless operation of the application was the goal.
- The fourth problem area involved developing code in JavaScript **[25]**. The mastery of language manipulation based on adaptation to the application's needs has been and remains a severe field of research and development to this day **[26]**.

More generally, the difficulties that are analyzed and related to the implementation rate are part of the general context of web application development programming, which has been established over the last decade **[27]** and is constantly expanding. It was considered necessary for the validity of the research, the detailed presentation of the difficulty degree, and the different responses to each

problem involved.

IV. The Issue of Browser Selection (Browser)

Each browser has different features. This lies in the different specifications provided by their manufacturers. These differences are observed in terms of performance, color, and properties. For example, (Figure 2), we note that when our application runs on the Microsoft Edge browser, during the user-student data entry phase, an "X" appears in the fields at the end of the box. This signalling enables the data entry cleanup. Also, in the Chrome browser, we notice that the active field is colored blue compared to Microsoft Edge.

Fig. 2. Differences between Microsoft Edge (top) and Chrome (bottom)

Another difference when filling in the field concerns the user's password (Figure 3). The Microsoft Edge browser displays a unique character ("peephole") at the end of the box, allowing the user to see the digits he has typed, while Chrome does not display it in the corresponding input. Finally, Microsoft Edge, above the user's digits, does not display the field title, while these are displayed in Chrome.

Fig. 3. Differences between Microsoft Edge and Chrome

V. Connection to the Database (Firebase)

The use of advanced technologies to implement the application was a research option aimed at developing a modern personalized learning environment. One of the options that were enhanced was the Database (DB) option. The DB does not reside locally on our computer but in a single web-based centralized cloud space. In other words, instead of storing users and their data on a hard disk, USB, or laptop/PC, we store them on a server where access is only possible via the Internet. The advantages of using the cloud are:

1. more capacity on the local computer,
2. ease of data management,
3. security from the company offering the service,
4. cost minimization.

For this application, we followed the guide of the official Google page (https://firebase.google.com/docs/web/setup), according to which you must:

5. Have a Gmail account,
6. Create an environment on the link provided,
7. Connect your base with the application.

VI. Extending the Usage Time of the Database (Firebase)

The creation of a database (DB) is a crucial point for the development of a website. The database contains a series of tables that have as their primary purpose the recording of the website's content, data, and information relevant to its operation. In the DB, data is stored and extracted to be displayed as information on the website. We chose Google's Firebase as the DB for the application's website. The initial period of operation granted by Google to users is one month from the creation of the environment. After this period, the base stops working and requires the user to log in to their account on the website to refresh it (Figure 4).

```
rules_version = '2';
service cloud.firestore {
  match /databases/{database}/documents {
    match /{document=**} {
      allow read, write: if request.time < timestamp.date(2020, 8, 16);
    }
  }
}
```

Fig. 4. Database Operating Rule

VII. The JavaScript Code Development

To complete a fully functional environment, we developed JavaScript code **[28]**. The first construction approach involved simple knowledge of "Internet Technologies", but to develop the application requirements, we needed to expand on the knowledge level (self-education, personal engagement, searching for solutions from authoritative sources, watching educational videos on the web). The first steps of implementation may seem simple, but the expansion to a larger scale was completely different quantitatively and qualitatively. We believe that working with the JavaScript language is a personal achievement for anyone involved in Internet Technologies and Web Programming **[29]**. Engagement with JavaScript is used over time and will expand the professionalism of the analyst or developer.

VIII. Potential Problems in Future Uses

The possible future problems of the application are categorized according to the choice of the web server. As the Panhellenic School Network (PSN) is constantly upgrading its digital infrastructure, there is the case that for long periods the website will remain inactive or even need to be "loaded" again. There is a constantly updatable "backup" for the application. To solve this particular problem, to keep the websites acting as if the network has "fallen", long-term expanded research is required. Another problem that may appear as a consequence of the previous ones, concerns the connection of the DB to the web server of the PSN. The result

of the response loss makes the application non-functional since, in this case, it is not associated with the tables of the DB. In this case, the administrator must do the setting and the connection to the DB again.

IX. Conclusions

This article could also be included in the context of the upgrading of the digital infrastructure of Professional Training Education if such a thing is submitted as an overall perspective for the specific level, but, at this stage, it is included in the continuous modernization of the teaching methodology for its engineers under training meta-web 2.0 era. This interest is related, on the one hand, to the continuous exploration of the possibility of using digital mechanisms in course teaching, and on the other hand, to the urgent conditions of continuing teaching during the period of pandemic and blockades. The article reflects on this particular construct and seeks to formulate and provoke positive attitudes toward research on online learning environments. In this development, we first presented the overall framework that contributed to designing an online learning environment supported by advanced web-based technologies. The additional scientific interest in this paper lies in the analytical design on the effect of the students' psychology and their tense learning orientation. Through the final web application, we aim for students to become independent, not to focus on "mechanical" learning or achieving degrees, but on understanding and enriching their knowledge through other sources.

On the other hand, the special conditions that prevailed in education due to the pandemic should be considered for the implementation and completion of our work. Particular attention should be paid to the fact that the physical distance during the pandemic period, ultimately, negatively affected the improvement of the possibilities of our construction and the feedback that we had foreseen. This observation is part of an experiential conclusion, which was recorded during the period of use of the application and related to the overall expectations of online environments during the pandemic. Without being considered an "excuse", we should accept that the general use of online environments during the pandemic registered a type of disappointment and failure to meet expectations. The expectations of replacing experiential teaching, as done in school classrooms before the pandemic, could not be transferred to online environments, no matter how well-designed they were and how well they fulfilled their specifications. It would be unfair if we took this latent and entirely legitimate tendency from teachers and students as an evaluative measure of the online tools used in the exclusion phases. The boundaries and contexts of Distance Education, whether through synchronous or asynchronous environments, have their interactivity and boundaries and produce the outcomes associated with these boundaries. The intended distance interactivity of the laboratory courses, the loss of collaborative group practice of the Professional Training workshops **[30]**, and the different types of participation in the online classes cannot be measures of comparison for the tools that were used during the exclusion phase. In this sense, and as the contemporary - asynchronous tools of Distance Education are not sufficient to fully heal the reductions to the experiences of the physical classroom, they have suffered functional obsolescence from the educational community, conscious or unconscious sometimes, and registered a devaluation and at their level, commensurate with the damages and losses of all digital learning environments. The present analysis marks a different value-added approach to online learning environments in Professional Training Education.

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Investigation on the awareness of Greek Citizens regarding the Electronic Health Records

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Abstract:

Purpose *- This paper aims to examine Greek citizens' awareness regarding the necessity of transitioning from the traditional medical record to the Electronic Health Record. The present study attempts to investigate the degree to which the citizens of Greece know the use and the value of the Electronic Health Record and to study their opinion that the EHR can ensure data security and increase their knowledge regarding their health.*

Design/methodology/approach - The research methodology was based on bibliographic and qualitative tools to achieve the above purpose. As a research tool was chosen a questionnaire with closed-ended questions. The sample consisted of 100 Greek citizens who were selected through a random sampling method. For the data analysis, the statistic software SPSS (Statistical Package for Social Sciences) version 23 was used.

Restrictions *- The study is subject to certain restrictions, in particular, due to the way the questionnaire is distributed via e-mail, which means that it is aimed at citizens who have access to the internet and the use of e-mail. Another limitation is that the sample comes from the region of Attica and not from all regions of Greece, a fact that may have affected the results of the research, as the citizens of the decentralised areas may be less informed about the Electronic Health Record. In addition, another limitation is the inability of health professionals to collect data, which does not allow clear conclusions to be drawn regarding the use of EHR and the benefits of using it to upgrade health services.*

Findings *- Women agree more than men that the Electronic Health Record will contribute to saving time, cost, and error reduction in the medical system (p-value=0,008) and that the Electronic Health Record guarantee a better, more reliable and faster organisation of health care. (p-value=0,005). An interesting finding is that the younger participants with higher education levels had a more positive opinion about the advantages arising from the implementation of the Electronic Health*

Index Terms *— Medical Record, Electronic Health Records, Records Management*

I. Introduction

The Medical Record refers to the total amount of information relating to the patient's medical history. It is the cornerstone for diagnosis and treatment, also used for epidemiological studies. It provides information on administrative, financial, and statistical issues while being a quality control criterion. Patient data management has evolved in modern times, attributed to the advancement and widespread use of computers and new technologies.

The term "Medical Record" refers to the file in which documents related to medical information are recorded and relate to the complete picture of a person's illness. The data from the Medical Record can be used to inform the treating physician about the disease's diagnosis, treatment, and outcome or to be used for statistical and research purposes **[1]**. There is no universally accepted framework regarding the type of information and its detailed analysis that a Medical Record should contain. It is, of course, known that the Medical Record is the instrument of communication of the patient with the specialised personnel involved in managing his disease. At the same time, it contains vital data necessary for the planning of the patient's medical plan, without the required direct communication of the scientific team with the patient himself **[2].** The Medical Record is used as a memory bank, referred to by the health professional

who needs a complete picture of the patient's course during hospitalisation. It is often "commonplace" for the scientific team, each member of which completes, depending on its capacity, instructions for dealing with the medical problem **[1]**. The information provided by the medical record can also be used for administrative decisions and, in general, for formulating health policy and prioritising health system needs **[3]**.

The improved evolution of the Medical Record was recording one or more health issues for each patient. The SOAP model was used for the registration, the name of which is the acronym of the words:

- Subjective
- Objective
- Assessment
- Plan

The structure of SOAP includes the existing medical problem and the corresponding plan for treating and restoring health. The problem-oriented model was widely accepted, but in practice, it turned out that the requirements for its implementation were too great, especially in matters of discipline for the observance of this method, as data related to more than one problem needed to be recorded many times **[4]**.

The traditional Medical Record was preserved for many decades, contributing to the storage of medical information in many health systems; however, its use was unprofitable, as the cost of maintenance and upkeep is high **[3]**.

The progress of computer science and telecommunications marked the revolution in medical data recording and enabled electronic recording and high-speed communication to exchange medical information **[5]**.

A. Medical data

The most fundamental medical data which can be recorded in the medical file are patients' symptoms, vital signs, laboratory test results, biomedical signals recorded during routine testing, imaging test methods presented in the form of images and videos, as well as data from the patient's lifestyle (smoking, sedentary lifestyle), heredity or by any factor that can be considered aggravating for the occurrence of the disease **[5]**.

B. Coding of medical data

Codifying medical data is how information and health data are organised into categories with specific codes. The purpose is to shorten, store and retrieve data with a single system. A codification system presupposes that the terminology that refers to a disease and its synonyms will be imprinted with a single code **[6]**.

Thus, the systems of classification and codification of medical information were invented. The most well-known international coding and classification systems that are widely used for medical data are HL7, ICD-10, ICD-9-CM, MeSh, SNOMED, UMLS and ATC **[6]**.

C. Keeping a medical record in healthcare organisations

The basic ways of keeping medical records or medical records of patients in health care organisations are either in printed or electronic form. Their primary function in any form, either hardcopy or electronic, is to accumulate data collected during the patient's course, which is a "memory" for future use **[7]**. In addition, the health record contributes to the coordination of activities between different parts of the health organisation, even between health units located in different geographical locations **[7]**.

D. Printed patient medical file

In healthcare, the printed file system has been widely used to preserve patients' medical information **[8]**. Although it has helped the health care system from antiquity to the present day, Coeira **[9]**, argues that printed records have many disadvantages, making them unsuitable method of recording health data. Thus, many professionals believe the printed system cannot cope with modern challenges. More specifically, it presents the following weaknesses:

- Difficulty accessing and exchanging patients' medical history
- The improper organisation of patient records
- Prescribing errors
- Unable to back up information
- Violation of sensitive data **[10, 11]**.

E. Electronic Health Record - Electronic Patient Record (EPR)

The internationally recognised definition of electronic health records was given by the International Organization for Standardization (ISO). ISO (2005) defined the Electronic Health Record (EHR) as a "*repository of information about a caregiver's health care, in the computer-editable format*". According to Coiera **[9]**, EHRs should be perceived as consisting of retrospective, concurrent and prospective information with the primary objective of supporting the continuous, effective, and quality-integrated healthcare provision. Luo (2006) also argues that EHRs include integrated management of data required for patient care, while Bernstein et al. **[12]** agreed that EHRs play a more diverse role in healthcare delivery than just being an electronic medical record system.

In a qualitative study by Hammack-Aviran et al. (2020), in a sample of four American states with wide differences in demographic and socioeconomic characteristics, it was found that the potential benefits of research use of EHR data outweigh the risk of a confidentiality breach. These benefits include improving the participant's health, family, and society **[13]**.

Devkota & Devkota (2014) argue that implementing the EHR helps reduce morbidity and mortality rates, improve efficacy, reduce adverse drug interactions, and reduce healthcare costs **[14]**. A literature review by Ben-Zion et al. (2014) found that the critical success factors for EHR adoption are the external environment, the organisation's strategy, business objectives and infrastructure **[15]**. In their study, Hägglund & Scandurra (2017) found that many of the EHR applications, although developed for patients, were designed from the perspective of healthcare providers without considering patient involvement in their design **[16]**.

F. Healthcare and Technology

Healthcare, which in some cases can be said to touch the industry, is considered one of the largest sectors worldwide. Hospitals continue to spend many resources on processing medical data and administrative records **[16]**.

As all activities are based on data interconnection, so does healthcare. On the other hand, these changes require high infrastructure costs and additional training requirements **[17]**. Therefore, changes in healthcare are slower. The evolution of e-health applications and their ability to improve healthcare practices has positively impacted health **[18]**.

Health-related IT promises many benefits and is already paving the way for personalised diagnosis. This technology also allows for real-time patient monitoring, fitness and wellness monitoring, drug distribution and data collection for healthcare research **[17]**.

II. METHODS

A. Purpose and objectives of the research

The purpose of the survey is to determine the extent to which Greek citizens are aware of the electronic health record. Within the framework of this research's central goal, the work's objectives include capturing citizens' opinions on whether they believe the electronic health record ensures data security and whether it is helpful regarding health information.

B. Research questions

The research questions are as follows:

- To what extent are Greek citizens aware of the electronic health record?
- What is the public perception of the security of electronic health record data?
- How useful do they consider the electronic health record?
- How do their perceptions differ concerning the gender, age, occupation, and education of the participants?

C. The research tools

In the present research, the creation of a closed-ended questionnaire with dichotomous questions and graded questions was chosen to obtain the views of a representative sample of the Greek population with clear and specific answers to achieve neutrality and objectivity. Simple random sampling was applied for sample selection.

D. Conducting the research

The survey was conducted during April - May 2021 through an electronic questionnaire on a sample of 100 citizens aged 18 - 65+ years, with an electronic questionnaire of the google form platform, which was sent via e-mail. The questions are 33 and arose from the study of Greek and foreign literature. This tool was based on the questionnaire of Jorge Tavares and Tiago Oliveira (2016) and secondly investigated the factors that lead individuals to adopt the use of Electronic Health Records **[18]**.

The answers to four of the questions are two-dimensional. In contrast, for most questions, the answers are given on a five-point Likert scale (1: Strongly disagree 2: Disagree 3: Neither disagree / Disagree 4: Agree 5: Strongly agree).

E. Data analysis

The statistical data analysis program SPSS (Statistical Package for Social Sciences) version 23 was used for this analysis. Qualitative variables are presented as frequency (N) and percentage (%). Quantitative variables are presented as average value - standard deviation. The chi-square test was used to test two categorical variables, while the Fisher exact test was used where the conditions were not met. The non-parametric Mann-Whitney U test was used to test a quantitative variable and a qualitative one with two categories. In contrast, the Kruskal – Wallis one-way analysis was used to test a quantitative variable and a qualitative one with multiple categories.

III. RESULTS

Regarding gender, participants were 45% male and 55% female. Of the total respondents, 47% were aged 18-30,

followed by those aged 31-45 with 23%, 46-60 with 20%, while only 10% were aged 61 and over. Most of the sample had a high level of education. Only 15% were Lyceum graduates, and 11% IEK graduates. 59% were University Degree graduates, and 15% had a master's degree. Regarding professional activity, the largest percentage of respondents, 33% were students, 28% were private employees, and 5% were civil servants. The self-employed were 5%, the unemployed 10% and the retirees 9% (Table 1).

Table 1. Demographic characteristics of the sample

	Frequency	Rate
GENDER		
Man	45	0,45
Woman	55	0,55
Total	100	1
AGE		
18-30	47	0,47
31-45	23	0,23
46-60	20	0,20
61 plus	10	0,10
Total	100	1,00
EDUCATION LEVEL		
Vocational training institute	11	0,11
High school	15	0,15
University	59	0,59
Master's degree	15	0,15
Total	100	1
PROFESSION		
Student	33	0,33
Private employee	28	0,28
Public servant	15	0,15
Freelance	5	0,05
Retired	9	0,09
Unemployed	10	0,1
Total	100	1

The Pearson Chi-Square test for the question: "Do you know or have you heard about the Electronic Patient File" showed a statistically significant relationship with gender (p-value = 0.001) (Table 2).

Table 2. Bivariate analysis of the question "Do you know or have heard about the Electronic Patient File" by gender

			"Do you know or have you heard about the Electronic Patient File"			
			NO	YES	Total	
	Gender	Man	1	44	45	
		Woman	6	49	55	
	Total		7	93	100	
Chi-Square Tests						
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	10,243[a]	1	0,001	0,002	0,001	
N of Valid Cases	100					

a. 0 cells (0,0%) have an expected count of less than 5. The minimum expected count is 10,80.

b. Computed only for a 2x2 table

c. The standardised statistic is -3,184.

For the question: "Do you know or have you heard about the Electronic Patient File" showed a statistically significant relationship with age (p-value = 0.008) (Table 3). However, no statistically significant relationship was found with respect to the occupation and educational level of the survey participants.

Table 3. Bivariate analysis of the question "Do you know or have heard about the Electronic Patient File" by Age

"Do you know or have you heard about the Electronic Patient File"					
			NO	YES	Total
	AGE	18-45	22	48	70
		46 Plus	2	28	30
		Total	24	76	100
Chi-Square Tests					
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	7,059[a]	1	0,008		
N of Valid Cases	100				

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 7,20.

In addition, the Pearson Chi-Square test showed that the answers to the questions "Do I have a computer and an internet connection and can I access the Electronic Health Record", "Have you been treated before", "Would you give your data in research or pharmacy for studies" and "Which of the hospital staff handled your medical record", are independent of the gender, age, occupation and educational level of the participants (p-value > 0.05).

Table 4. Variable analyses in relation to gender

	Gender	Mean	SD	Mann-Whitney U	p-value
HR will contribute to saving time and costs and to the reduction of errors in the health system	Man	3,36	1,048	868,5	**0,008**
	Woman	3,87	0,982		
EHR serves the best and fastest organisation of health care	Man	3,69	0,848	863	**0,005**
	Woman	4,15	0,65		

Women agree more than men that the Electronic Health Record will help save time, costs and reduce errors in the health system (p-value = 0.008), and that the Electronic Health Record serves the better and faster health care organisation. (p-value = 0.005) (Table 4).

Table 5. Variable analyses in relation to age

	Age	N	Mean	Sd	Mann-Whitney u	P-value
EHR will contribute to saving time and costs and to the reduction of errors in the health system	18-45	70	3,84	0,942	674	**0,003**
	46 plus	30	3,17	1,117		
EHR will contribute to my faster service and reduction of my waiting time in the health system	18-45	70	4	0,901	501	**0**
	46 plus	30	2,93	1,112		
EHR will serve in future visits to hospitals and doctors	18-45	70	4,21	0,778	798	**0,038**
	46 plus	30	3,93	0,64		
	18-45	70	4,59	0,648	822	**0,028**

EHR is useful because it gathers your entire health history	46 plus	30	4,87	0,346	

Table 6. Variable analyses in relation to the level of education

	Education level	N	Mean	Std. Deviation	Mann-Whitney	p-value
I have the know-how to use the PC to use the EHR	Secondary	26	3,69	1,158	671,5	**0,013**
	Higher	74	4,27	1,024		

Participants aged 18-45 are more likely to agree that the Electronic Health Record will save time, costs and reduce errors in the health system (p-value = 0.003), will contribute to my faster service and reduce the waiting time in the health system (p-value <0.001) and will serve in future visits to hospitals and doctors (p-value = 0.038), in relation to the participants who were 46 years old and over. In contrast, participants aged 46 and over agreed more that the Electronic Health Record was useful because it compiled the entire health history (p-value = 0.028), compared to participants aged 18-45 (Table 5).

Participants who had a higher education level, agreed more that they have the know-how to use the PC to use the Electronic Health Record, compared to participants who had a secondary education level (p-value = 0.013) (Table 6).

Table 7. Variable analyses in relation to the profession

	PROFESSION	N	Mean	SD	Kruskal-Wallis H	p-value
I have the know-how to use the PC to use the EHR	Student	33	4,03	1,159	13,325	**0,004**
	Employee	48	4,42	0,964		
	Retired	9	3,33	0,707		
	Unemployed	10	3,7	1,252		
I believe that EHR usage will be easier for the citizens	Student	33	3,7	0,728	8,276	**0,041**
	Employee	48	3,25	0,812		
	Retired	9	3,22	0,441		
	Unemployed	10	3,3	0,823		
EHR will contribute to saving time, costs and to the reduction of errors in the health system	Student	33	4,09	0,914	12,244	**0,007**
	Employee	48	3,46	1,091		
	Retired	9	3	0,707		
	Unemployed	10	3,6	0,966		
EHR will contribute to my faster service and reduction of my waiting time in the health system	Student	33	4,06	0,966	9,216	**0,027**
	Employee	48	3,65	1,021		
	Retired	9	2,89	1,364		
	Unemployed	10	3,3	1,059		

Employees agree more than the other groups that they have the know-how to use the PC to use the Electronic Health Record (Student M: 4,03 SD: 1,159, Employee M:4,42 SD: 0,964 Retired M: 3,33 SD: 0,707 Unemployed M: 3,7 SD:1,252). The students agree more than the other groups that they believe that the use of the Electronic Health Record will be easy for the citizens (Student M: 3,7 SD: 0,728 Employee M: 3,25 SD: 0,812 Retired M: 3,22 SD: 0,441 Unemployed M: 3,3 SD: 0,823), that the Electronic Health Record will help save time, costs and reduce errors in the health system (Student M: 4,09 SD: 0,914 Employee M: 3,46 SD: 1,091 RetiredM: 3 SD: 0,707 Unemployed M: 3,6 SD: 0,966), as well as that the Electronic Health Record will contribute to the faster service and reduction of the waiting time in the health system (Student M: 4,06 SD: 0,966 Employee M: 3,65 SD: 1,021 Retired M: 2,89 SD: 1,364 Unemployed M: 3,3 SD: 1,059) (Table 7).

IV. Discussion

This survey showed that EHR is a useful service, and most citizens are interested in accessing available information about their health. The findings align with the Andersen & Davidson **[19]** study conducted to analyse the use of e-health services and the individual determinants of access to them. Specifically, demographic characteristics (gender, age) and other factors related to society, such as education, were found to be significant. The present research does not cover other factors like income; thus, no relationship to the use of services can be investigated. In this study, positive attitudes regarding the use of IBS were found to be related to gender, age, level of education and professional background **[20, 21]**.

Older patients are more likely to suffer from chronic diseases, so they find access to their medical records extremely useful **[22]**. Even though users of all age groups have access to the internet, citizens over the age of 45 consider that they can use the service to a lesser extent than the rest of the population due to a lack of know-how. Initially, this can be explained by the fact that those older citizens need to become more familiar with the use of computers; thus, it is less likely to use digital services **[23]**. In addition, these older patients are likely to get sick very often, possibly developing health conditions that may affect their ability to use technology and understand the information in digital format **[23, 24]**. Therefore, those who can use the advantages of the EHR may be the least who can use it **[24]**. Therefore, the providers of the HER need to focus on this group of patients so that more older people can have access to exams like PCT in the future. In the present study, women were the most informed about PCT, which is quite similar to findings in recent large-scale studies related to this topic **[25, 26]**. A recent European study on citizens of seven countries related to e-Health services also proved that women and people with higher education were more likely to use online health services **[27]**.

Technical and privacy issues and issues reported in previous studies **[28, 29]** affect few users and do not appear to be a barrier to the use of services. Another interesting finding from studies in Norway conducted is that there are several clinical, including advanced health knowledge and improved self-preservation, greater patient empowerment and easier communication with healthcare providers **[20]**

V. Suggestions

On the part of the state, there is a need for continuous investment in the security of the network and information systems, implementing appropriate technical and organisational measures to ensure the maximum possible protection of personal data. Given that the study's findings show the citizens need more information about the EHR, the state needs to develop targeted information campaigns for the public. These campaigns should emphasise the benefits that result from the use of Electronic Health Records for the individual but also for the health system. Primary care professionals can make a significant contribution in this direction. Nationwide research is also considered important, focusing on the attitudes and opinions of the doctors who are called to apply the EHR.

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