T.C.

ANTALYA BILIM UNIVERSITY

INSTITUTE OF POSTGRADUATE EDUCATION

ELECTRICAL AND COMPUTER ENGINEERING
THESIS PROGRAM

NEXT-GENERATION LEARNING ENVIRONMENT PLATFORM DESIGN FOR PROFESSIONAL EDUCATION

DISSERTATION

PREPARED BY

MERT EFE SEVİM

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ASST. PROF. DR. ALİ CEM BAŞARIR

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APPROVAL/NOTICE FORM

ANTALYA BILIM UNIVERSITY

GRADUATE EDUCATION INSTITUTE DIRECTORATE

This thesis work of Mert Efe SEVİM named "NEXT-GENERATION LEARNING ENVIRONMENT PLATFORM DESIGN FOR PROFESSIONAL EDUCATION" was accepted by our Thesis Board unanimously as Electrical and Computer Engineering DEPARTMENT/PROGRAM thesis.

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Thesis Submission Date **:**

Thesis Exam Date **:** 02.01.2023

PREFACE

In this study, which we prepared as an electrical and computer master thesis of Antalya Bilim University, we tried to bring a holistic approach to education. In this study, historical examination of education, literature review and examination of modern education systems were made.

I would like to thank my mentor and thesis advisor, Dr. Ali Cem BAŞARIR, who helped me learn by experiencing multidisciplinary work and never left any of my questions unanswered, to R.A. Cansu Altan KOYUNCU, who helped keep my feet on the ground in my work, to my colleagues Sude TURHAN and Buse BÖCEKLİ for their unwavering support in the creation of this study, and my mother Av. Dilek ÖZMEN, who devoted her life to make me a better version of myself.

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Mert Efe SEVİM

ABSTRACT

NEXT-GENERATION LEARNING ENVIRONMENT PLATFORM DESIGNED FOR PROFESSIONAL EDUCATION

The aim of this thesis is, within the scope of the education transformation program of a law enforcement organization that trains with conventional methods; It is to create the main architecture and algorithm of a platform where content can be presented with artificial intelligence-supported algorithms in accordance with the learning characteristics of people while ensuring the high level of use of technology in education processes.

Conventional education offers students with different learning characteristics in the same physical place, at the same time, and with the same course content. In the new structure proposed in the transformation program, regardless of time and physical space, individuals' learning competencies will be taken into account, and content suitable for these features will be presented.

The methods and similar algorithms that direct and manipulate the user behaviors of the new generation platforms such as social media, YouTube, Instagram, Twitter, and Netflix have been benchmarked and used effectively in the design processes.

Keywords: artificial intelligence, individual supportive education, learning analytics

ÖZET

MESLEKİ EĞİTİM İÇİN TASARLANMIŞ YENİ NESİL ÖĞRENME ORTAMI PLATFORMU

Bu tezin amacı, geleneksel yöntemlerle eğitim veren bir kolluk teşkilatının eğitim dönüşüm programı kapsamında; Eğitim süreçlerinde teknolojinin üst düzeyde kullanımını sağlarken, insanların öğrenme özelliklerine uygun olarak içeriğin yapay zeka destekli algoritmalarla sunulabileceği bir platformun ana mimarisini ve algoritmasını oluşturmaktır.

Geleneksel eğitim, farklı öğrenme özelliklerine sahip öğrencilere aynı fiziksel mekanda, aynı zamanda ve aynı ders içeriğiyle sunulmaktadır. Dönüşüm programında önerilen yeni yapıda, zaman ve fiziksel mekandan bağımsız olarak bireylerin öğrenme yetkinlikleri dikkate alınacak ve bu özelliklere uygun içerikler sunulacaktır.

Sosyal medya, YouTube, Instagram, Twitter, Netflix gibi yeni nesil platformların kullanıcı davranışlarını yönlendiren ve manipüle eden yöntem ve benzeri algoritmalar kıyaslama yapılarak tasarım süreçlerinde etkin bir şekilde kullanılmıştır.

Anahtar Sözcükler: bireysel destekleyici eğitim, yapay zeka, öğrenme analitikleri

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1.INTRODUCTION

Humanity always searched for new ways to transfer knowledge to the new generation. Exploring methods to share information about food, dangerous animals, etc., with others in the same tribe in primitive times, with an exponential increase in population leads humankind to establish systematic and more manageable mass teaching methods in the modern era. E-learning platforms reach millions of students today and industry players are taking the lead in mass education with innovative approaches such as their platforms, use of artificial intelligence, and user experience applications. It has been stated that online e-learning platforms' global market growth found $101 Billion in 2019 and is expected to reach $167.5 Billion in 2026. (Statista, 2022)

Educational environments, which have become more systematic and accessible over the years, offer self-paced, cost and time-efficient course structures in addition to independence from place or time. With the development of Massive Open Online Courses (MOOCs) form of courses, platforms can reach any student who has an internet connection and computer. Mentioned platforms continue to grapple with some problems that they cannot solve today. It is understood that today's mass and innovative education systems, which have difficulties in pedagogical methodology and educational content quality assessment, the completion rate of enrolled online courses, difficulties in creating personal motivation, and the definition of the educator's role in the system, cause high drop-out rates. (Atiaja & Guerrero, 2016) The fundamental design of these platforms is based on today's education system. Present systems come with their weaknesses such as complicatedness, modeling based on old education systems, and the need for pedagogical updates.

This study aims to propose a new learning environment that focuses on providing new approaches to today's common learning platform problems based on where today's e-learning systems lack. The proposed system is designed to determine the characteristics of each learner who enrolls. After this evaluation is processed in the artificial intelligence model, a personalized learning pathway can be created according to the learner's suitable learning and assessment characteristics.

In the introduction part, it's been explained that challenging topics of contemporary learning systems are used today, and a summary of our proposed method. Later parts of this dissertation are divided into sections as follows, history of education, where the origin of education is emphasized and will be focused on education systems of today and the future. In the literature review part, current related academic developments are going to be discussed. After that, the proposed methodology going to be described. As a conclusion, points made, findings and limitations will be discussed.

2.HISTORY AND LITERATURE REVIEW

Humanity has not reached modern educational advancement without trial and error, requirements for circumstances, and thought layers throughout history. Societies in the ancient world used and developed hieroglyphic and Phoenician writing systems. Later, in ancient writings, it was mentioned that tablets and styli were used, and the first examples of educational texts began to be utilized. Schools started to be established for fundamental knowledge teachings and libraries opened to share information with the public. Academic institutions started to be formed and spread around the world between 1100-1200 years, and formal educational institutions such as the Universities of Bologna, Paris, and Oxford began to emerge.

In the Middle Ages, the foremost medieval institutions were established, bearing the foundations of today's university structure where lecturer uses handwritten textbook and students take notes. Although some historians think that there was no primary and secondary school in medieval times, the author states that this idea is wrong. Primary and secondary schools are seen as an important step in creating the knowledge infrastructure for the students who will come to universities, as we have seen similar structures around the world today. In fact, some universities offer beginner-level courses to new students and aim to make up for their lack of infrastructure in their previous education. Universities opened in the Middle Ages and these processes supporting their development are shown as proof of this. (Thorndike, 1940)

These establishments separate studies, so students can create their pattern of learning in law, medicine, theology, and more. In order to get a degree, a student had to study with his master for 3-7 years and defend his studies before a jury. (Review & Macconnell, 1964) To see how organized the education system in the Middle Ages was, the example of Alexandria in terms of medical education can be examined. Stating that professors have opened courses for doctors and advanced students, the author emphasizes

that the foundation of today's medical systems has been built thanks to the work done while preparing the courses. The beginning of the curriculum and grading system, built on regular study, was designed at this stage. (Temkin, 1956) As an example of the regularization of education in the medical field, the translation of surgical procedures into encyclopedias for two centuries in Italy can be given. Thanks to such advances, the profession of doctor has begun to create a perception of a profession that progresses in a disciplined way with academia, rather than a craft. (Mc Vaugh, 2000)

Medieval people, who attached great importance to education, depicted this importance in their works of art. As can be seen in **Figure 1**, three words are seen on the queen sitting in the middle of the work with her crown; "ethica", "logica", and. "physica". The Queen holds the sentence on the parchment that says "All wisdom comes from the Lord God; the wise alone achieve what they desire." in support of these words symbolizing Platonic thought, and the seven liberal arts are grammatica, rethorica, dialectica, musica, arithmetica, geometa, and astronomy. This distinction reveals how clear the multidisciplinary divergence is.

The university culture, which strengthened in the Middle Ages and left twenty-nine institutions in the renaissance period, paved the way for the opening of universities in Europe in the coming years. The humanism movement, whose influence is increasing in Italy, has adopted the principle that man is in the middle of his universe and has emphasized achievements in many disciplines. (*Renaissance Period: Timeline, Art & Facts - HISTORY*, n.d.)

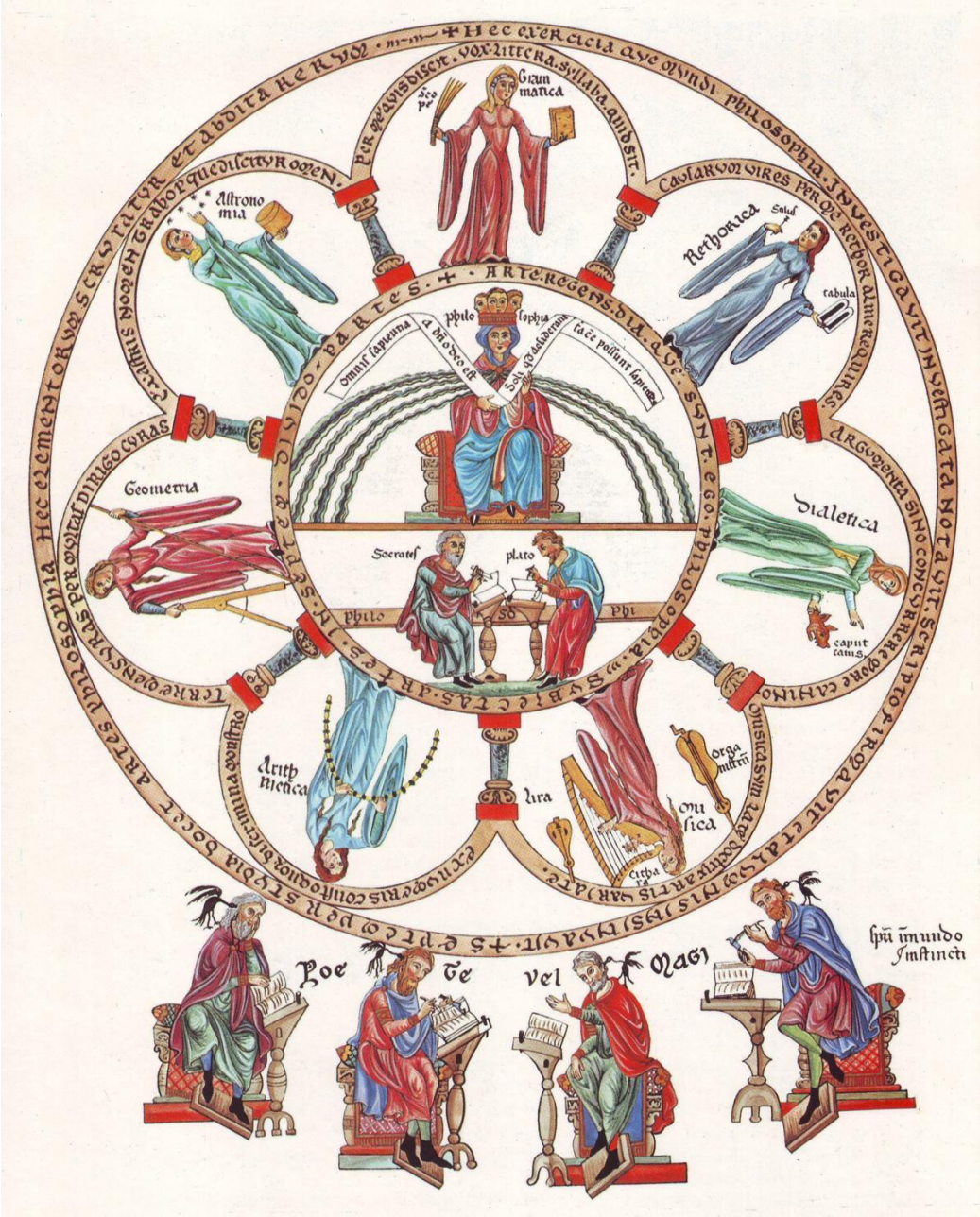

Figure 1. Illumination from Hortus deliciarum Herrad of Landsberg, 1180

In the Renaissance and early history, decision-makers build universities in anticipation of the growing knowledge of society so ready to learn. They took this approach to train a wise man and teach them about many different topics that we today define as "multidisciplinary". As such, universities had significant impacts on society,

and institutions focused on students who graduated from certain professions, such as doctors and lawyers. Advances in scientific methodology have resulted in great findings in a variety of disciplines. (Grendler, 2004)

2.1. Contemporary Education Platforms

In the modern era, formal and mass education system requirements have emerged due to the increase in the number of students. The maturation of IT systems and computers which are financially reachable has tried to create a solution. Although these structures, which aim to solve problems in parts, could not create a radical transformation. They started to be used in the education system while the conventional education system continued and has become an essential part of any school or university student.

Other than universities, online platforms are developed, and self-learning environments introduce themselves without needing any physical space or scheduled lectures. The most well-known example of such a platform is called Wikipedia, where anyone can access and share information related to any topic.

The concept of an Open University, which started as an idea in 1920 with technologies such as radio and television, (*Exhibition: The OU Story: 1963-1969 - Open University Digital Archive*, n.d.) then began to spread information with platforms where their online content was transferred to the online environment, while conventional and traditional education systems continued, as shown in **Figure 2**.

Even the newest platforms offered the chance to teach and learn from others with sophisticated artificial intelligence applications integrated into the platforms. These platforms have found success in a short time, virtual degree programs and Massive Open Online Courses (MOOC) created to published by mostly self-motivated lecturers. These courses feature the ability to deliver their university-like content to an unlimited number

of students that they can access from anywhere with an internet connection. (*What Are MOOCs?*, n.d.)

These courses feature the ability to deliver their mostly open university-like content to an unlimited number of students that they can access from anywhere with an internet connection. Unless student enrolls in the course which offers live lectures and Q&A with start/end dates, can progress according to their pace. Automatization of assessment and evaluation systems and learning paths adds value to both students and teachers. Students know their learning path and their homework or assignment before they are announced, and it is clearer in which direction the course will develop in the following weeks. Educators don't have to come up with new assignments or assessments and evaluate results for each term because it's automated.

The ancestors of MOOC platforms evolved into today's contemporary platforms, starting with the years of open-source culture and thought in 2000-2007 as shown in **Figure 2**. Some platforms continue their knowledge-sharing mission with no cost, while others articulate financial profits to advance their services in diverse ways such as software and/or content creation. As a next step, platforms focus on corporate training, competency-based education, and other new service models. (Yuan & Powell, 2015)

Figure 3 states that MOOC's approach to education attracts a variety of organizations and people, starting with venture capital firms, companies, universities, and nonprofits. (*Major Players in the MOOC Universe*, n.d.) Among these parties, universities have added MOOC courses to the traditional courses they offer, creating value for academic growth. Thanks to this approach, universities have the opportunity to benefit from a large number of teachers with different perspectives. As a recent trend, courses on MOOC platforms include adding student credits if the university accepts them. In addition, these platforms give a diploma or certificate to the student to support academic progress at the completion of criteria that platform management generally decides. (*Earn University Credit on EdX | EdX*, n.d.)

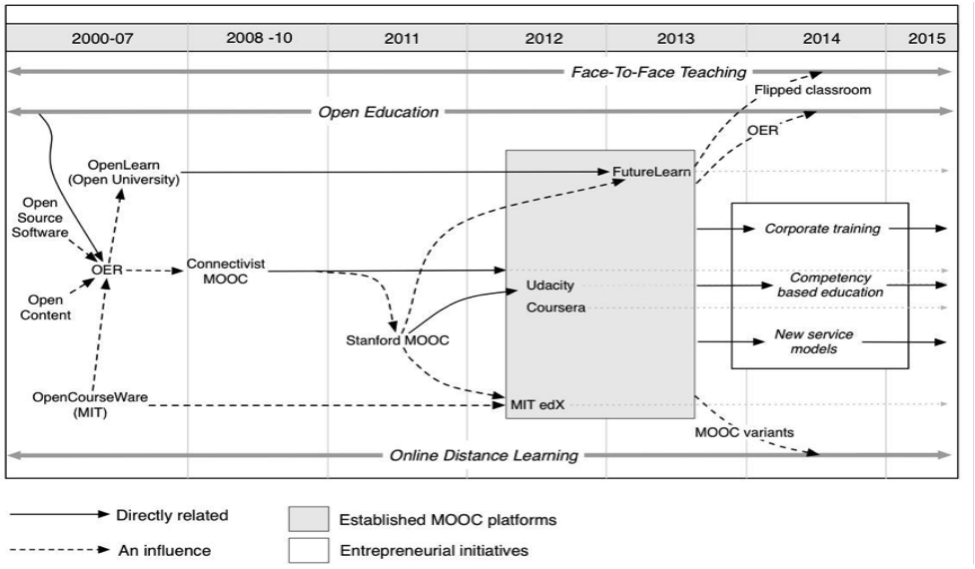

Figure 2. Potential Impact and Trends of MOOC on Education

Source: Yuan Li & Powell Stephen, n.d.

Despite all the mentioned benefits, MOOCs suffer from several points such as; Business model design, low-level course completion, certification, pedagogical model, quality, and validation. (Mendes Bezerra & da Silva, 2015) Students point out that these systems are challenging to operate with at the beginning and while the teaching staff's workload decreases, the stress on students increases. (Maatuk et al., 2021)

The application about the change between the teaching methods of the trainers and the learning styles desired by the learners was also made in 1991 and its types were determined. (Cooper & Miller, 1991) Another study focused on how students' expectations, needs and learning styles can be established in online education (Mupinga et al., 2006). Researchers did not find a dominant learning method and stated that multiple learning styles should be on platforms. Evaluating that MBTI has important difficulties, the researchers stated that it improves students performance in the classroom, especially in the field of engineering, and that each student's learning style should be taken into account. (Rosati et al., 1988) As a different result, the (Putri et al., 2016) showed that the judgmental feature is dominant in the education style in history education. In fact, it has been observed that students in nursing education generally have thinking and judgmental

personality structures. (Li et al., 2014) In the study on architectural design processes, it was evaluated that there are different learning styles in the studio and that it is valuable to associate the stages of design education with different learning styles. (Demirbaş & Demirkan, 2003) In addition, study shows that students cite the lack of practical applications and interaction as a disadvantage. (Gherheş et al., 2021)

The authors researched characteristic types of students who enrolled in MOOCs and found seven distinct patterns of interaction. (Ferguson & Clow, 2015) Researchers who focused on students who complete MOOCs state that motivation and decisiveness have the utmost importance. (Barak et al., 2016) In addition, (Kizilcec & Schneider, 2015) suggests that education platforms should be designed with the inclusion of learner's motivation. The review of the emotion-aware systems for e-learning environments, (Feidakis, 2016) explains that the positive emotional states of the students increase their learning skills, and it is said that the emotional conditions of the students can be analyzed and monitored, and reported with sensors and artificial intelligence technologies. (Mayer, 2020) explaining the place of emotions in e-learning systems works on A Cognitive-Affective Model for E-Learning has divided their model into four parts; e-learning episode, affective processing, cognitive processing, and learning outcome but the systematic study is required to explore additionally in this subject.

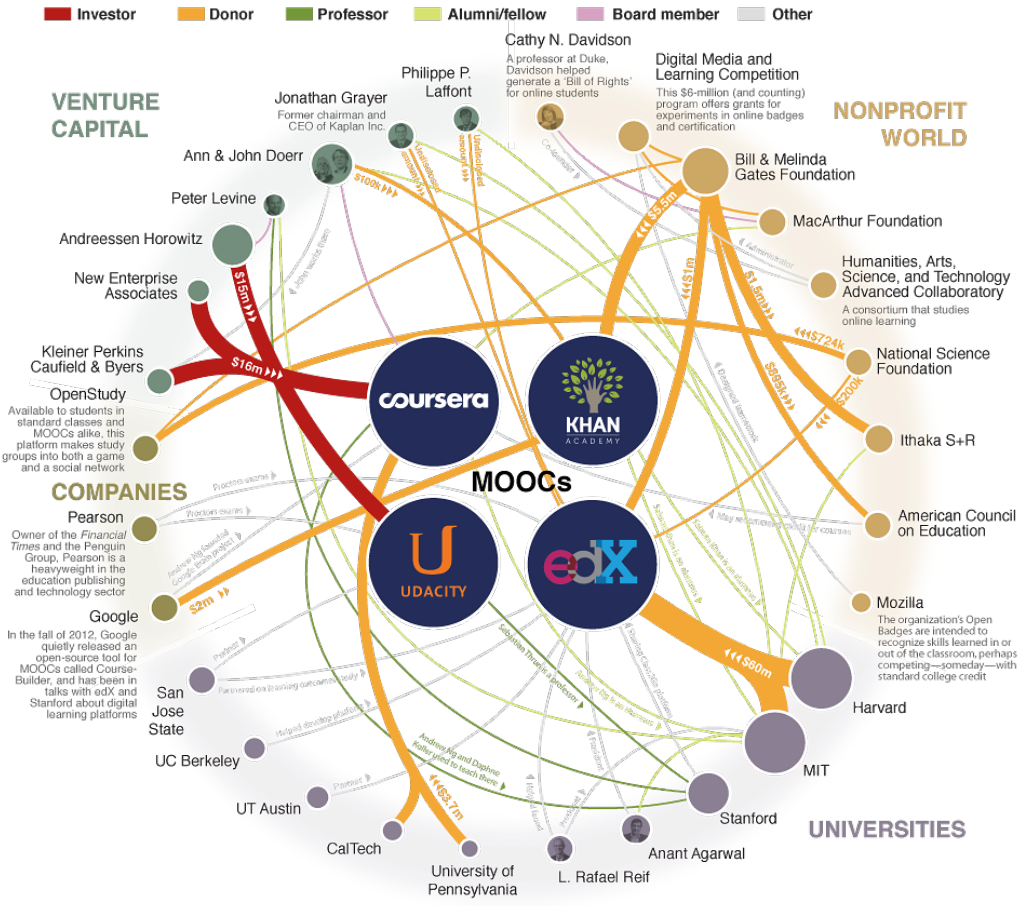

Figure 3. Major Players in the MOOC Universe

Source: https://www.chronicle.com/article/major-players-in-the-mooc-universe/

The taxonomic study of D-Learning shown in the article explains that the main perspectives of the E-Learning system include cognitive, emotional, behavioral, and contextual, while the perspectives of the E-Learning system are technology, digital content, and teaching. In the D-Learning part, technology refers to the delivery of digital content to learners via the Internet or a similar connection, via a PC or tablet. In the instruction section, the (Basak et al., 2018) talks about transforming the role of educators more into a guide for long periods. Authors suggest that to design learning systems harmonious with pedagogical models, the system must be focused on the learners' progress, has to have the on-the-job type of stages and social environments that will accelerate learning, and support the emotional channels of a learner.

A study by (van Seters et al., 2012) shows that learners took individual learning paths when interacting with contemporary learning platforms materials and how learner's characterization affects the chosen learning paths. While tracking learners' progress, this information can create vital help. (Sahasrabudhe & Kanungo, 2014) studying the learner's characteristics and learning styles focused on four learning styles based on media. In this division, researchers examining text, graphics, sound, and image-animation fields aimed to increase learning efficiency by developing a media selection model that can work according to the e-learning program.

Regarding the benefits of Cloud-Based E-Learning systems, the authors focus on lower costs, increased performance, instant software updates, document compatibility, and benefits for students and educators. In response to these advantages, cyber security, privacy, reliability, legal situations, and cloud systems integration standards are still in the process of being determined, cloud service companies do not comply with the wishes of their customers within the framework of legal regulations, the cloud system does not physically allow data storage, problems to be experienced in case of a collapse of cloud service companies and the importance of choosing a service provider are mentioned. Considering that e-learning systems are generally cloud-based, we can consider these advantages and disadvantages as issues that platforms should pay attention to in general. (Viswanath et al., 2012)

For the M-Learning approach, the researchers divided the components for quality management as follows; different mobile educational content prepared for easier learning of the student, the software infrastructure required to provide the connection and transmit the educational content to the student, and the hardware infrastructure that can support the software. As for educational features, (Pocatilu & Boja, 2009) mentions that there is no method of creating mobile educational content that can be applied to everyone, in the same way, the researchers stated that this content creation should be personalized. They point out that since there is no trainer to supervise in the mobile learning environment, there should be different types of educational content that will attract the attention of the students and even a learning environment open to collaborative learning. (Al-Fraihat et al., 2020) evaluating E-Learning systems similarly to M-Learning state that interaction

and communication are of high importance, and that the quality of trainers and diversity in learning styles positively affect these learning systems.

Researching the E-Learning system that makes the most sense to use during the pandemic period when education is severely interrupted, (Alqahtani & Rajkhan, 2020) found that the Blended Learning (can be seen in **Figure 4**) approach is the right choice by using the multi-criteria analytical hierarchy process and the TOPSIS technique. After that, Asynchronous Learning and ICT Assisted Face-to-Face learning, Flipped Classrooms, and Synchronous Learning techniques are listed. They stated that the type of the course and the content is not more important than the student's characteristics in the E-Learning systems.

Partial studies among some disciplines seem to be successful in their own fields. It is understood that to achieve success as a whole, it is necessary to focus on solving the problem with a holistic approach in contemporary education systems. The study in this thesis aims to propose a learning environment design that combines the topics examined in the literature.

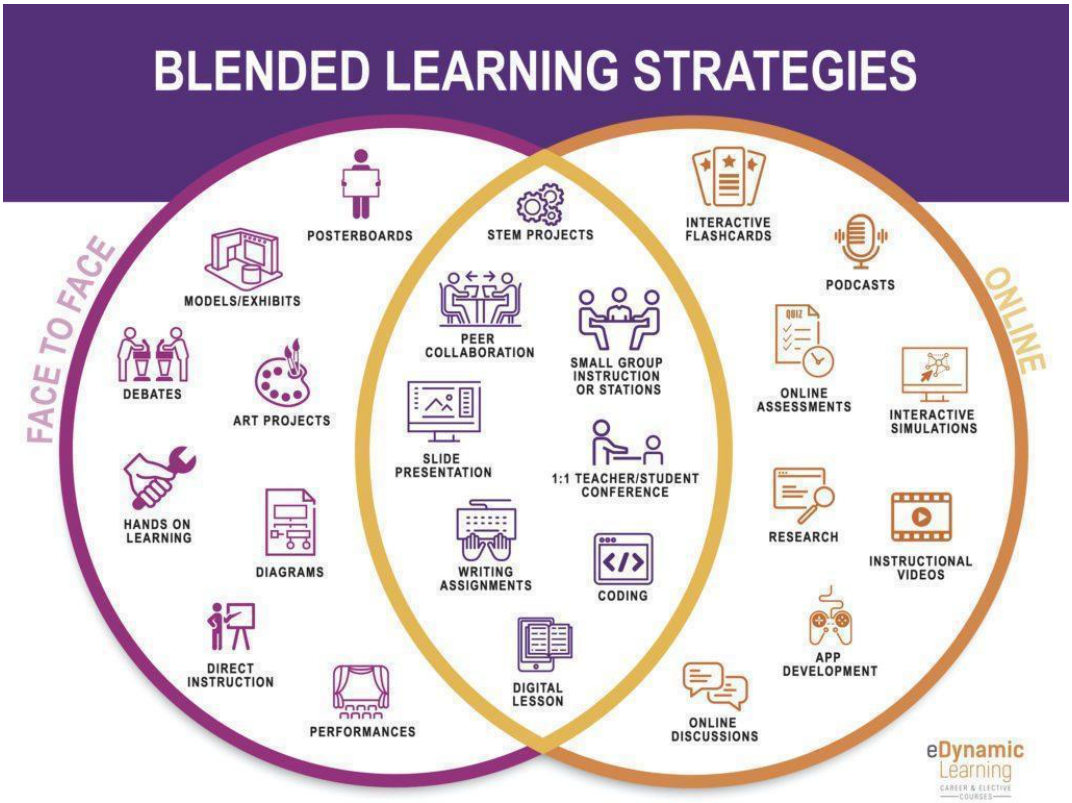

Figure 4. Blended Learning Strategies

Source: https://edynamiclearning.com/5-effective-blended-learning-strategies

3.PRELIMINARIES

3.1.Recommendation Systems

Recommendation systems, also known as recommendation systems, are a subclass of information filtering systems whose purpose is to predict a consumer's preferences or ratings for a certain item. These systems are widely used in e-commerce and social media platforms to provide personalized content recommendations to users. These systems use collected user interaction data or predefined data such as YouTube, Netflix and Facebook to provide customized content recommendations to users. To predict what content will be viewed for a particular user, mentioned systems use filtering algorithms that incorporate ranking and preference variables derived from behavioral data and specific user interaction data. There are several types of recommendation systems, including collaborative filtering, content-based filtering, and hybrid systems that combine collaborative and content-based filtering.

Collaborative filtering relies on the interaction of a group of users to provide recommendations to a specific user, while content-based filtering uses the properties of elements to provide recommendations. Hybrid systems combine both collaboration and content filtering to provide more accurate and differentiated recommendations.

Overall, recommendation systems are valuable tools for improving the user experience by providing personalized content recommendations based on the user’s past interactions and preferences. These systems can help increase engagement and loyalty to a particular platform or service.

3.1.1.Collaborative Filtering

This type of filtering produces outputs based on previous interactions between users and content. The most beneficial use is when there are no user and content data properties in the system, in this scenario the filtering algorithm compares the user with the behavior of other users. For example, let it be an educational application where the user can access the suggested learning path according to personnel data analysis. Let our example scenario be two users named User 1 and User 2. User 1 is receiving A, B, and C courses and User 2 is receiving A, C, and D courses. User 1's next educational choice can be predicted by an AI algorithm according to User 2's educational choice. There are 2 types of collaborative filtering techniques;

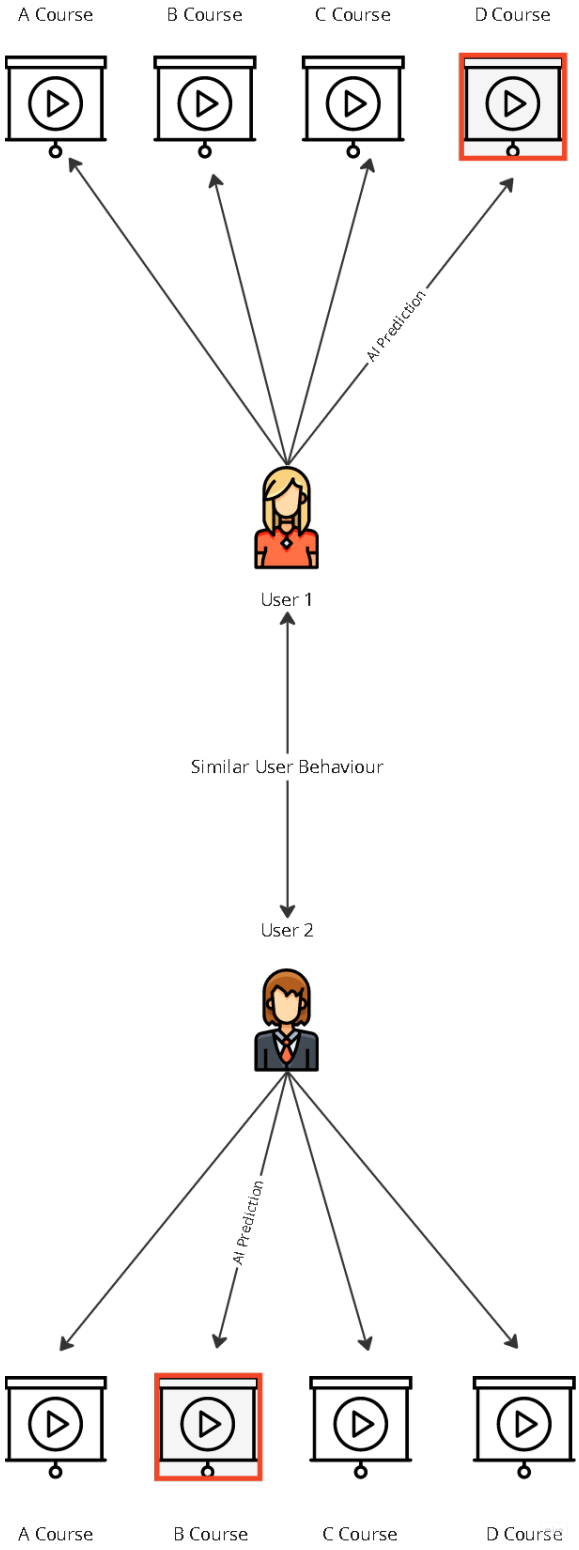

Figure 5. Collaborative Filtering

3.1.1.1.Model-Based in Collaborative Filtering

Model-based recommendation systems utilize a previously trained model to make predictions about a user's preferences or ratings for a particular item. These systems use advanced machine learning algorithms to analyze user interaction data and predict which items a particular user is likely to enjoy or find valuable. These systems are mostly used in and social media platforms to provide personalized content recommendations to users. They can provide accurate and relevant recommendations to users, which can help to improve the overall user experience and increase engagement and loyalty for a particular platform or service.

3.1.1.2.Memory Based in Collaborative Filtering

Memory-based collaborative filtering is a type of recommendation system that utilizes an algorithm to find similar users based on collected user interaction data. These systems use a simple method of measuring distance, such as the nearest neighbor algorithm, to compare users and predict their preferences or ratings for a particular item. Memory-based collaborative filtering systems are commonly used in electronic commerce and social media platforms to provide personalized content recommendations to users. They rely on the idea that similar users will have similar preferences, and can provide accurate and relevant recommendations to users based on this principle. Memory-based collaborative filtering systems can help to improve the overall user experience and increase engagement and loyalty for a particular platform or service.

3.1.2.Content-Based Filtering

Content-based recommendation systems are designed to provide users with personalized recommendations based on content characteristics and the user's previous interactions with the system. These interactions may include explicit ratings given by the user or implicit actions such as clicking on a particular link. By analyzing content characteristics and the user's past interactions, content-based recommendation systems can provide recommendations that are more relevant to the user's needs.

To provide on point recommendations, content-based recommendation systems rely on extracting features from the content itself. This may include analyzing the text, images or other characteristics of the content to determine its relevance to the user. The more data about user preferences and interactions, the more accurate the recommendations.

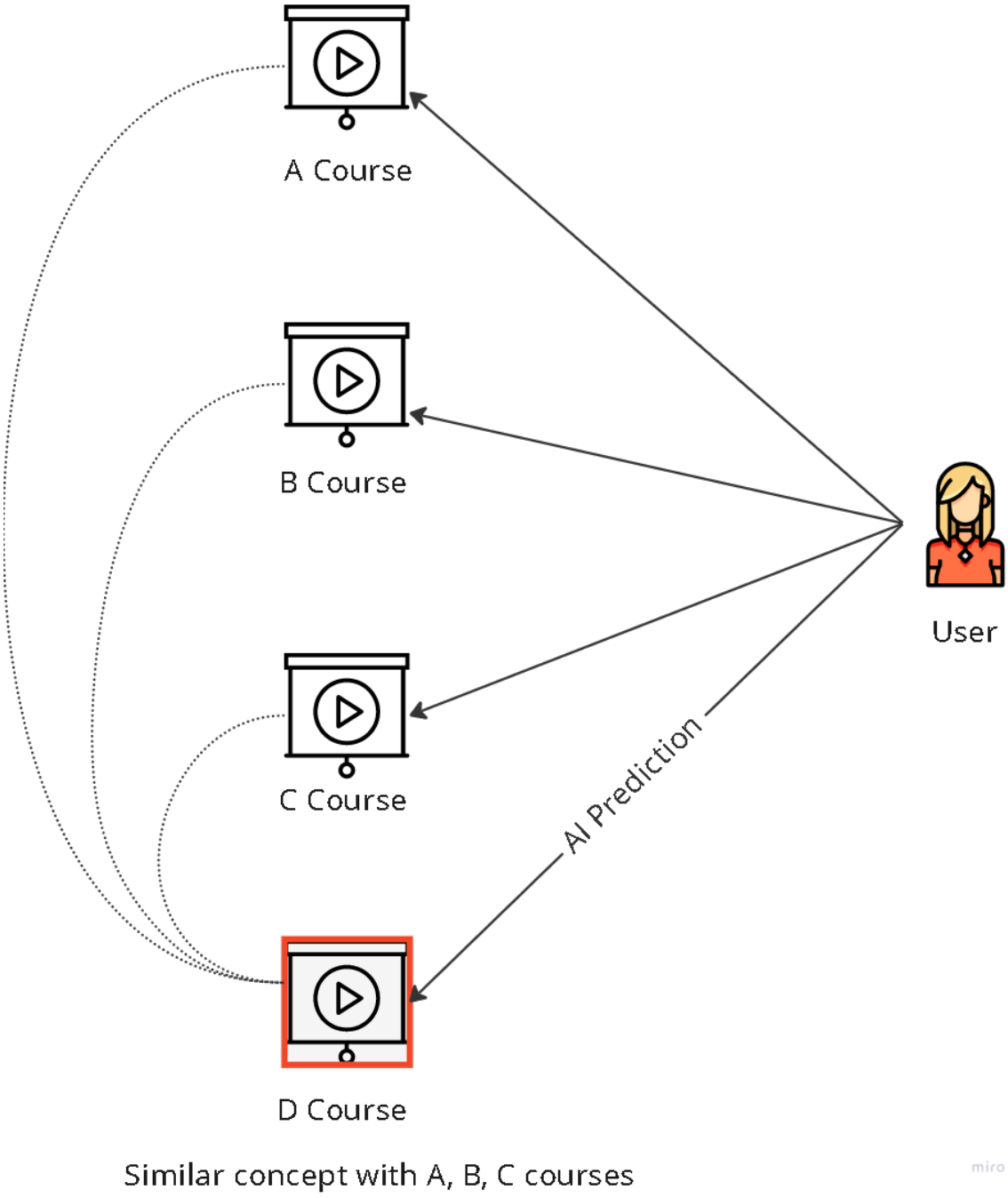

Figure 6. Content-Based Filtering

3.1.3.Hybrid Systems

Hybrid recommender systems are designed to combine the strengths of content-based and collaborative filtering systems to provide users with more accurate and diverse recommendations. These systems work by combining the predictions of both models and using the resulting combination to make recommendations.

Hybrid recommender systems can be particularly useful in situations where the data available to make recommendations is limited. By combining the predictions of both content-based and collaborative filtering systems, this systems can suggest more accurate recommendations based on a wider range of data.

Overall, hybrid systems are a useful for providing users with personalized content. By combining the strengths of both content-based and collaborative filtering systems, can provide more accurate and diverse recommendations that are tailored to the user's interests.

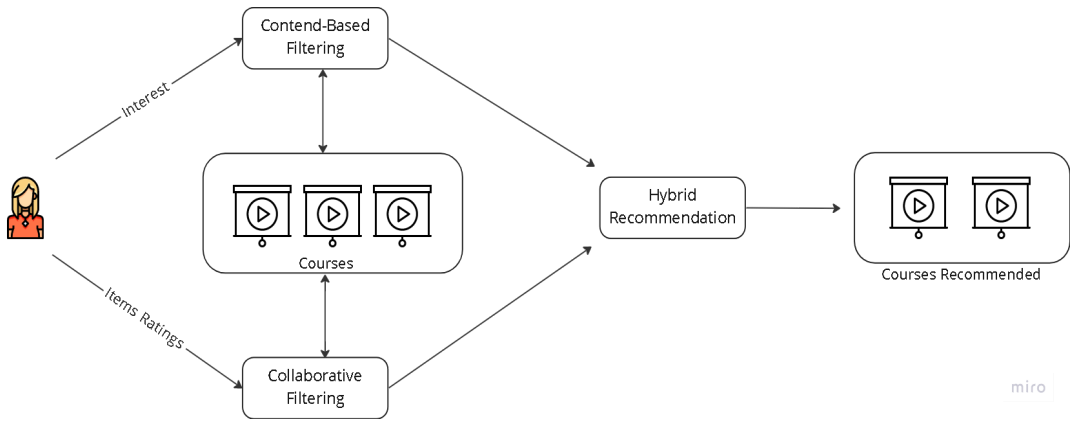

Figure 7. Hybrid System

3.2.Contemporary Online Learning Environments

3.2.1.Coursera

MOOC stands for Massive Open Online Course, and Coursera is a platform that offers a wide variety of online courses from top universities and educational institutions around the world. In addition to offering courses in a variety of subjects, Coursera also provides certification programs and degrees for those who want to further their education and advance their careers.

One of the key features of Coursera is that it is open to anyone with an internet connection, making it an accessible and convenient option for learners around the globe. The platform offers both free and paid courses, and students can choose to audit a course for free or pay a fee to receive a certificate upon completion.

In addition to its vast course offerings, Coursera also has a strong emphasis on community and collaboration. Students can interact with their peers and instructors through forums and discussion boards, and many courses also include interactive elements such as quizzes and projects.

Overall, Coursera has revolutionized the way we think about education&training and has made it possible for anyone, regardless of their location or financial circumstances, to access high-quality educational content and resources.

3.2.2.Udemy

Udemy is a popular MOOC platform that offers a wide range of courses in a variety of subjects, including technology, business, design and more. It differs from other MOOCs by allowing individuals to create and sell their own courses on the platform, resulting in a diverse range of course offerings. In addition to its courses, Udemy also provides diverse features to better the learning experience such as interactive quizzes and projects, peer-to-peer support and progress tracking. Mentioned features, combined with the convenience and accessibility of online learning, make this platform a popular alternative for those looking to learn new skills and knowledge through MOOCs..

3.2.3.Udacity

Udacity is seen as an online university by Silicon Valley, which was established as a university-industry partnership. Lessons at Udacity are more informatics oriented. The programs offer industry giants such as Google, AT&T, Facebook, Salesforce, Cloudera, and Nanodegree user degrees designed for professional webmasters, data analysts, or mobile developers.

Supported by coaches and student communities, participants learn programming and data science topics through online courses and practice projects. There are courses with content such as Android and IOS processors, data analysis, data science, developer fundamentals, digital marketing, machine learning, mobile application development, software engineering, virtual reality, and web development.

3.2.4.edX

EdX is a MOOC platform that was founded by a partnership between MIT and Harvard University and has since grown to include collaborations with over 100 universities around the globe. It offers a wide range of courses in subjects such as mathematics, computer science, and more. Unique feature of edX is its use of AI to assist with assessment and evaluation of exams.

In addition to its course offerings, edX also provides a number of features to improve the learning experience, such as interactive practices and the ability to connect with other learners through online platform. These features, along with the simplicity and usability of online learning, make edX a widely chosen alternative for those looking to advance their knowledge and skills through MOOCs.

EdX is aiming to make education accessible to all and offers financial aid options for those who may not be able to afford the cost of course fees. This commitment to inclusivity and reachability has helped to make edX one of the largest MOOC platforms in the web.

3.2.5.Khan Academy

Khan Academy, which was founded in 2008 with the aim of providing free, high-quality education to anyone, anywhere. Khan Academy offers courses in a variety of subjects, including mathematics, science, arts, social sciences, economics and finance, and computer science.

One of the distinctive features of Khan Academy is its way of personalized learning approach, which benefits algorithms to design the learning experience to the each student. This allows students to focus on the areas where they need the most support and

to progress at their own pace. In addition to its course offerings, Khan Academy also provides a range of resources to support learners, such as training videos and interactive practices.

3.3.Machine Learning

Machine Learning (ML) is a subfield of Artificial Intelligence (AI) and mimics how humans think and learn as its main work. Algorithms are used to classify the data, these classifications are used to create a data model that can make predictions. For more accurate results in machine learning, the amounts of data and experience must be high. There are various types of machine learning algorithms, each with its own unique characteristics and capabilities. These can be broadly classified into three main categories: supervised learning, unsupervised learning, and reinforcement learning.

Supervised learning algorithms are trained on a labeled dataset, which means that the data includes both input and output examples. The goal is to build a model that can predict the output for a new, unseen input. Examples of supervised learning include predicting the likelihood of a customer churning, or identifying spam emails.

Unsupervised learning algorithms, on the other hand, are not given any labeled examples and must discover patterns and relationships in the data on their own. Unsupervised learning can be used for tasks such as clustering, which involves grouping similar data points together.

Reinforcement learning algorithms are trained through a system of rewards and punishments in order to teach them to take actions in an environment in order to maximize a reward. This type of learning is often used in control systems and robotics.

Overall, the utilization of machine learning algorithms has the potential to greatly enhance the accuracy and efficiency of decision-making in a wide range of applications.

3.4.Unsupervised Learning

Unsupervised Learning is a machine learning type for problems with unlabeled datasets. The machine learning algorithms used to analyze untagged datasets learn useful patterns or structural features of the data with/without human intervention. In unsupervised learning, models are not checked using the training datasets. Inferences about the data are made by using the distances of the input data given to the system to each other and the neighborly relations. The model is not expected to give a specific output because it does not indicate to the system what is wrong. Unsupervised learning is used in many areas such as recommendation systems, data research, customer segmentation, data preparation, data visualization, etc.

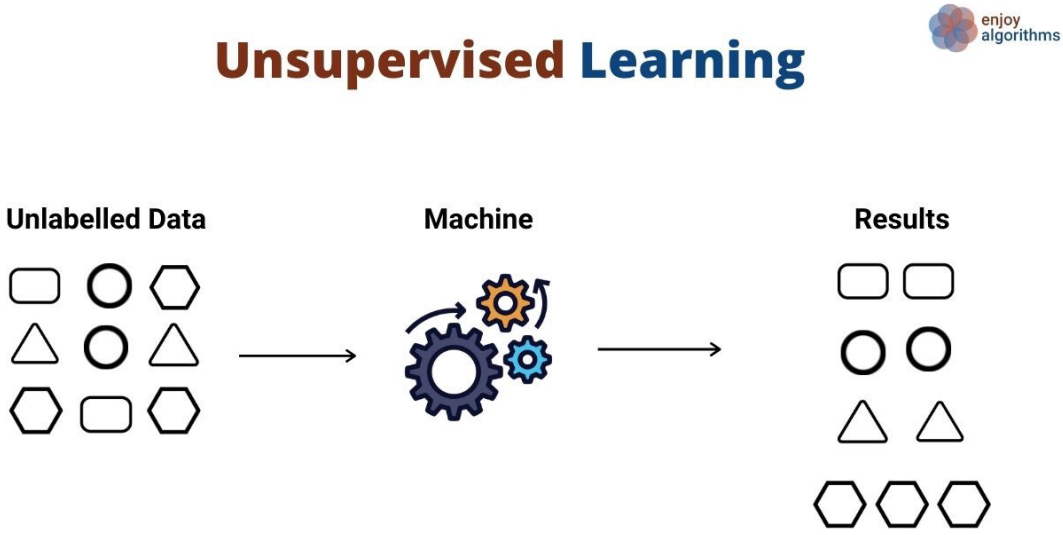

Figure 8. Unsupervised Learning

Source: https://www.enjoyalgorithms.com/blogs/supervised-unsupervised-and-semisupervised-learning

3.4.1.Clustering

Clustering is an unsupervised learning method. There are multiple clustering algorithms, and these algorithms are often used to analyze similarities found in the data. Although there are many similarities within the same set, there are fewer similarities between the clusters. The good clustering criterion depends on the user and the requirements they can use to meet their needs. The most common use of clustering analysis is classification. For example, in marketing, cluster analysis can be used to transmit messages with appropriate content to different customer groups. Customer groups are characterized by their purchasing patterns.

3.4.1.1.K-Means Algorithm

The K-Means algorithm is one of the most widely used clustering algorithms. The most important 2 goals of this algorithm are that the data in the cluster have the highest similarity to each other and that the clusters have the least similarity to each other as much as possible. It defines the number of K clusters in the K-Mean, and this value is taken as a parameter. After the K value is determined, K center points are randomly selected. The data is assigned to the cluster at the nearest center point according to the distances between the selected center points. New center points are selected for the clusters and the clustering process is repeated until the system becomes stable.

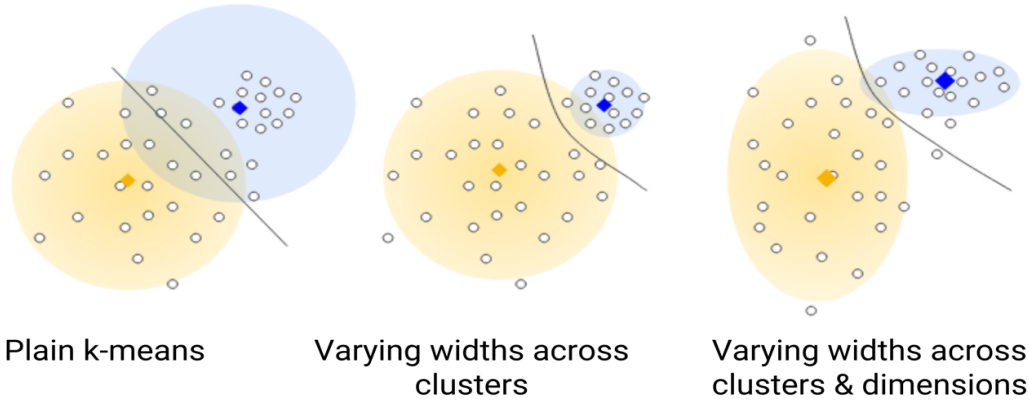

Figure 9. K-Means Algorithm Representation

Source: https://developers.google.com/machine-learning/clustering/algorithm/advantages-disadvantages?hl=en

3.5.Character Analysis

3.5.1.The Myers-Briggs Type Indicator (MBTI)

The Myers-Briggs Type Indicator (MBTI) is a self-report questionnaire that identifies various psychological tendencies in how people view the environment and make decisions. The core concept of MBTI is that we all have preferences for how we perceive our experiences, and these choices form the basis of our interests, needs, values, and motivation.

3.5.2.MBTI Personality Categorizations

Many platforms have free tests for the Myers-Briggs personality indicator that take less than ten minutes. As a result of these tests, it is understood which 16 different personality types the test taker has. According to the results of personality tests, MBTI itself; Analysts, Diplomats, Scouts, and Explorers are divided into four main categories, and personality types are divided into 8 categories. It is administered in English and is based on the combination of four main categories:

Thinking-Feeling: This category describes how people collect information. Thinkers evaluate data in a logical way and make decisions based on their thoughts. Feelers, on the other hand, collect information based on their senses and experiences and focus on remembering what they have lived.

Introversion-Extraversion: This category describes how people relate to time and space. Introverts focus on their thoughts and feelings and pay less attention to the external world. Extraverts, on the other hand, focus on the external world and pay more attention to the events happening around them.

Judging-Perceiving: This category describes how people make decisions. Judgers make decisions based on their feelings and express their thoughts emotionally. Perceivers, on the other hand, evaluate data in a logical way and base their thoughts on objectivity.

Judging-Perceiving: This category describes how people work and prefer to manage their time. Judgers prefer plans and structured methods of working. Perceivers are open to new ideas and have the ability to adapt to change.

3.5.2.1.Analysts Group

Analysts prefer to make decisions with conviction and confidence and value competence and efficiency. They may also be perceived as independent and introverted due to their preference for working alone or in small groups. Analysts are known for their logical and strategic thinking, and they typically flourish in fields that require abstract and analytical thought.

3.5.2.2.Commander (ENTJ)

They are recognized for their lively, vivacious, and steady dispositions as ENTJ personality types. They have the determination and endurance required to accomplish their long-term goals as well as the ability to adapt effectively to different conditions and environments. In addition, they stand out for having inspiring, clever, charismatic, and self-assured personality attributes that help them motivate and lead others. They are excellent and influential leaders in a number of contexts thanks to these traits as well as their strong sense of purpose and resolve. In general, the ENTJ personality type is characterized by assertiveness, confidence, and the capacity to efficiently develop and carry out strategies.

3.5.2.3.Logicist (INTP)

They are known as "logicists" because they have an INTP personality type, which is characterized by calm, shyness, and thoughtfulness, with friendliness frequently taking a backseat. They have an adaptable attitude and favor taking an unbiased, analytical, and rational approach to problems. They may also be distinguished by their innovative,

ambitious, and curios personality traits in addition to these characteristics. These qualities, together with their ability to reason logically and analytically, may make them suitable for jobs requiring autonomous and creative problem-solving. The adaptability, open-mindedness, and capacity to see different viewpoints on a subject are hallmarks of the INTP personality type.

3.5.2.4.Argumentative (ENTP)

They are described as having an ENTP personality type and are known for their lively, enthusiastic, and confident dispositions. They can give fresh perspective to any situation thanks to their creative side. Their uniqueness, ingenuity, and aptitude for innovative thought are well-known. Additionally, they could have endearing, witty personality traits that could aid them in convincing people and influencing them. Because of these qualities, as well as their versatility and open-mindedness, they may be particularly well suited for jobs that require innovation and ingenuity. The ENTP personality type is recognized for its ability to see things from a variety of perspectives and for being willing to take calculated risks in order to achieve its goals.

3.5.2.5.Architect (INTJ)

They are recognized for their critical and objective style of thinking and are classified as having an INTJ personality type. They are able to set their emotions aside while speaking and expressing themselves, and they usually come up with solutions to make processes more efficient. They could be more drawn to speculative and abstract subjects and like to focus on fundamental ideas as opposed to being mired down in details. These qualities may likely make them appropriate for jobs demanding creative and

analytical problem-solving, together with their aptitude for autonomous and strategic thought. The INTJ personality type is well known for emphasizing competence and efficiency as well as having the ability to carry out plans successfully.

3.5.2.6.Diplomats Group

According to the MBTI, those who are labeled as "diplomats" typically exhibit cooperative, empathic, and emotional expression. They have a strong sense of personal ideals and are frequently characterized as visionaries. The INFJ (introverted, intuition, feeling, judging) and ENFJ (extraverted, intuitive, feeling, judging) personality types are included in this category and are renowned for their capacity to deeply comprehend and connect with people. Conflict avoidance, peace, and interpersonal connections are often values held by diplomats. Since they frequently put other people's wants and feelings above their own, they may also be seen as sensitive and empathetic.

3.5.2.7.Advocate (INFJ)

They are compassionate, peaceful, and empathetic people. They are determined and pay close attention to details. They are very sensitive with their soft temperament which avoids conflict. In addition, they have altruistic, creative, passionate, and principled character traits.

3.5.2.8.Mediator (INFP)

As people with the INFP personality type, they frequently have an introverted nature and may not be drawn to working in groups. They may approach assignments and undertakings with greater emotion and spontaneity since they tend to concentrate on ideas and concepts. They can be identified by these attributes in addition to their idealistic, ardent, and open-minded personalities. They may be well suited for occupations that demand creativity and empathy because of these qualities as well as their capacity to comprehend and relate to others on an emotional level. The INFP personality type is renowned for its focus on individual ideals and beliefs as well as its adaptive and flexible thought process.

3.5.2.9.Leader (ENFJ)

ENFJ personality typed people are known for their empathy and emotional outbursts. They have excellent communication skills and well-honed persuading capabilities. Additionally, they frequently possess leadership traits and have the capacity to influence and motivate others. They may also be distinguished by their altruistic, dependable, passionate, and open minded personality traits in addition to these characteristics. These characteristics may make individuals well-suited for occupations requiring leadership and interpersonal abilities. The ENFJ personality type is renowned for its capacity for successful interpersonal interaction and the development of satisfying relationships.

3.5.2.10.Campaigner (ENFP)

They have been recognized for their talkative and creative personalities as well as their sensitivity to social and ethical ideals as those with an ENFP personality type. They frequently have emotionally expressive personalities and may struggle to preserve continuous concentration on pressing activities. They can also be identified by their curious, insightful, fun, and enthusiastic personality traits in addition to these elements. These characteristics may make individuals well suited for occupations requiring creativity, empathy, and interpersonal skills. The ENFP personality type is renowned for its flexibility, openness, and capacity to perceive a situation from various angles.

3.5.2.11.Scouts Group

Scouts are described as being flexible, inquisitive, and open-minded people. They are frequently characterized as impulsive and curious about novel concepts and encounters. The ENTP and INTP types, noted for their creative and adaptable thinking tones, are included in this category. Scouts appreciate openness and innovation and have a tendency to be autonomous and adaptive. Due to their propensity for experimenting with novel concepts and experiences, they may also be seen as impulsive and inquisitive. Scouts are renowned for their flexibility, openness, and innovative problem solving skills.

3.5.2.12.Logistician (ISTJ)

The ISTJ personality type is characterized by a tendency to be aloof and a potential for poor communication. They may have structured personalities and are noted for their timeliness and attention to detail. Along with these characteristics, they may be identified by their personality traits of obedience, honesty, vigilance, tranquility,

practicality, and responsibility. They may be well suited for professions that demand responsibility and attention to detail because of these qualities as well as their capacity for correct information research and interpretation. The ISTJ personality type is well-known for dependability and its capacity to carry out strategies and processes with success.

3.5.2.13.Defensive (ISFJ)

They have a reputation for being serious and occupied, as well as being quiet and modest, as ISFJ character types. They are generally sociable and attentive to the well being of communities. Also they can be recognized with their dependable, pragmatic, perceptive, and passionate features. These characteristics may make people the right fit for professions demanding interpersonal skills and a strong feeling of responsibility. Characterized by trustworthiness, the ability to carry out projects and procedures successfully, an focus on practicality, and attention to detail.

3.5.2.14.Manager (ESTJ)

They are outstanding for their great managerial abilities and their honest, patient, and loyal character as those with ESTJ personality types. They frequently pay close attention to the little things, and their dependability may be used to describe them. These characteristics make them well suited for occupations requiring accountability and decision making skills, combined with their capability for correct information analysis and interpretation and their leadership qualities. The ESTJ personality type is distinguished by reliability, the capacity to execute plans and procedures successfully, and a concentration on practicality.

3.5.2.15.Consul (ESFJ)

Their practical expertise, capacity for planning, and capacity for making decisions are well known. Despite the fact that they need to improve their capacity for innovation. They can be differentiated from others by their commitment, responsibility, sensitivity, and excellent communication talents in addition to these characteristics. They can be well fit for careers that need interpersonal skills and a robust sense of obligation because of these qualities as well as this type's comprehension ability. The ESFJ personality type is recognized for dependability.

3.5.2.16.Explorers Group

The Explorer personality type is characterized by a genuine curiosity and desire for adventure. They are independent and ready to try new things. They are often self assured in their capacity to adjust to new situations and not hesitant to take chances. They are also very observant and have a remarkable capacity to perceive and comprehend the emotions of others. Explorers in academic settings may like subjects that provide a lot of variety, hands-on experience, and opportunities for autonomous inquiry and exploration.

3.5.2.17.Skilled (ISTP)

They are observant craftsmen with mechanical savvy and an interest in troubleshooting. They approach their environment with a flexible logic, seeking practical solutions to the problems at hand. In addition, they have energetic, creative, prioritizing, optimistic, rational, crisis management, and relaxed character traits.

3.5.2.18.Adventurer (ISFP)

They are loyal, kind, compassionate, and often think more of others than themselves. They keep most of their personal ideals to themselves. In addition, they have creative, sensitive, artistic, curious, and passionate character traits.

3.5.2.19.Entrepreneur (ESTP)

They are confident, friendly, and curious people. They are focused on fun and adventure. They choose difficulty in focusing because they lack attention. Long-term monotonous jobs are not for them. In addition, they have original, rational, courageous and practical character traits.

3.5.2.20.Entertainer (ESFP)

They are friendly and talkative people. They are energetic with experiential and action-loving personalities. In addition, they have artistic, original, observant, communicative, courageous, and practical character traits.

3.6.Memory Types

3.6.1.Analytical Memory

People with an analytical memory adopt logical action and score higher on IQ tests. They tend to learn faster in mathematics-based courses, and their statistical and graphing-reading skills are high. Thanks to their inclination towards mathematics, they show compatibility in jobs such as engineering and programming.

3.6.2.Long Term Memory

Long-term memory is the ability to maintain the learned knowledge, skills, and behaviors for at least a few days or years. The storage time of information is theoretically infinite, and the ability to store it is very large. The stored information is not forgotten. Some information cannot be remembered because it cannot be recalled from within the repository in which it was encoded, and it is assumed that this information has been forgotten. An example of this is when asked for the name of the primary school teacher, the person cannot remember the name of the teacher and cannot say it. This refers to a situation in which the name of the primary school teacher of the person cannot be recalled from within the repository in which it is encoded in the long-term memory. It is not a permanent situation. After a while, it is noticed that the person remembers the name of his primary school teacher.

3.6.3.Visual Memory

In visual memory, words are kept in mind by encoding them into images. People perceive the visual landscape around them and then process this visual information to form a memory. Visual memory can help people recognize the faces of loved ones, remember where they parked their car, find aisles in a supermarket, tell about childhood experiences, and much more.

3.6.4.Sensory Memory

Sensory memory is the first type of memory used by the brain to form new, short-term memories. It is a real impression with the signals received by the 5 senses. For example, when we turn the pages of a book quickly, the writings on the pages leave traces in our eyes, and this process is called sensory recording.

3.6.5.Working Memory

Memory features are important because one of the main purposes of education is to make knowledge permanent. At what intervals, under what conditions, and with supportive pieces of training do these issues arise? Working memory is the part of the brain that briefly stores processes and allows them to be modified.

While some studies use the words working memory and short-term memory interchangeably, others distinguish working memory from short-term memory in which

objects are stored and formed, while other researchers prefer to use separate terminology while emphasizing various elements of the same processes.

Working memory can also be distinguished from the short-term memory component, which, according to certain models of memory, is characterized by its storage function only, the ability to work on long-term memory representations. Working memory, according to a stricter definition, is a decomposable component of short-term memory.

3.6.6.Spatial Memory

Spatial memory, according to cognitive psychology and neuroscience, is a type of memory responsible for gathering and retrieving information needed to plan a trip to a particular area and remember the location of an object or the occurrence of an event. Spatial memory is essential for orientation in space.

3.6.7.Short-Term Memory

Short-term memory is the ability to retain learned knowledge, skills, and behaviors for a very short period of time. It is repeated so that the information remains in memory. When the repetition is stopped, the information is deleted. For example, short-term memory is used to remember recently made address descriptions.

4.METHODOLOGY AND PROPOSED NEXT GENERATION LEARNING ENVIRONMENT PLATFORM DESIGN FOR PROFESSIONAL EDUCATION

The training method currently in use of the institution has been analyzed as an as-is model. Although the background of the learners participating in the institution differs, it has been seen that the same educational content and form are presented in a single structure for different personality structures. It has been determined in the literature review that personality structures, learner's mood and similar situations are effective in the content and presentation of the education. Considering this literature review and the observations made in the institution, a detailed study was carried out under the title of personal learning competencies, and it was emphasized that the learning depths were developed by commissioning and the learning content was created and presented to the learner accordingly.

Process models that can be put into use if these studies are desired to be put into practice have been designed using the Architecture of Integrated Information Systems (ARIS) program. At the end of these studies, the interface designs that will be presented to the learner when put into practice are designed in Adobe Xd program.

In **Figure 10**, the process model prepared in the Architecture of Integrated Information Systems (ARIS) program related to the working principle of the Artificial Intelligence algorithm is described in detail. This process starts with the registration of the Learner and ends with the completion of the Learning Path. The subjects that the institution personnel involved in this process will take part in are defined.

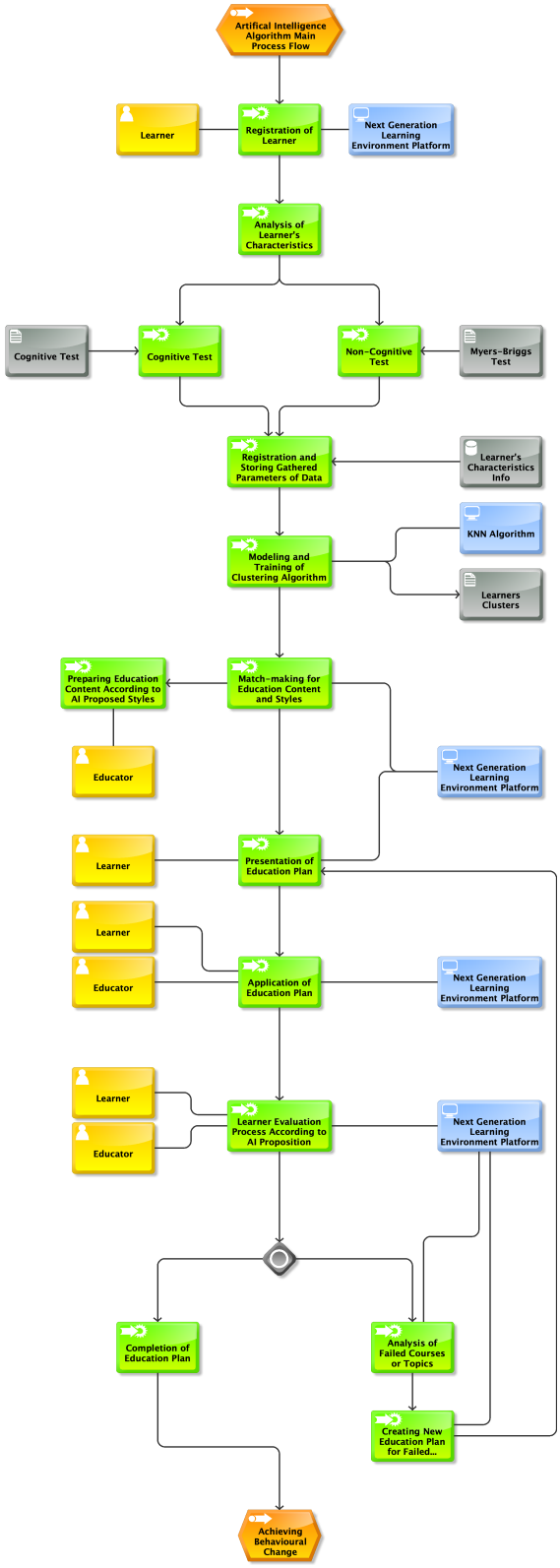

Figure 10. Artificial Intelligence Algorithm Main Process Flow

Following the student's registration, cognitive and non-cognitive tests and character and learning competency analysis are performed. The collected data is saved in the database and modeling and training processes are carried out with artificial intelligence algorithms working in the Clustering method. In this process, the Trainer has the chance to see the general participation, as the data of not only a learner, but also all registered students are included. In the following, learner-specific teaching content and styles are defined. Educational contents to be added to the library of the institution later on are prepared by the Educators and presented to the Learner. The training plan is put into practice and the evaluation processes are completed. Successful learners are graduated. Learners' deficiencies found to be unsuccessful are analyzed and the missing topics are presented again. If they are successful in the evaluation process, they are graduated.

This methodology has been developed in a program to provide Digital Transformation in the training system of a Law Enforcement Agency, which carries out most of its operational activities at sea and in the air. During the development phase, interviews were held with learners, instructors, and managers, literature research was conducted, and innovative models were developed. In this process, information about the culture and future vision of the institution was understood, and the studies were completed considering this culture. In light of this information gathered through meetings and interviews, the system architecture proposed in this project was designed with the outlines and made ready for implementation. While preparing the model, has been prepared by making it suitable for the institution, taking into account the internal functioning of the subjects.

When the current situation of the institution is analyzed, it is seen that the number of experienced personnel number is low and the number of expert personnel at the intermediate level is very few. This situation revealed that the new personnel who graduated from the institution’s educational activities could not benefit from the master-apprentice method, which should be used a lot throughout their working life. A methodological system that changed the role of the instructor was developed and

presented to the institution to close the gap in personnel at the intermediate level and to ensure that the information needed by the new personnel is transferred.

While the aforementioned modeling and developments are being made, the latest e-learning systems, character-analyzing structures, algorithms that will provide personalization in learning paths, and newly emerging technologies/platforms have been examined and a holistic structure has been designed.

As one of the most important topics, it has been understood that in the design of the system, the learner should be examined anthropologically and sociologically. In addition, the cognitive, social-emotional, and physio-physical characteristics that each person is anthropologically predisposed to are emphasized, and the hierarchy of rank and title in the law enforcement agency is taken into account. Thanks to these categorizations, the taxonomic resolution of the training that the learner should receive from the first registration to the system until the end of his working life is increased.

The process will begin after the learner who has been accepted to the institution for education is registered in the system with his/her personal information proceeds as shown in **Figure 11**.

In order to learn the learner's learning and assessment and evaluation styles, two character tests are taken, cognitive and non-cognitive. In cognitive measurement, the memory types are investigated, and cognitive measurement output is obtained. In some studies, it has also been observed that the outcome of the tests is left to the learner's judgment. (Felder, n.d.) Considering the holistic approach of the tests in our study and the hierarchical characteristics of the institution, it was considered more appropriate for the Educator and the Institution to follow this process and change it if necessary, and the platform was designed in this way.

In the non-cognitive measurement part, the Myers-Briggs Character Type is practiced. In this section, as can be seen in **Figure 11, Figure 12 and Figure 13**, character analysis is examined under eight main character features and in correlation with sixteen

subheadings, and learning and assessment strategies for each character category are defined in the subheadings.

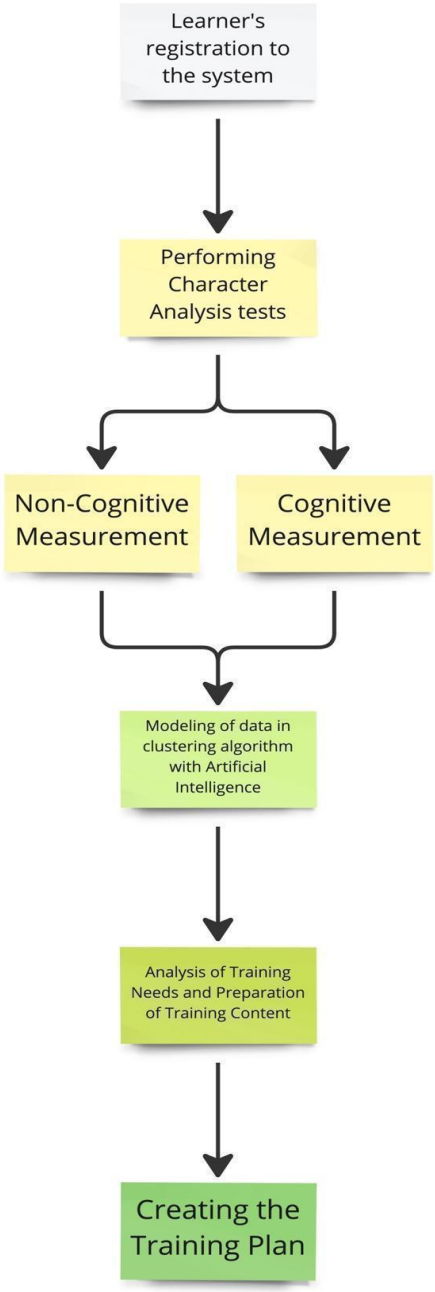

Figure 11. Learner's Proposed Workflow

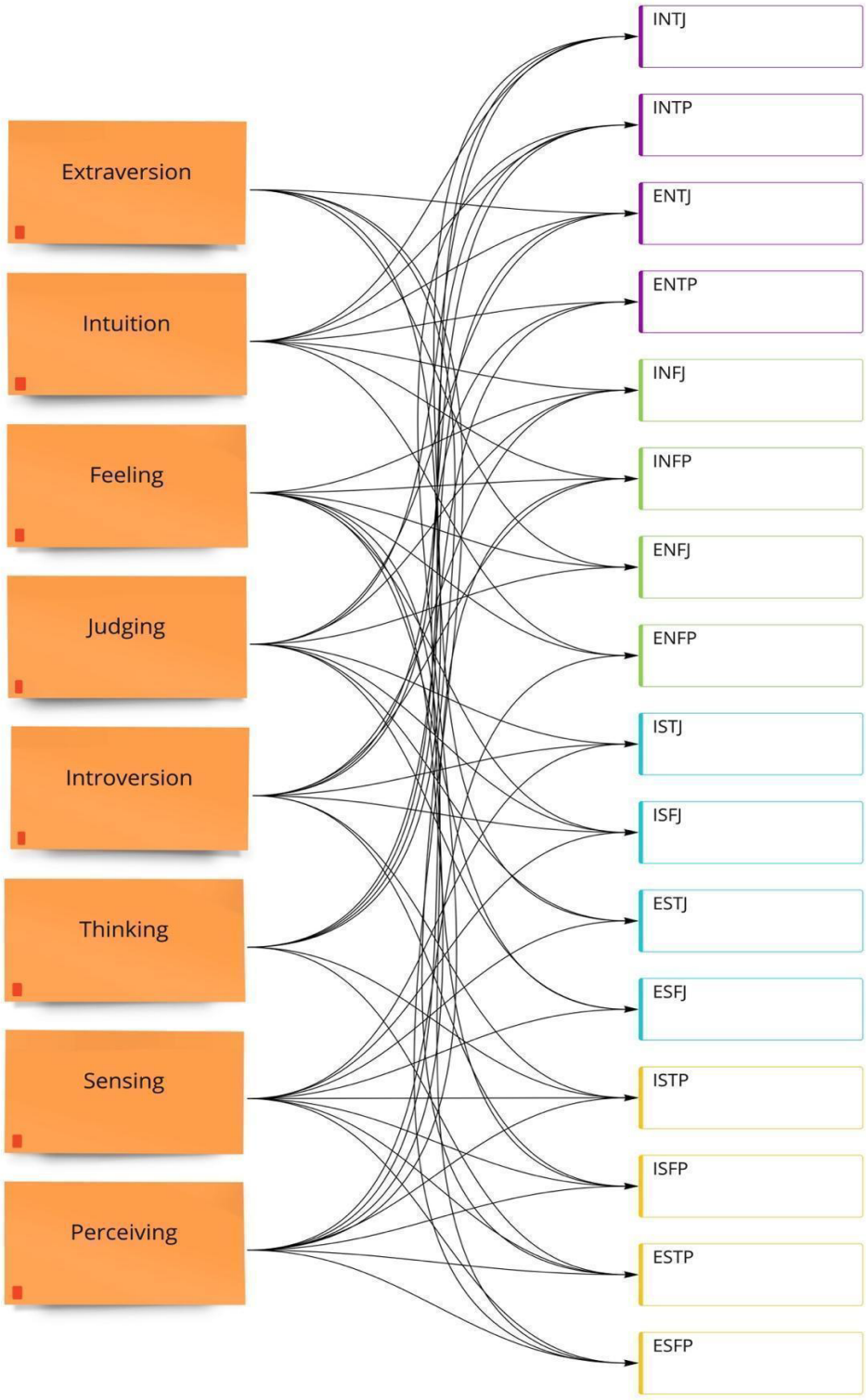

Figure 12. Myers Briggs Representation

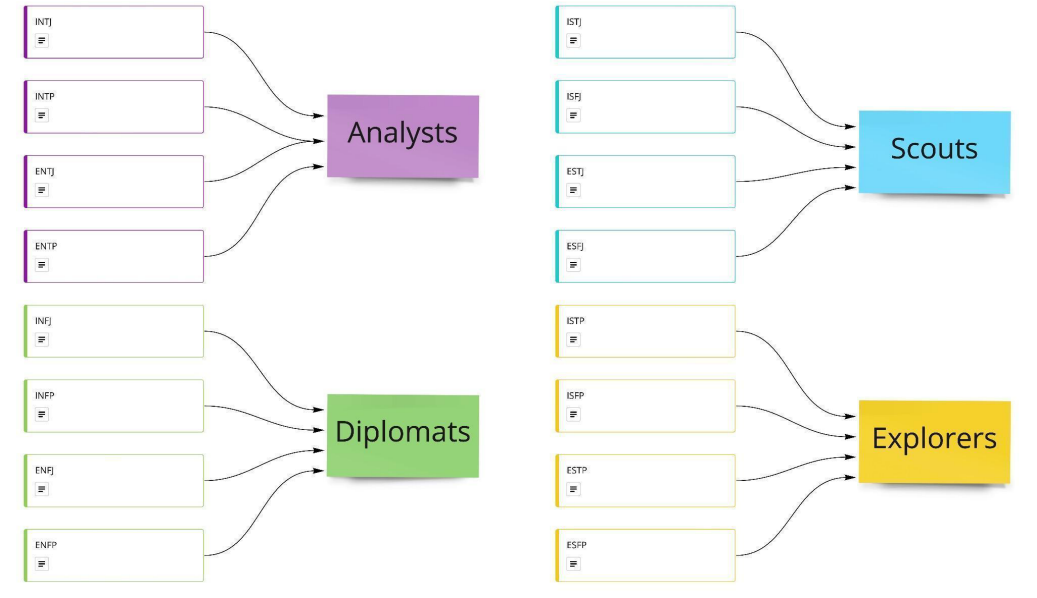

Figure 13. Division of Character Types

Considering that the initial data will be limited during the transition to the proposed system in this section, and aiming to process all the data to be obtained as much as possible, the unsupervised learning method has been preferred. By examining databases and the diversity in data in the medium and long term, a transition to supervised learning methods can be made. It is considered that this transition in the future will provide the system with the ability to make more detailed predictions about learners and provide training plans to be presented with increased precision.

With the clustering algorithm approach, the learner's measurement outputs are compared with the information of other learners, and model training is done in the artificial intelligence algorithm. K-Means Algorithm, one of the unsupervised learning methods, was preferred. This algorithm has been preferred because it is a fast method that can adapt to large data sets and adapt to new samples.

According to variables provided such as the learner's previous knowledge, measured cognitive and non-cognitive outcomes, and rank-title status, a training needs analysis is performed, and a training plan is prepared. While the training needs analysis

is being made, the career direction expected by the institution from the personnel plays a major role in the training to be given on the platform. Due to the differences in subjects that need to be specialized according to variables such as rank and title, these subjects had to be considered.

Another issue is the preparation of training content. Personalized content must be integrated into the training plan without departing from the rank variable link mentioned earlier. In this section, the density of the library, which contains the training content that the trainers have prepared before, will help artificial intelligence fill the gaps. If there is no content in the library that is suitable for the learning and assessment-evaluation characteristics of the learner, the system will have to offer the traditional face-to-face education model.

Another issue with learning methods is optimizing course durations. Course durations are organized by including the analysis of learning competencies that have been analyzed before. In case of remaining time, the educational content that is expected to take the learner to a higher level is presented. This progression makes it easier for the learner to prepare for the process in front of him on the learning path and aims to reach a more holistic vision. As can be seen in **Figure 14** and **Figure 15**, learning competency analyzes of Learner 1 and Learner 2 were made and different course durations and methodologies were defined based on the similar course list.

To make personalization while determining the education styles and creating the education content, as stated before, personalized planning is made thanks to the outputs obtained from the character analysis. At this point, categorization has been made by taking inspiration from the learning styles defined by (Myers et al., 1998). (Carrell & Monroe, 1993) concluded that positive correlations would have positive returns.

This categorization is divided into four categories: Analysts, Explorers, Scouts, and Diplomats to get started quickly without waiting for the artificial intelligence to get enough data. (*Roles Defined | 16Personalities*, n.d.) While making these definitions, detailed teaching methods that are planned to be used when the database reaches the

desired maturity in the future are determined. Similarly, evaluation strategies were determined by this method followed.

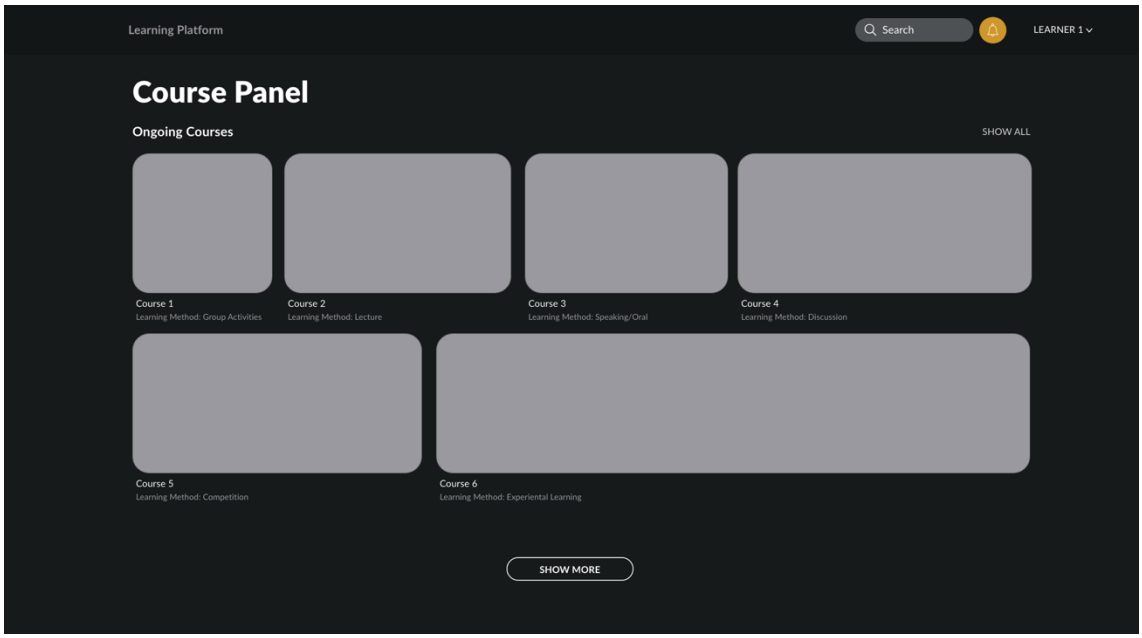

Figure 14. Interface Use Case for Learner 1

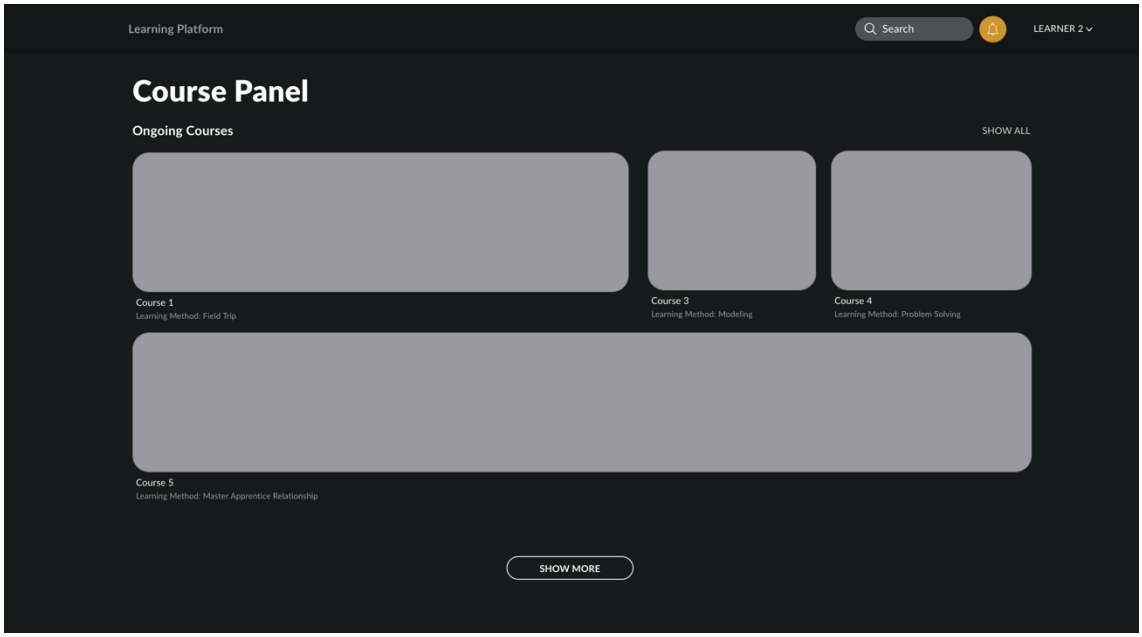

Figure 15. Interface Use Case for Learner 2

In the grouping of Analysts, ENTP, ENTJ, INTP, and INTJ characteristic types can be examined and the following points represent their characteristic features in **Figure 16**. In this group, we can see these people have the ability to process information rapidly and practically integrate to their environment. It is evaluated that people with this character type take part and work in teams, and it is seen that the following training strategies are most suitable for them (**Figure 17**). Assessment strategies for Analysts are considered to be the most appropriate in a way that will support their ability to express the information they have learned quickly and interact with other students when appropriate as shown in **Figure 18**.

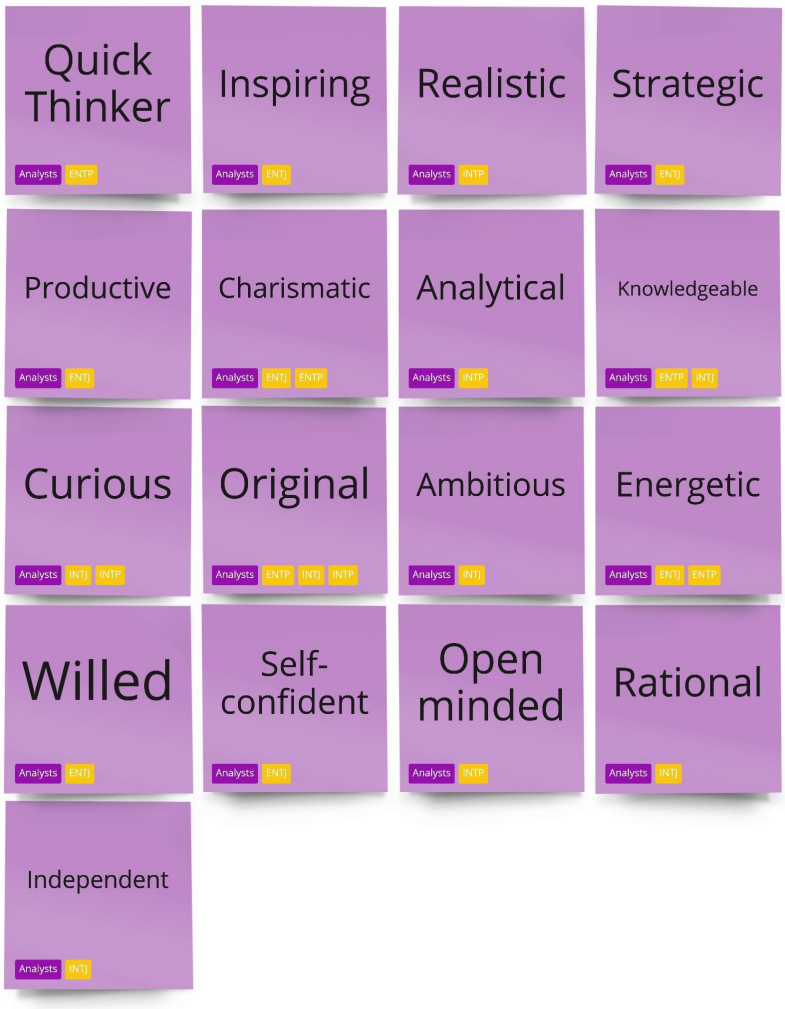

Figure 16. Analysts Characteristic Features

Figure 17. Analysts Learning Strategies

Figure 18. Analysts Evaluation Strategies

ISTJ, ISFJ, ESTJ, and ESFJ characteristic types can be examined in grouping the Scouts and as can be seen in **Figure 19**, the main characteristics of the people in this group are revealed. In the learning strategies of this group, where communication and human skills are more prominent, it is thought that there are features such as taking part in the educational environment, as in the Analysts, and mentoring and education models that are far from structured where deemed appropriate. All learning strategies are grouped in **Figure 20**. When the assessment strategies are studied for Scouts, it is evaluated that methods such as traditional learning, master-apprentice method, and educational games are articulated. The similarities with the Analysts group studied earlier are striking. Detailed work can be viewed in **Figure 21**.

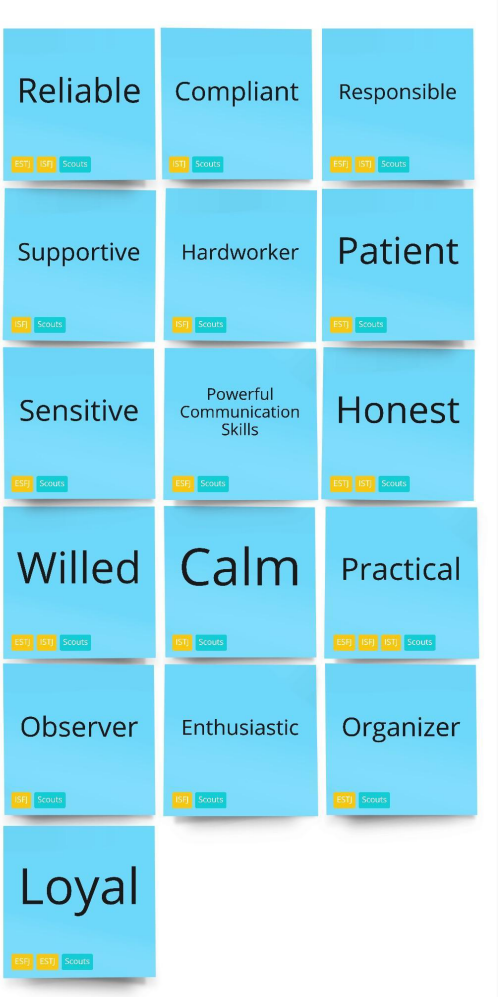

Figure 19. Scouts Characteristic Features

Figure 20. Scouts Learning Strategies

Figure 21. Scouts Evaluation Strategies

ESFP, ESTP, ISTP, and ISFP character headers are examined in the Explorer group. Character traits are shown in **Figure 22**. Supporting the topics such as prioritizing and observing, which discusses the character traits, with emotional elements bring teaching techniques such as the Emotional Approach and Experiential Learning to the fore. Explorers are similar to the Scouts group. (**Figure 23**) In evaluation strategies, it is considered that there should be methods such as utilizing newly learned information, creating content such as brochures and even preparing case studies, unlike other groups. (**Figure 24**)

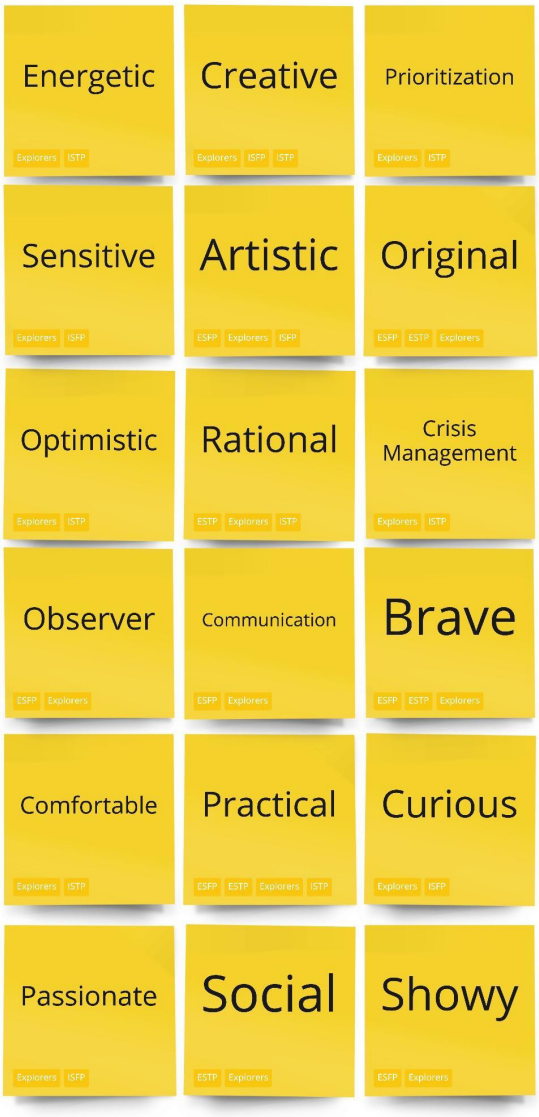

Figure 22. Explorers Characteristic Features

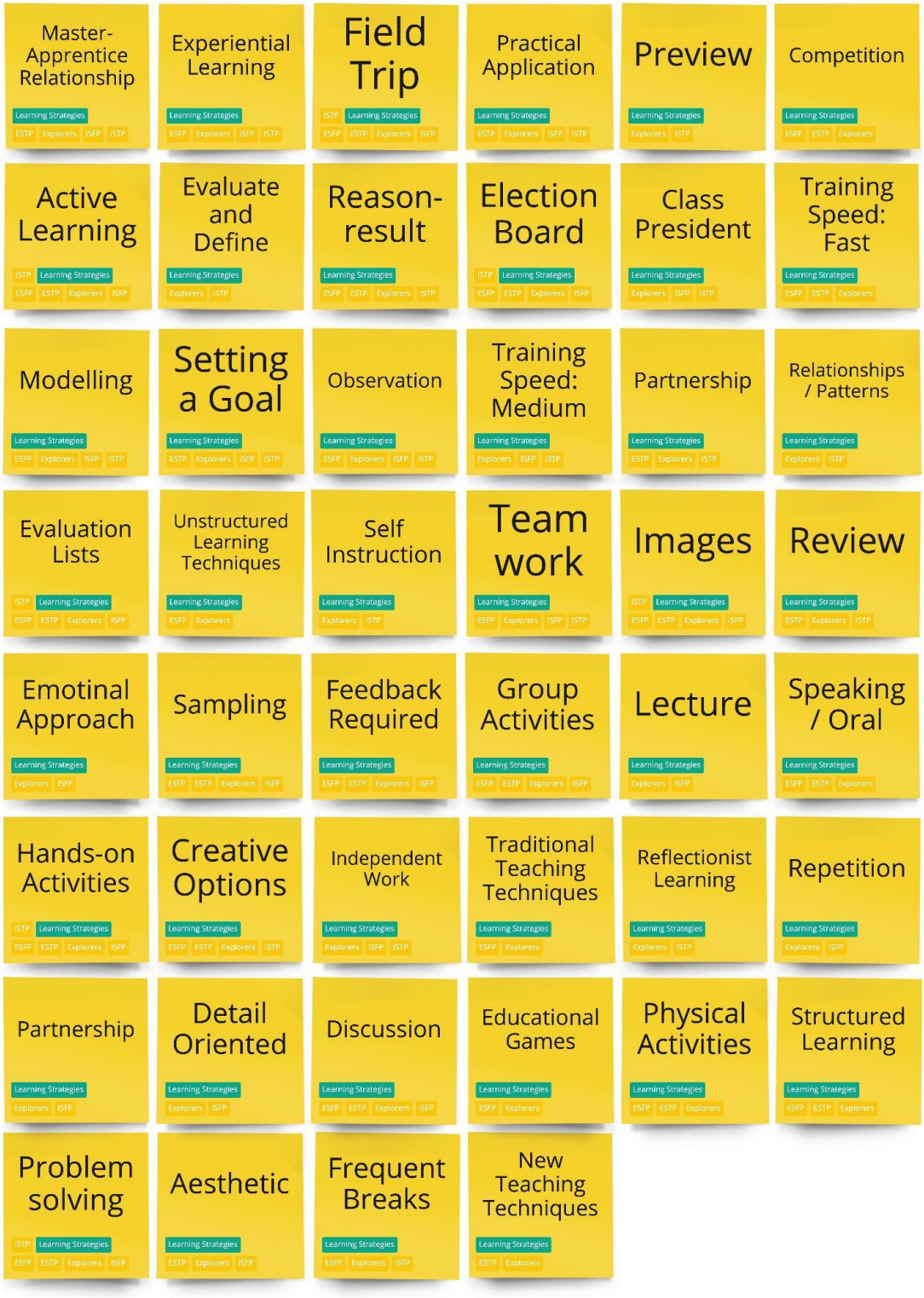

Figure 23. Explorers Learning Strategies

Figure 24. Explorers Evaluation Strategies

Diplomats will be studied as another group and its members are ENFJ, INFJ, INFP, and ENFP. This group is defined as people who are open-minded and love what they do (**Figure 25**). Due to their characteristics, they can give instructions on their own, work in a master-apprentice model, and approach the most appropriate learning environment when they receive feedback from their peers (**Figure 26**). Activities such as brainstorming, using technology, preparing simulations, and generating questions are among the distinctive features of this group. The detailed list in **Figure 27** was prepared as an evaluation tool.

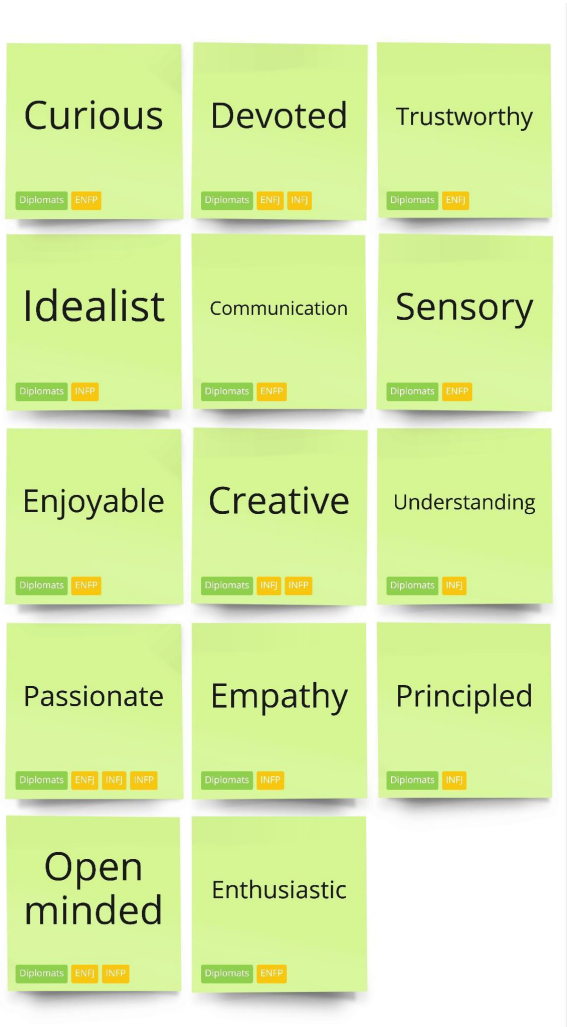

Figure 25. Diplomats Characteristic Features

Figure 26. Diplomats Learning Strategies

Figure 27. Diplomats Evaluation Strategies

By transmitting the information of the learners to the educators on the system, the instructors will be able to plan their lesson planning, content management, training, and measurement-evaluation studies according to this information.

As the use of the system continues, thanks to the data collected and the training content prepared by the educators, a rich library will be formed, and a higher level of consistency will be achieved by transferring information and behavior changes to the next generations.

Instead of teaching the same lesson to different students every year, as in traditional ways, the educators were assigned a new task. With the educational content to be prepared on the education platform, the learners are expected to reach a level of knowledge and form the basis of the pieces of information that they normally need to listen to in the lecture.

The previously collected data is of great importance in terms of presenting the educational content to be provided to create this level of knowledge. Personalization is aimed to present educational content in a way that appeals to the interest and attention of the person.

As another dimension of personalization, the necessity to include the career progression that the institution wants from the staff/learner has emerged. Considering the level of expertise targeted for the future personnel as a variable in the recommendation algorithm, the training content is planned to be prepared as a medium-long term rather than short-term. If the institution changes its career goal according to the learner's performance in the assessment methods, a dynamic infrastructure has been considered where the algorithm can update the training content and learning path of specific personnel.

After the learners who reach the personalized content on the education platform have completed their progress on the platform, they will work with the educators on the understanding of already studied information in more detail, based on the learning strategies (determined according to their characters). Also there are studies researchers working on MBTI-based Learner ontologies aim to help students with learning activities on the web. (Talhi & Behaz, 2017) In this part of the proposed methodology, it is taken into account that the institution may have problems such as staffing or timing. If this is

the case, learning and assessment strategies that appeal to the majority will be preferred, taking into account the character analysis of most of the learners.

The methodology proposed here offers the possibility of personalization by considering many variables about the learner. This customization environment is based on cognitive and non-cognitive metrics and an artificial intelligence approach, with a high level of accuracy in learning paths, training content, and future career development for the institution's staff. Apart from the training that the person receives only when he/she joins the Institution, long-term development is aimed and the foundations have been established to support lifelong learning.

5.CONCLUSION

In this thesis, the history of education and the modern systems used today have been researched, and useful parts that need improvement have been determined. At the end of the literature review, it was seen that the studies related to education are carried out in a particular field of specialization in a fragmented way. The successes achieved within the framework of the field of expertise studied are similarly divided. For this reason, it is necessary to conduct a study that considers education as a whole.

As a result of the studies carried out within the scope of the Education Transformation Program of an institution with a Law Enforcement Force, it has been observed that the number of experienced personnel in the institution has decreased and there are problems in the transfer of knowledge by the master-apprentice method. It has become necessary to carry out studies using modern approaches in education for new entrants and intermediate staff.

In this thesis, in which technological developments and pedagogical approaches are used, learners are provided with personalized educational content with their own character types and learning strategies, independent of time and place.

It was designed to collect information about the learners by applying tests while forming their learning and assessment strategies. In these analyses, two approaches were focused on cognitive and non-cognitive tests. In the cognitive measurement part, it has studied which type of memory the learner can provide more effective learning. As an example visual memory, and spatial memory can be given. In a study that strengthens the belief that the cognitive model and learning styles are independent, it is emphasized that there are mutually supportive issues. (Sadler-Smith, 2000) In the non-cognitive measurement, the Myers-Briggs test was applied and the character type of the learner was

examined. Within this test, learning and assessment strategies were defined in terms of character types divided into 4 main titles.

In this thesis study, in which we assign a new mission to the educator, it is evaluated that role is not a person who constantly teaches the same subjects to different students and that role evolves into a mentorship who implements learning strategies with learners. In order to implement these learning strategies, a platform design is recommended that will enable learners to access information on their own. The training contents to be created and presented on this platform will be detailed within the information collected about the individuals and learning paths will be created. A topic that should be considered here is what the Institution expects from its personnel in terms of career development. This career development expectation is designed as one of the variables in the artificial intelligence algorithm in which the training content is prepared.

With this platform design, which has been prepared with the outlines of the Institution, pieces of training will be offered for each personnel of the Institution with approaches such as personalized training paths and lifelong learning

6.FUTURE WORK

In this thesis, in which we tried to deal with education holistically, we touched upon subjects such as character analysis, artificial intelligence, personalized education path, and content. When we consider future studies, detailing the studies in these mentioned areas and adapting them to newly discovered technical and pedagogical information may increase the benefits of the system.

The analyzes made in this study mostly covered Learners and educational content. In a published study, it was seen that the character analysis study was also focused on the Educators, and it is considered that progress in this subject in future studies will increase the quality of education in a positive way. (Grindler & Stratton, 1990) In additon, some studies have been conducted on the learning styles of teacher candidates. (Cano & Garton, 1994) Another important measurement is the online behavior map prepared using the Felder-Silverman Learning Style Model, and the structure in which the learner's behavior in Learning Management Systems is mapped. With this structure, it is foreseen that an alternative measurement that can be built on the platform proposed in the thesis study can be studied. (Liyanage et al., 2014)

The article, which was studied as a review, focused on making emotional evaluation analysis with the help of bioinformatics. Other studies have been mentioned in the relevant parts of the thesis on this subject and it has been stated that there are statements in the literature on the importance of deepening these studies. It will be very important for learners to carry out studies in the field of emotional assessment in future studies. (Khamparia & Pandey, 2020)

The system can be improved by data mining thanks to the data library, which will be enriched when the data recommended to be collected about the learners reaches a

certain maturity. It can be prevented from starting the artificial intelligence algorithm from a more easily operable state due to the immaturity of the data.

It is of great importance that learners can dynamically integrate their knowledge in any institution where they have studied before.

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