A Systematic Literature Review on AI Algorithms and Techniques Adopted by e-Learning Platforms for Psychological and Emotional States

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A Systematic Literature Review on AI Algorithms and Techniques Adopted by e-Learning Platforms for Psychological and Emotional States

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***Abstract*—Computers are becoming increasingly commonplace in educational settings. As a result of these advancements, a new field known as CEHL (Computing Environment for Human Learning) or e-learning has emerged, where students have access to a variety of services at their convenience. Using an e-learning platform facilitates more efficient, optimized, and successful education. They allow for personalized instruction and on-demand access to relevant, up-to-date material. These e-learning strategies significantly impact learners' emotional and psychological states, which in turn affect their abilities and motivations. Because of the learner's physical and temporal detachment from their tutor, encouraging learners can be challenging, leading to frustration, doubt, and ambivalence. The learner's drive to learn will be weakened, and their emotional and psychological state will be badly impacted as a result, both during and after the learning session. This research aimed to learn about the methods currently used by research facilities to analyze human emotions and mental states. The findings reveal that only e-learning has been used in education and other fundamental technologies, including machine learning, deep learning, signal processing, and mathematical approaches. A wide variety of e-learning-focused real-world applications make use of these methods. Each study subject is explained in depth, and the most frequently used methods are also examined. Finally, we provide a comprehensive analysis of the prior art, our contributions, their ramifications, and a discussion of our shortcomings and suggestions for future research.**

***Keywords*—Psychological states; emotional states; e-learning; online platforms; solutions**

I. Introduction

Technology has become an integral part of our lives in the twenty-first century, prompting a reevaluation of fundamental beliefs on the part of professionals, educators, and students in order to re-design or re-engineer the educational and training infrastructure. In addition, these technology tools play a crucial role in enabling students and educators to reap its many benefits [1]. The education community is left with the difficult task of increasing the number of creative and original graduates while keeping costs down by applying cutting-edge technical and ecological methods [2]. This process has been a deliberate evolution from the traditional Gurukula methods to the present day, when the digital world has invaded the realm of education and revitalized the student body by providing them with a dynamic, interactive, and electronic environment on which to study. There have been many shifts in the previous few decades, and the meaning of "e-learning" had to adapt. Web 1.0 (the web of knowledge), Web 2.0 (the web of communication), Online 3.0 (the web of interaction), and now Web 4.0 (the web of integration) are all instances of the great progression seen in the world of the web.

II. Literature Review

Due to the accessibility of new technologies and their capacity to generate and maintain stakeholders, e-learning has risen to the fore in today's ever-changing and dynamic online environment. The term "e-learning revolution" describes the widespread adoption of technological aids to education. To promote safe, cooperative, constructivist, and long-term knowledge exchange, the education sector and its allies hope to usher in an era of paperless learning made possible by technological advancements. As the pace of the technical education revolution quickens, it becomes more difficult for stakeholders to keep up with their commitments [2].

No concerns or pressures were placed on either the educational institutions or the students due to the annual 15.4% increase in e-learning worldwide [3]. However, this study was undertaken during COVID-19, and a lot has changed since then. As a consequence of worldwide limitation measures established to curb the spread of COVID-19 [5], more than 60 percent of students throughout the globe today get the majority or all of their education online, including lectures and a variety of assessments on numerous platforms.

A. Psychology and Emotional States

Psychological and emotional health is crucially important in many aspects of daily life. A person's emotional state is the overall emotional tone of their personality (especially with regard to pleasure or dejection). While the nature of a state may change over time, the concept of a "psychological state" refers to a more stable mental situation.

1) Types of emotional states: Researchers in [15], have identified 27 distinct human emotions: awe, admiration, amusement, anger, calmness, confusion, disgust, empathy, excitement, fear, horror, enchantment, entrancement, joy, nostalgia, relief, romance, sadness, satisfaction, sexual desire, and surprise. Moreover, Fig. 1 shows how multimodal settings and sources might identify an individual's emotional state. In addition, Table I outlines the various sorts of feelings that are significant to the surroundings, which gives concrete instances of how each of the seven emotion types is evaluated and how they tend to act.

TABLE I. ENVIRONMENTALLY RELEVANT EMOTION TYPES [4]

Emotion Type	Appraisals	Action-Tendency
Self-condemning Emotions (Guilt, Shame, Embarrassment)	Own Norm violations	Correction (e.g., repair the environmental damage)
Other-condemning Emotions (Anger, Disgust, Contempt)	Others' norm violations	Punishment (e.g., punish those responsible for environmental destruction)
Self-praising Emotions (Pride)	Own positive norm deviations	Support oneself (e.g., in-group favoring pro-environmental behavioral intentions)
Other –praising Emotion (Elevation, Admiration, Awe, Being Moved, Gratitude, Love)	Others' positive norm deviations	Support the source (e.g., protect nature)
Other-suffering Emotions (Compassion, /Empathy, Emotional Contagion)	Other's suffering	Help those in need (e.g., victims of environmental destruction)
Threat-related Emotions (Fear, Anxiety, Hopelessness)	Anticipated negative consequences	Escape (e.g., fleeing from climate change)
Hedonistic Emotions (Joy, Pleasure, Amusement)		Reinforcement (e.g., enjoying car driving predicts car use)

2) Types of psychological states: The distinction between the two perspectives is: Extraversion: Libido that is directed outward is known as extroversion [7]. With an extrovert, the subject's interest in the object shifts in a positive direction. To be introverted is to direct one's libido inward toward the subject's own core. This fact conveys the nature of the subject-object relationship. The focus shifts away from the item and back to the subject. These four roles include: There are two senses: Synergy of Sensation and Intuition Separate evaluations: Feelings and ideas In particular, it is important to note how the perceiving functions can be effective for the diagnostic a subjective process to get in relation to patients and for creativity, while the thinking and feeling processes are related to rationality and can well serve to scientific ideas. Learning styles and personality types in medical school 5 Understanding the different personality types can help provide insight into how pupils' learning styles come into play. Whereas psychological types are highlighted in [6] and scientist pinpoints emotions in [15] also plays a significant role. Emotional and psychological visualization in e-learning environments shown in Fig. 2.

This psychodiagnostic test proposes highlighting four types of learning styles:

1) Concrete experience: In-the-moment reflection and problem-solving that prioritizes intuitive, emotional, and visceral processes over logical, scientific ones. The best learning environments for people with such strong relational and social abilities contain minimal organization, direct participation in real-world challenges, and a willingness to share personal information and perspectives.

2) Reflective observation: stressing observation and comprehension over application, with a tendency to grasp the meaning of ideas and circumstances. Subjects who exhibit this form of learning are experts at identifying causation and deducing consequences. They exhibit composure, impartiality, and independent judgment by seeing the same problems from diverse perspectives.

3) Abstract conceptualization: skill in working with ideas and concepts in accordance with logical principles, using mostly rational thought rather than emotion in the learning process. There is a predisposition toward quantitative reasoning, planning, and design in these fields. Precision, discipline, analysis, and the organic arranging of conceptual systems are expressed as values by these topics.

4) Active experimentation: propensity to take action to influence reality (regarding situations or individuals). His philosophy emphasizes doing as opposed to thinking, which compels him to approach life with a strong dose of pragmatism, placing importance on how things work rather than their intrinsic worth or ultimate significance. People who have this skill can influence their environments to get what they want. These findings have the potential to illuminate medical treatment that takes into consideration patients' own awareness of their own preferences in learning styles, personality traits, and so on.

Fig. 1 and Fig. 2 depict the visualization of emotional recognitions in human from different sources.

B. Learning Types

Technology-based education can be referred to by a variety of names, including e-learning, m-learning, and d-learning [1]. e-Learning can replace conventional schooling or work in tandem with it (e-learning m learning). e-Learning goes under many names, including e-education, distant learning, and online education.

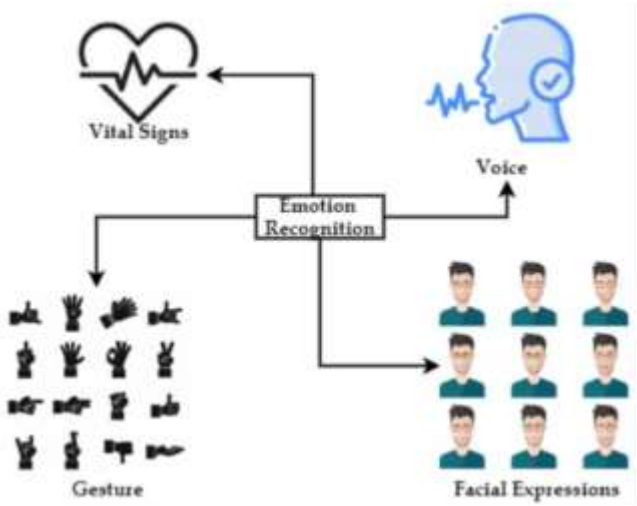

Fig. 1. Human emotional recognition of different sources [60].

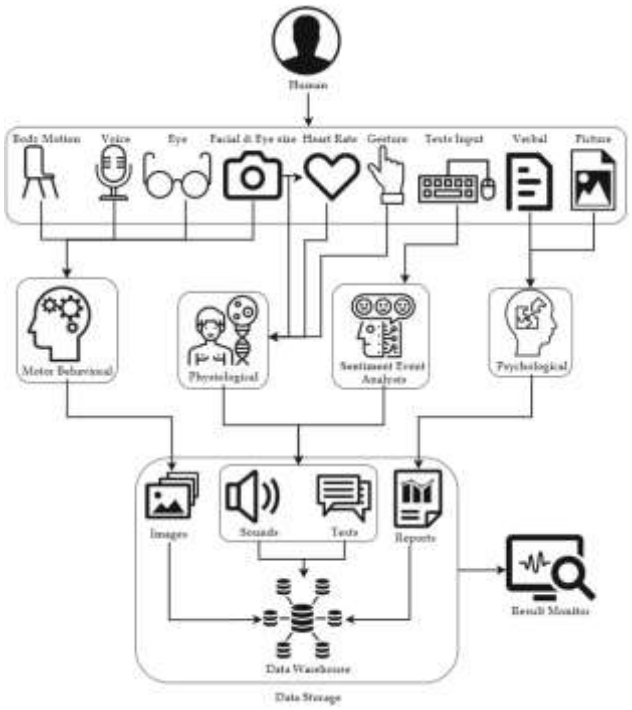

Fig. 2. Visualizations of emotional cartography for e-learning heuristic multimodal approaches [60].

The authors describe e-learning in [3, 8] as "the wide variety of applications and processes that leverage available electronic media and resources to offer vocational education and training." According to research [9], e-learning is "the use of multiple web-based, web-distributed, or web-capable technological instruments for education." Increasing numbers of individuals are becoming aware of the multiple advantages of e-learning [10], which include mobility, accessibility, and cheap cost. Considering these advantages, education may become a lifelong pursuit. According to [11], having limitless access to lectures assists students in retaining the essential information for formal education.

Higher education institutions are also adopting e-learning technology to expand the learning community and facilitate the flow of knowledge between students and teachers [12]. Due to its convenient scheduling, e-learning has the potential to attract more students who are otherwise unable to pursue higher education because of their other responsibilities at home or at work. In fact, this benefits not only the students, but also the teachers.

The founding of the National Center of e-learning and Distance Learning (NCEDL) in the Kingdom of Saudi Arabia in 2005 [13] involves at least nine institutions. This crucial role was created to enhance the overall e-learning experiences of students in schools by adopting and applying the finest e-learning techniques from across the globe [14]. According to the National Center for e-learning and Distance Learning, the NCEDL has participated in various e-learning system initiatives, including the Learning Portal, which gives students remote access to online learning resources and offers instructors training in the use of e-learning technologies.

To further encourage educational institutions to embrace e-learning, the center has created the Award for Excellence in e-learning, for which around 42 institutions are now competing. Since its inception in 2011, a large number of students and graduates have enrolled in courses at the Saudi Electronic University (SEU). Since then, King Abdelaziz University has developed several technological tools to enhance its e-learning system, including the Learning Management System (LMS), which provides access to over 16,000 e-books and other online academic materials for freshmen and juniors [14]. In addition, Tables II and III outline the kinds of e-learning systems, their major components, and their definitions.

TABLE II. E-LEARNING SYSTEM DEFINITION PRIOR RESEARCH [1]

Types of E-Learning System	Prior Research	Definition
Blended Learning	[16,17,18,20]	A mix of traditional and online classes.
Flipped Classroom	[17,20,21]	Focus on the individual learner by distributing preparatory readings and videos online.
ICT Supported Face-to-Face Learning	[22,23]	The integration of ICT with conventional teaching methods.
Synchronous Learning	[17,21,24]	A real-time interaction distance learning.
Asynchronous Learning	[17,21,24]	Non-real-time interaction distance learning.

TABLE III. E-LEARNING CRITERIA AND PRIOR RESEARCH [1]

Factors	Prior Research
Student Characteristics	[22,25-27]
Instructor Characteristics	[10,22,25-27]
Learning Environment	[10,22,25,27]
Instructional design	[10,22,25,27]
Support	[10,22,25-27]
Information Technology	[19,22,29,25,26,28]
Technology Knowledge	[10,22,25-27]
Course	[10,18,19,22,25,27]
Level of Collaboration	[10,19,26,27]
Knowledge Management	[10,19,26,27]

Researchers in [1] claim that e-learning, focusing on the online, is utilized in educational settings to teach and learn about a wide variety of electronic technologies (e.g., television, radio, CD-ROM, DVD, mobile phone, Internet, etc.). According to the definition, e-learning encompasses studying with web-based training facilities, such as digitally collaborative and technology-assisted distance learning offered by virtual universities and classrooms. It is possible to define e-learning innovation as any form of e-learning seen as a novel by its target audience, whether it be a new piece of technology or a new approach to teaching.

It's undeniable that e-learning has had and will continue to have a significant impact on educational progress around the globe. It also presents exciting new possibilities for developing countries eager to advance their educational infrastructure. In

addition, it facilitates the transition of the next generation of educators to the pedagogies of learning made possible by the digital age technologies. It's also been said that the internet and other modern technology are used to help education and training in ways that go well beyond the traditional classroom.

e-Learning, or education delivered by electronic means such as the Internet, CDs, DVDs, and mobile phones, arose in the 1980s as an alternative to traditional classroom instruction. Other benefits of online education have contributed to its rapid expansion in recent years. The following are some definitions of e-learning. e-Learning uses computer network technology to convey knowledge and instructions to humans, typically over the internet.

- The term "e-learning" refers to a wide range of uses and procedures, including using many online multimedia content delivery systems, including the World Wide Web, Internet video SD-ROMs, television, and radio. All of these resources are available to students to educate themselves.
- Web-based education, computer-based education, virtual classrooms, and digital collaboration are all examples of e-learning. Content can be distributed in a variety of ways, such as on the web, intranets, wide-area networks (WANs), CDs, DVDs, radio, television, satellite, and even cassette tapes.

"The experiential aspect of online education involves motivation, interest, experimentation, and repetition.

As indicated, the four significant e-learning perspectives illustrated in Fig. 3 are equally important in making electronic devices conceivable as tools for the delivery of educational institutions, and they are interconnected. The cognitive viewpoint analyses the function of the brain and its processes in learning from a logical standpoint. Smart learning systems and adaptive learning technology can be used to optimize learners' progress in an e-learning environment based on cognitive pedagogical models; similarly, virtual (simulated) worlds and other structured learning environments can facilitate students' comprehension of the subject matter.

Social media and other collaborative platforms can be used to facilitate conversation and learning through observation and imitation, and students can be coached through the use of the system in a short amount of time.

The emotional perspective considers the feelings of the learner and their environment. The researchers highlight several emotions as closely linked to integrating cognition, motivation, and behavior. These include pride, frustration, relief, resistance, fear, expectancy, hopelessness, anxiety, confidence, a complex, and jealousy.

Focus is placed on the skills and behavioral outcomes of the learning process from a behavioral viewpoint, emphasizing role-playing and practical application in real-world scenarios. Central to the contextual view is the learners' contacts with others, their discovery of the importance of collaboration, and the impact of their peers.

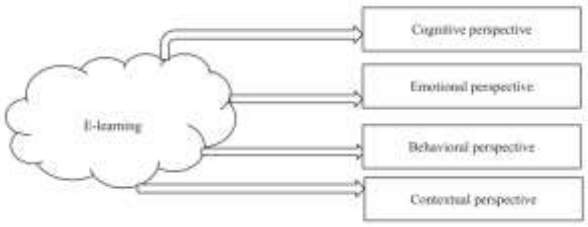

Fig. 3. Fundamental perspective of e-learning [1].

Table IV, illustrates the advantages and disadvantages of e-learning which focuses on the advantages of adopting it and as well as facing challenges by having it.

TABLE IV. ILLUSTRATES THE MOST COMMON ADVANTAGES AND DISADVANTAGES OF E-LEARNING [1]

Advantages	Disadvantages
• Easy Access, individual instructions , different, flexibility, motivating and interesting, self-learning and self-improvement, feedback and evaluation, efficient and cost-effective strategy	• Required knowledge and skills, lack of equipment, isolation, missing social contact, negative attitude, technical defect, stressful and consumed more time, lack of co-curricular activities, lack of teacher training program

C. Challenges in e-Learning

Some difficulties arise from mediating technology [2] by putting forth consistent work overtime is the biggest obstacle to creating a learning company. Getting people interested in a new concept is straightforward, but consistently implementing it is far more challenging. When individuals are motivated and ready to learn, course content and organizational policies that are strategically aligned work together to use existing talent to accomplish corporate objectives. Administrators, instructors, and students of e-learning encounter a variety of hurdles. In the Web 0 era, students experienced a range of difficulties, including a fear of technology (7.24%) and bandwidth issues (3.0%); now, students suffer a lack of support from senior management (3.6 percent).

The current generation of e-learners has a new difficulty: getting businesses to recognize their degrees earned online. Web 0 implementation was problematic due to learners' epistemic beliefs and bandwidth availability. In seven pieces, educators from different generations of online education express their greatest worry about students' lack of willingness to learn. A designer's work is difficult due to the constant developments and upgrades of technology.

Dropout rates (11.97%) are a big obstacle for implementers. Still, dispersion in learner requirements (7.24%), synchronization of the most recent design and technology (5.07%), and unsuitable structural design (3.2%) have been significant issues for designers. 7.99 percent of firms described dealing with cultural opposition to be challenging. It has been observed that resistance to change is lessening as the Internet evolves. e-Learning stakeholders prioritized access to sophisticated technology and bandwidth for continued online course delivery (Diffusion of Innovation Theory) and the learning community's acceptance of online learning (Technology Acceptance Model).

The knowledge gap between the intended audience and the rest of the population filled by taking serious efforts. These efforts were made to make e-learning extremely interactive (Engagement theory). By keeping the goal of the learner interested and motivated (ARCS Theory). In today's world, students need to be engaged from the very beginning of a course if they are to remain motivated throughout its duration. This places a premium on the designer and implementer creating highly relevant, interactive, and individualized courses. One of the most important aspects of successful e-learning [2] is using the most appropriate and up-to-date technology for delivering the course.

This paper will adhere to the following structure. In Section III, we see an example of a research methodology with three major stages: review planning, review execution, and review reporting. Section IV presents the discussion. In Section V, the results of the chosen articles, study goals, standard processes, data formats, and performance approaches are discussed. Section VI discusses existing research, their contributions, managerial implications, and a conclusion that includes limitations and potential study pathways.

III. Research Methodology

This Systematic Literature Review (SLR) methodology was based on the ideas presented in [30, 31]. Research is conducted in three distinct stages. As part of this preliminary preparation, we will discuss the steps of identifying research subjects, developing review procedures, and checking their accuracy. In the second, we discuss finding and choosing relevant research; in the third, we present the steps involved in writing and validating the SLR; and in the fourth, we discuss the process of information synthesis. Fig. 4 shows the progression of the three phases.

A. Plan Review

In this first stage of the research process, the relevant searching strategy is outlined alongside the key research questions and the establishment of review methods.

- *RQ #1:* What are the types of emotional and psychological states found and used in different types of learning?

The study's goal is to establish the utility of emotional and psychological states detected in the learning environment by organizations such as education sectors, development and training centers, and researchers for their models, frameworks, or applications. Nowadays, e-learning is being used, which has some emotional and psychological effects.

- *RQ #2:* Which type of algorithms and techniques admitted for the emotional and psychological states in e-learning platforms?

This study seeks to identify the approaches businesses, industries, and centers use in learning platforms such as online or e-learning and face-to-face learning.

- *RQ #3:* How emotional and psychological states observed/examined in e-learning platforms?

This study's subject is related to the algorithms, techniques, or models that are implemented in e-learning or face-to-face platforms, as well as identifying and evaluating the performance of these techniques in various e-learning platforms. This study aims to gain a comprehensive understanding of the procedures employed in Learning types and techniques. This review aims to look at models, frameworks, and applications that use e-learning and face-to-face approaches to address emotional and psychological difficulties.

1) Review protocols: The development and validation of the review protocol affirm the use of appropriate keywords to search for related articles and literature sources.

a) Searching keywords: To guarantee that the evaluation closely covers deep learning technologies for dental informatics, we attempted to focus our search to the most relevant specific keyword. As a result, we started with the terms and then proceeded to the next steps:

i) Extracting the key terms from our study questions.

ii) Using different terminology.

iii) Adding keywords from relevant publications to our search terms.

As indicated in Table V, we used the primary alternatives and added the "OR operator" and "AND operator" to find the most immediately relevant works in the literature.

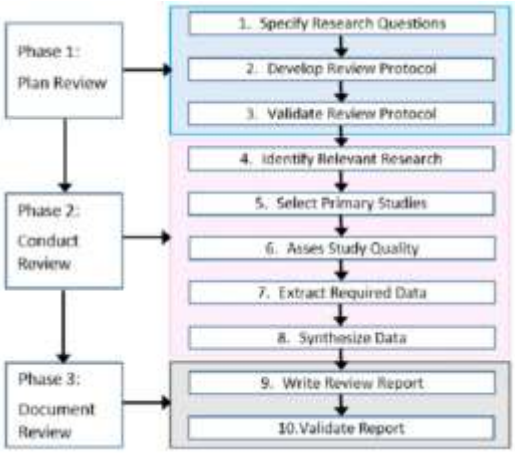

Fig. 4. SLR process.

TABLE V. Inclusion and Exclusion Criteria Description

ID	Keywords
1	("Psychological states" OR "psychological effect") AND ("Emotional states" OR "Emotions") AND ("Learning" OR "E-Learning")
2	("Psychological states" OR "psychological effect") AND ("Emotional states" OR "Emotions") AND ("Online Learning" OR "E-Learning")
3	("Psychological states" OR "psychological effect") AND ("Emotional states" OR "Emotions") AND ("Learning" OR "E-Learning") AND ("Tools" OR "Techniques")
4	("Psychological states" OR "Psychological effect") AND ("Emotional states" OR "Emotions") AND ("Learning" OR "Online Learning" OR "E-Learning") AND ("Tools" OR "Techniques")

b) Literature resources: The databases Web of Science, Scopus, ACM Digital Library, Springer, Science Direct, and IEEE Explorer were used to find relevant publications for primary review research. These databases, which include ISI, Scopus indexed papers, and publications from major conferences, provide the most comprehensive coverage of quality literature on our topic. The search phrase was developed by utilizing the extensive search possibilities provided by each of these databases. Our search included the years 2013 through 2022.

2) Conduct review: We used the research questions, keywords, and protocols as a reference to conduct the review in this step. This phase mostly deals with article inclusion and exclusion, as seen in (A) and (B) of Table VI.

TABLE VI. (A) INCLUSION CRITERIA DESCRIPTION AND (B) EXCLUSION CRITERIA DESCRIPTION

(A) Inclusion Criteria
The research was relevant to psychological and emotional states.
The research was directly related to the learning platforms.
The research was conducted using techniques and algorithms used by learning platforms.
The research is used in multiple domains.
The research was conducted for the analysis of algorithms and techniques performance in Learning Platforms.
For duplicate publications of the same study, the newest and most complete one was selected. This is recorded for only one study whose related work appeared two times.
(B) Exclusion Criteria
Studies unrelated to emotional and psychological states in dance, music, or any other field than education and health were excluded. Because traditional forecasts and visualizations are referred regarded as having "emotional and psychological effects," these results appeared in our search.

a) Study selection: Study selection is shown in its entirety in Fig. 5. There were a total of 1779 items found through the search. After sorting by title, keyword, and inclusion/exclusion criteria, we narrowed the list down to 150 articles. The criteria for inclusion and exclusion are listed in (A) and (B) of Table VI, respectively. Fifty-two papers were disqualified as a result of questionnaire-based predictions, and another 68 were disqualified because they dealt with other concepts, such as a theoretical model or a conceptual framework. Thirty items are crossed off the list after careful reading of the articles.

The selection criteria for relevant articles based on keywords are described in Table VI. Duplicate articles and those that do not address all of the research questions are omitted.

The quality checklist criteria for study evaluation are included in Table VII. The questions are primarily meant to assist in the selection of studies that are more relevant, thorough, and comprehensive in nature.

b) Data extraction: In order to obtain the data which are needed to address our research questions and contributions, we used the data-extraction methods highlighted in Table VIII.

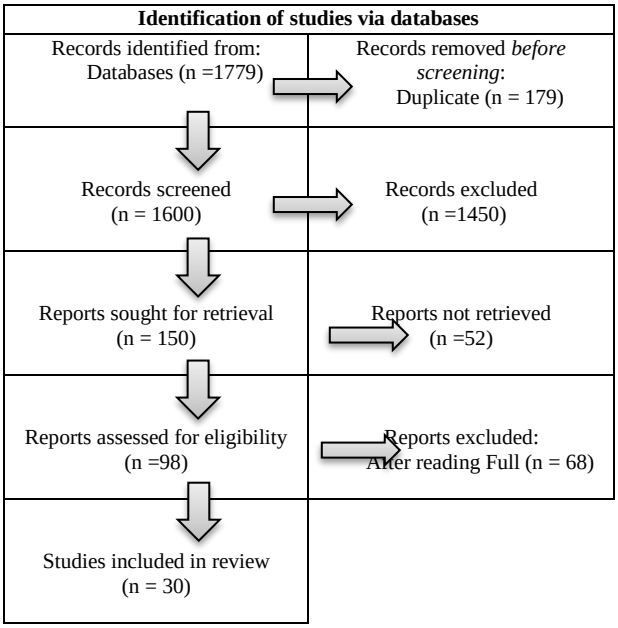

Fig. 5. Process of identifying relevant studies.

TABLE VII. QUALITY CHECKLIST

No.	Questions
1	Was there a strong focus on emotional and psychological states?
2	Was the study able to describe how emotional and psychological states is applied in learning?
3	Is there any algorithm or technique used to evaluate emotional and psychological states in education and medical learning that has been proposed?
4	Is the study concentrating on the basic learning approaches for Learning systems?
5	Is there any mention of core approaches used in the study?

TABLE VIII. DATA EXTRACTION

Study
Study Research Problem Contributions
RQ1: Psychological States
RQ2: Emotional States
RQ3: Techniques or algorithms used by learning platforms

c) Information synthesis: At this point, the retrieved data were pooled in order to respond to the research questions. For our research questions, we used the approach of narrative synthesis. Consequently, we used tables and graphs to describe our findings.

d) Report review: Four research questions were answered using information taken from primary studies. In describing the findings, strict adherence was made to the recommendations presented in [29,30].

IV. DISCUSSION

Emotions play an essential role in many facets of everyday life. We describe them as the predictable reactions we always have to unforeseen stimuli [32-37]. There is a short duration to these responses, which can be physical (muscle twitching,

trembling, etc.), behavioral (angry, fleeing, aggressive, immobile, etc.), physiological (sweating, redness, discomfort, pallor, accelerated pulse, palpitations, feeling ill, etc.), or psychological (positive or negative thoughts). Numerous studies have shown that emotions may alter the quality of learning if the learner's motivation is seen as a barrier to achievement [38-43]. Whether in a classroom setting, under test conditions, or in the comfort of one's own home, the process of learning is always accompanied with a complex and nuanced range of feelings [44-48]. Emotional influences on training in the workplace are the focus of this research. How emotions play a crucial role in learning, especially at a distance.

V. RESULTS

In Table IX, 43 research met the criteria for inclusion. 15 research focused on emotional states utilized in e-learning platforms, and another 13 studies covering the various AI-based methods for assessing these states. Whereas 15 studies helped in addressing the question about the methods employed to assess mental health.

TABLE IX. RQ STUDIES

RQ	*Studies*
Emotional and psychological States	15
Emotional and psychological states evaluation techniques	13
Techniques or algorithms used by learning platforms	15

RQ #1: What are the types of emotional and psychological states found and used in different types of learning?

Effective feedback systems may aid in re-engaging and encouraging learners in these circumstances [32], which can eventually lead to enhanced learning. Therefore, in an e-learning situation, a successful system should be able to read the learners' emotions and evaluate their attention to deliver intelligent feedback that enhances the learners' learning experience. In e-learning circumstances, embodied conversational agents (ECAs) can give learners with effective and intelligent feedback. Sadly, creating these systems can be very difficult. Matching emotional states to facial expressions might be difficult when working with emotion recognition.

To overcome this, Paul Ekman attempted to map typical facial expressions for emotions like contempt, fear, fury, sadness, and surprise [34]. In addition, the effective identification of emotion by a computer in the late 1990s from IBM Watson was a significant milestone. Appropriate feedback systems may assist learners in regaining their footing and motivating them, eventually leading to enhanced learning. Embodied conversational agents (ECAs) [33] can provide effective and intelligent feedback in e-learning to students. Effective systems should be able to interpret learners' emotions and evaluate their attentiveness in order to deliver feedback that enhances their educational experiences.

However, developing these systems may be quite challenging. In emotion identification, it may be challenging to correlate emotional states to visual expressions. To overcome this, Paul Ekman attempted to map typical facial expressions for emotions like contempt, fear, fury, sadness, and surprise [34]. In addition, late in the 1990s, when machines were able to identify emotion from both static photos and audio-visual input, 2 Wireless Communications and Mobile Computing drew further attention to this topic.

According to the literature, information about an individual's emotions may be gleaned by observing the face as a whole and paying close attention to the usage of the different facial muscles. [35] This is known as the sign-judgment strategy.

Using the Facial Action Coding System (FACS), facial expression action units (AUs) may be categorized and categorized according to emotion [36]. Automatic engagement recognition is another fascinating field. A real-time engagement recognition system might be used extensively in the following scenarios: (i) instructors working in distance education might get instant feedback based on their students' interest levels; (ii) participants' responses could be utilized to identify specific video segments. (iii) utilizes computer vision technologies that may evaluate student engagement in a distinct manner by examining body position, hand movements, and facial indications [37].

Learning, human intelligence, and emotion are all interconnected. Focus, learning motivation, and self-regulated learning are all impacted by emotions in learners. Through self-regulated learning and engagement, emotions, especially happy emotions, have a greater impact on academic performance. In e-learning, it is frequently seen that students become noisy during the same lectures or even courses as a result of unfavorable feelings. Additionally, associated learning material is activated in the long term memory by emotion. Positive feelings can thereby enhance students' ability to study more, perform well in assessments, and amass substantial knowledge. Numerous scientists have studied the identification of emotion in e-learning as a result of the connection between emotion and learning. Several scientists to investigate the e-ability learning's to recognize emotions.

A crucial aspect of every person is their emotional state, which affects their behavior, judgment, capacity for thought, adaptability, wellbeing, and interpersonal connections [38]. Emotions have a significant impact on human behavior, and human practices like e-learning must take this into account [39]. According to a study on the impact of experimentally induced positive and negative emotions on multimedia learning, students with the greatest previous knowledge or working skill could counterbalance the emotional influence on learning results.

According to [40, 41], e-learning promotes not just the learning process but also the connection between learning and emotion. As a consequence of the expansion of Learning Management Systems, traditional face-to-face learning is gradually being replaced by e-learning (LMS). Noteworthy is the significance of the data sources employed for emotion categorization. In typical classroom education, a teacher may alter his or her teaching style by analyzing students' facial expressions and body movements. However, this becomes difficult in e-learning situations.

According to study, a single data modality may not be able to capture the whole knowledge of the learning process. Therefore, several data sources are predicted [42, 43] to increase the accuracy of emotion classification [44]. EEG, EDA, eye tracking, audio, video, RB, and ECG are included in these data streams.

The authors of [45] also show the relevance of establishing robust user models and learning via the fusion of knowledge and technology. In reality, Learning Analytics and Knowledge (LAK) has recognized the significance of incorporating dynamic behavioral data in addition to traditional e-learning data (e.g., MOOCs, LMS data, etc.) [46]. Combining physiological data, such as electroencephalogram (EEG) or electrocardiogram (ECG), with external behaviors, such as eye movement or facial expressions, is a potential way for recording the sentiments and experiences of learners, according to [44]. According to the authors of [47], Multimodal Machine Learning (MML) is an approach for handling multimodal data sources as well as Data Harmonization of data [64].

Learning using diverse (multimodal) sources enables you to see how multiple modalities interact and provides a comprehensive understanding of how natural events operate. Recent research [48] indicates that incorporating multimodal data boosts accuracy and provides a better knowledge of the learner's emotions and experiences. Appendix A discusses the RQ1 in further detail.

RQ #2: How emotional and psychological states observed/examined in e-learning platforms?

This research question aims to identify how emotional and psychological states are measured by the techniques or algorithms used to measure them. Selected studies in this Research question show that the e-learning domain is used as it shows a high impact on higher education institutes. State types shown in Appendix B are both psychological and emotional as education institutes implemented it to understand e-learning's impact on students ethically and morally. The learning type mentioned in these studies is e-learning.

Whereas the techniques used to identify the states are diverse, such as AI, ML, DL, Signal system, mathematical representation. The techniques under AI, ML and DL are BiLSTM, Feed-Forward Neural Network, Hierarchical attention network, CNN, DESNet, SVM, Naïve Bayes, Logistic regression, Linear SVC and multinomial NB, Random Forests. Signal systems uses the concept of mathematical representations to measure the states. The techniques or methods are Gaussian mixing model (GMM), Partial least square structural equation modeling method, Gabor filter bank, MFCC features.

RQ #3: Which type of algorithms and techniques admitted for the emotional and psychological states in e-learning platforms?

Algorithm and techniques adopted by e-learning platforms for emotional and psychological states shown in Appendix C.

A. Contribution

To the best of my knowledge, this is the first SLR to discuss the emotional and psychological states as one unit, the mathematical methods, and signal and AI-based techniques applied in e-learning platforms. The main scientific contribution of this SLR is that it will be helpful for the government to adopt measures for mental health by putting criteria for psychological and emotional states. As well as practically implemented in Higher Education Institutes to check teaching and learning performance. Also, this SLR focuses only on the AI and related tools which are widely used nowadays and help organizations to implement emotional and psychological state measures while teaching and conducting training through e-learning platforms.

Based on the findings and discussion, the information provided by this SLR will be helpful for researchers and stakeholders in applying these approaches and techniques, which deal with the wide variety of e-learning training and webinars. As previously said, the most current approaches for machine learning, deep learning, and neural networks would aid in retrieving, representing, and displaying recently used data.

B. Implication for Practice

This study has several practical implications on the provision of e-learning platform technology in higher education institutions and training institutes around the globe. It will help the government reduce the percentage of psychological and emotional pressure in youth and young children and helps in making work balance environment in all organizations in the country. Also, it will enhance the learning capabilities in students and teachers by adopting the latest tools and techniques that are mentioned in Appendix B and C.

C. Limitations

Only e-learning department was targeted, and the major focus was health and education. The studies are excluded related to learning dance, music, art, craft, sports and so on. The included studies are only that are written in English. The studies that only focuses on implementation of AI algorithms are included and all theoretical and conceptual models are excluded.

D. Future Suggestions

Emotional and psychological factors affect the public due to sudden changes in state and federal governing bodies. Emotional and psychological factors effects on public due to the retirement of favorite players from sports, politics, school, college or university. Emotional and psychological factors affect public due to inflation rate and change in prices in daily use items. Emotional and psychological factors effects on public due to political and shocking news related to interfaith harmony.

In addition, comparative research based on online, hybrid/blended formats are required to understand how the outcomes vary and how these changes impact the e-learning design framework. Comparative studies of the effectiveness of e-learning systems at various levels, such as the impact felt by learners vs. the effects experienced by instructors, are necessary.

VI. CONCLUSION

Education may be improved, streamlined, and made more effective through an online learning platform. The development of e-learning has made it possible for students to get an education whenever and wherever they like. They make it possible to receive customized instruction and information at any time. These online instructional methods profoundly influence learners' mental and emotional states, affecting their skills and motivation. Distance between tutor and student, both in terms of space and time, makes it difficult to inspire students, who may experience a range of emotions from annoyance to uncertainty to ambivalence.

The student's motivation to learn, as well as his or her emotional and psychological well-being, will take a serious hit as a result, both during and after the class. This study aimed to investigate the techniques now employed by academic institutions for analyzing human sentiments and mental states. Only e-learning, alongside other fundamental technologies like machine learning, deep learning, signal processing, and mathematical techniques, has been employed in the field of education, as shown by the results.

These strategies are employed in a wide range of practical applications, emphasizing online education. The most common research techniques are analyzed, and each topic is presented in detail. In conclusion, we offer a detailed assessment of the state of the art, our contributions, and their implications, as well as our limitations and recommendations for future study.

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APPENDIX A

Study	Domain	State Type	Learning type	Format
[49]	Health and Education	Psychological	E-learning	Video
[50]	Education	Emotional	E-Learning	Speech
[51]	Education	Psychological	E-Learning	Text

[52]	Education	Emotion and psychological	E-Learning	Speech
[53]	Education	Emotional	E-Learning	Multimodal
[54]	Education	Emotional	E-Learning	Image and Text
[55]	Education	Emotional	E-Learning	Image and Text
[56]	Education	Psychological	E-Learning	Image
[57]	Education	Emotion	E-Learning	Image
[58]	Education	Emotion	E-Learning	Image
[59]	Education	Psychological	E-Learning	Multimodality
[60]	Education	Emotional	E-Learning	Image
[61]	Education	Emotional	E-Learning	Image
[62]	Education	Emotional	E-Learning	Video
[63]	Education	Emotion and psychological	E-Learning	Tweets

APPENDIX B

Study	Domain	State Type	Learning type	Technique/Method
[49]	Health and Education	Psychological	E-Learning	BiLSTM
[50]	Education	Emotional	E-Learning	Gaussian mixing model
[51]	Education	Psychological	E-Learning	Partial least square structural equation modeling method
[52]	Education	Emotion and psychological	E-Learning	Gabor filter bank, MFCC features
[55]	Education	Emotional	E-Learning	Gaussian mixing model (GMM)
[53]	Education	Emotional	E-Learning	Feed-Forward Neural Network
[54]	Education	Emotional	E-Learning	Hierarchical attention network,
[56]	Education	Emotion	E-Learning	CNN
[58]	Education	Emotion	E-Learning	Proposed Algorithm
[60]	Education	Emotional	E-Learning	E-Learning Heuristic Multimodal
[61]	Education	Emotional	E-Learning	Dense Squeeze-and-Excitation Networks (DSENet)
[62]	Education	Emotional	E-Learning	SVM and Naïve Bayes algorithms are fused to be used as a Hybrid algorithm
[63]	Education	Emotion and psychological	E-Learning	Logistic Regression, Linear SVC Multinomial NB, Random Forests

APPENDIX C

Study	Domain	State Type	Learning type	Algorithm /Technique	Evaluation	Performance
[49]	Health and Education	Psychological	E-Learning	BILSTM	They provide a new error threshold for this evaluation task. If the difference between the algorithm's evaluation and the gold standard label is less than a certain threshold, we accept the algorithm's assessment as accurate; otherwise, we reject the algorithm's assessment as wrong.	We also compute an error score for each assessment task, where an error is the absolute difference between an algorithmically assessed score and the corresponding score in the gold standard, to better examine the relative performance difference across these methods.
[50]	Education	Emotional	E-Learning	Supervised	Not mentioned	Therefore, we were able to capitalise on and collect data that could be used to gauge a student's cognitive health and inspire more engagement in the classroom.
[51]	Education	Psychological	E-Learning	Partial Least Square Model	The internal and external dependability of the model are tested using Cronbach's alpha, the Composite Reliability (CR) test, and the AVE method.	The technology factor, E-Learning factor, intention factor, and user satisfaction factor all have CR scores of 0.81, 0.88, and 0.64, respectively.
[52]	Education	Emotion and psychological	E-Learning	Proposed algorithm	Wilcoxon's one-sided matched test was utilised in the first experiment. For this second set of data, the Mann-Whitney U test was utilised.	When compared to the significance level, the estimated Pvalue is less than the significance threshold was set at the.05 alpha level. P-values below the significance level are not calculated. significance level = 0.05 (Pvalue = 0.00018 0.05).
[53]	Education	Emotional	E-Learning	Feed-Forward Neural Network,	Weighted Majority Voting	Valence: Accuracy 0.8477 F1-score 0.8649 Arousal: Accuracy 0.9551

				Incremental Stochastic Gradient Descent		F1-score 0.9589
[54]	Education	Emotional	E-Learning	Naive Bayes (NB), Logistic regression (LR), Support Vector Machine (SVM) and Multi-layer perception (MLP)	The threshold for training batches is 50 words or sentences, and each batch consists of 16 individuals. The stochastic gradient descent at a speed of 0.9 A 0.1 rate of learning was used for a total of 10 iterations.	HAN outperformed the other prediction results obtained from standard text classification algorithms with its 70.3% classification accuracy.
[55]	Education	Psychological	E-Learning	Convolutional autoencoder model architecture	Principal Component Analysis	The majority of students in both classes are engaged and participating in their learning, as depicted by the flow charts. For this finding to hold, it is necessary to assume that the course material was satisfactory to the vast majority of participants.
[56]	Education	Emotion	E-Learning	CNN	In order to move a point from the Image domain (top panel) to the Hough transform domain, the Hough transform is applied (bottom panel).	The classifier is developed using 70% of the data, and its predictive accuracy is evaluated using 30% of the original data.
[57]	Education	Emotion	E-Learning	*Emotional web assistance for EREIL*	When a student is communicating in the classroom, EREIL can read cues from the student's body (such as emotions, volume of voice, gestures, etc.)	EREIL is able to learn about a student's nonverbal cues through interacting with their eyes, gestures, facial analysis, and voice recognition. This newfound knowledge allows EREIL to positively identify students.
[58]	Education	Psychological	E-Learning	Logistic regression, Open Gaze And Mouse Analyzer (OGAMA) 5.0	Executed on the basis of the motivation evaluation; deducing the Each of the inspiring factors can be ranked on a high or low scale, machine learning factors using logistic regression classifier.	The precision of The best threshold for EEG and eye tracking-based motivating factor prediction ranges from 68.1% to 92.8%. values.
[59]	Education	Emotion and psychological	E-Learning	Empirical research method i.e V.E. Milman	seven The several varieties of motivational outlooks are discussed. of mental effort devoted to informational actions. Using this method, consisting of seven distinct measures of intrinsic motivation, and being of a standard profile	Not mentioned
[60]	Education	Emotional	E-Learning	navy Bayesian classifier networks	The superiority of a dynamic system for the rational mind, implying that emotional data could considerably improve the effectiveness of the e-learning platform.	The end result is an e-learning success rate of 93.85%, a hand gesture success rate of 92.70%, a speech recognition success rate of 82.26%, a decrease in emotional problem success rates of 84.50%, and so on.
[61]	Education	Emotional	E-Learning	Dense Squeeze-and-Excitation Networks (DSENet	The Facial Expression Recognition 2013 open dataset is used for DSENet's training and validation.	The model outperforms ResNet-34 by 6% when it comes to identifying emotional states.
[62]	Education	Emotional	E-Learning	SVM and Naïve Bayes algorithms are fused to be used as a Hybrid algorithm	Regression	The proposed hybrid approach achieves an accuracy of almost 97%.
[63]	Education	Emotion and psychological	E-Learning	Logistic Regression Linear SVC Multinomial NB Random Forests	To help decision-makers and staff in the educational sector improve and adjust the educational process during and after the pandemic, the created analytics are then factored by location and time to provide more thorough insights.	Linear Support Vector Classifier (SVC) performed best on all measures of accuracy, precision, recall, and F-measure (91%), according to a study of 11 different classifiers for emotions.