EMOTION RECOGNITION AND VIRTUAL REALITY: CHALLENGES AND NEW OPPORTUNITIES FOR TREACHERS AND EDUCATORS.

RICNONOSCIMENTO DELLE EMOZIONI E RALTA' VIRTUALE: SFIDE E NUOVE OPPORTUNITA' PER DOCENTI ED EDUCATORI

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ABSTRACT

The aim of this essay is to investigate how artificial intelligence and traditional didactics can interact with each other to create a more inclusive learning environment which is more sensitive to emotional students' needs. In this perspective, the use of virtual reality as emotion recognition training can be a valuable tool for teacher to enhance their teaching strategies by capturing the emotional state of their students in order to improve the emotional interaction in educational contexts.

L'obiettivo del presente saggio è investigare come l'intelligenza artificiale e la didattica tradizionale possano interagire tra di loro per creare un ambiente di apprendimento più inclusivo e sensibile alle esigenze individuali degli studenti. L'utilizzo della realtà virtuale come training per il riconoscimento delle emozioni può rappresentare uno strumento prezioso per i docenti per ottimizzare l'efficacia dell'insegnamento intercettando lo stato emotivo dei propri studenti al fine di migliorare la relazione educativa.

KEYWORDS
Virtual Reality, Emotions, Emotion Recognition
Realtà virtuale, Emozioni, Riconoscimento delle emozioni

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Introduction

The contemporary educational context confronts teachers and educators with a dualism that is not always easy to manage: on the one hand, the need to keep up with the times of the latest generation of students; on the other hand, the need to develop and implement didactic approaches that are as empathetic as possible and careful to the many different needs of each student.

Over the last forty years, the teacher-student relationship has been characterised by a profound and radical transformation, going from a clearly asymmetrical and hierarchical relationship, characterised by a total absence of empathic communication with the student, to a much more complex relationship that, while still maintaining the essential aspect of asymmetry, perceives the student as an active interlocutor endowed with a critical sense that drives him or her to a continuous process of *self-education* (*Con gli occhi di studenti e docenti*, 2014). From this perspective, it is therefore possible to state that educators find themselves in a state of *functional superiority* that generates a bond of responsibility, in which *dialogicality* orients the relationship.

This transformation of the educational relationship has been strongly influenced, if not induced, by the progressive and increasingly in-depth attention that has been paid to the role that emotions play in learning processes by influencing attention, motivation, school performance and the development of critical thinking (Cipollone, 2021)

Therefore, it become essential for teachers to be able to intercept the emotional state of their students, grasping their doubts, perplexities, frustrations or satisfactions in order to make the educational relationship even more effective and guarantee an authentic improvement in the quality of learning.

In this perspective, technological innovation can be a great resource for teachers to face the challenges of recognising students' emotions.

Artificial intelligence, augmented reality and virtual reality represent tools that are increasingly becoming protagonists in the various fields in which the individual is called upon to act, including educational contexts by offering innovative learning experiences that are personalised and accessible to all, including students with disabilities or Special Educational Needs (Curcio et al., 2016). In this perspective, such tools can represent a valuable educational resource that on the one hand allows students to immerse themselves in simulated and interactive learning environments, allowing them to explore their emotional reactions in a controlled

and safe environment, and on the other hand gives to the teachers the opportunity to intercept students' emotional states more easily and quickly. As a matter of fact, this process lead to an improvement of the teachers' emotional competence and educational relationship with their students.

The aim of this essay is to examine the state of the art, challenges and opportunities arising from the integration of virtual reality in emotion recognition in education and how it can be a valuable tool for ensuring the development of a more inclusive and effective learning environment.

1. The role of emotions in learning processess

In educational context, the first, pioneering studies on emotions' recognition and their role in learning processes are undoubtedly due to Daniel Goleman. Goleman defines emotions as "*a feeling and thinking, to the psychological and biological conditions that distinguish humans, as well as a series of propensities to act"* (Goleman, 2011). From a psycho-pedagogical point of view, the development of emotions, from childhood to adulthood, is part of the process defined as "*affective development*," which constitutes that path of emotional growth that leads the individual to build a personal identity and to develop the ability to recognize one's own emotions and those of the others. With this in mind, it is therefore necessary to introduce the concept of emotional intelligence, which Goleman first discusses in the 1990s, delving into the concept of interpersonal intelligence, previously introduced by Howard Gardner (Gardner, 2005), defined as the ability to relate to others, perceive their moods and intentions. Emotional intelligence is substantiated through empathy, which is the ability to emotionally understand the other without ever neglecting our own feeling.

There is an inevitable interdependence between emotional processes and learning processes. In Goleman's words, *'the emotional areas of the brain are all closely related to the neocortex [...]. This gives the emotional centres immense power to influence the functioning of all the other areas of the brain, including the thinking centres'* (Goleman, 2011). As Cappello states, this leads to the construction of a circularity between emotions and the learning context in which the former, processed on the inside, are reflected on the outside with specific behaviours that in turn produce new emotions and generate new behaviours (Cappello, 2013). These behaviours can be virtuous, if the elicited emotions are positive and, consequently, drive the student to persevere in the task and focus on a specific objective. On the contrary, they can be deleterious if the perceived emotion by the

students is felt as negative and consequently drives him/her to abandon or avoid the required behaviour (Cappello, 2013). In this perspective, the teacher's responsibility is to understand and be aware that not all students react and experience things in the same way and that what may be exciting for one individual may generate anxiety or fear in another. It therefore becomes essential for the teacher to adopt teaching and methodological strategies that are not always identical to themselves but embrace modalities that are also very different from each other, and which are nevertheless capable of responding to all the different students' needs. This is an aspect that should not be underestimated because it allows one to understand how emotions can actually influence a student's behaviour.

2. Virtual reality in learning environments

The use of artificial intelligence has, in recent decades, entirely revolutionized the educational landscape, making the learning process an immersive and engaging experience for students. Specifically, virtual reality (VR) recreates a complete sensory experience that allows students to be transported into virtual environments that simulate real-world situations, enabling them to explore complex concepts in an interactive and hands-on manner. Moreover, it is a valuable tool for teachers because it gives them the opportunity to personalised the learning processes and the school inclusion paths (Curcio et al., 2016). Specifically, when we talk about virtual reality, a distinction must be made between immersive and non-immersive virtual reality. While in the former case we refer to computer-based settings that simulate real and/or imaginary scenarios, in the latter case we are talking about a fully immersive tool that also requires the use of apposite devices (such as, for example, Google glasses) that allow the user to have an even more immersive experience. With the ability to recreate real and imaginary environments , VR can literally transform the educational experience. One of the learning fields in which the use of virtual reality is most inflated is certainly in medical and scientific studies. For instance, through VR, medical students have the possibility to explore human anatomy in detail through immersive simulations or study natural phenomena through interactive virtual experiences (Górski et al., 2016). Another aspect to consider is, for example, the opportunity that virtual reality offers teachers to conduct immersive and interactive lectures. In the areas of geography and history, VR allows students to visit distant places or past historical periods giving them the opportunity to learn by using their senses as well, and most importantly, by exploiting the emotions that these kinds of experiences generate in

them. This broadens cultural perspectives and increases understanding of the world (Marín-Morales et al., 2020).

The interactivity of VR fosters students' engagement, motivation and also their sense of self-efficacy as they can actively explore, experiment and solve problems (Cipollone, 2021). In addition, the ability to customize the educational experience according to students' individual needs makes VR a powerful tool for differentiated learning by promoting, for example, the improvement and development of social and behavioural skills in children with autism spectrum disorders (Freina & Ott, 2015; Kamińska et al., 2019).

3. Virtual Reality as training for emotion recognition: implications for teachers and educators.

Emotion recognition represents, in the contemporary educational context, a considerable challenge for teachers who, compared to the past, must always be prepared to use their empathic resources to understand the needs and requirements of students and help them in their learning experience.

Usually, emotion recognition, also in educational settings, relies mainly, if not completely, on the direct observation of the teacher, who relies on nonverbal cues such as facial expressions, language and tone of voice. However, while instinctive and spontaneous, this modality may have significant limitations which are essentially related to the subjectivity of the emotional state interpretation and the possibility of misunderstanding. Moreover, students may manifest emotions in very different ways depending on the context or their personal experiences, making it very difficult for teachers to grasp and respond to their emotional states appropriately.

In this perspective, the use of virtual reality can be a valuable tool to elicit emotion recognition by teachers. The scientific literature is providing growing evidence about the effectiveness of virtual reality-based training in emphasising emotion recognition (Marín-Morales et al., 2020). To this regard, there are growing scientific evidences that assess the validity of integration of machine learning algorithms and biometric signals to automatically classify emotions (Calvo & D'Mello, 2010). Moreover, Zangh et al., showed the potential role of emotion recognition in virtual reality environment showing that their implemented software was able to distinguish emotions such as 'happiness', 'sadness' and 'surprise' (Zhang et al., 2023). In another study conducted by Marin Morales et al., it has been shown that

the use of Immersive Virtual reality Environments can elicit and automatically recognise different emotional states from neural and cardiac dynamics (Marín-Morales et al., 2018). Specifically, the authors used a Machine Learning algorithm called Support Vector Machine (SVM) which was used to classify emotional states starting from features extracted from electroencephalography (EEG) and electrocardiography (ECG). The virtual reality system was developed in order to give to the participants the opportunity to observe striking landscapes capable of arousing different emotions in them. The SVM display an accuracy around 70% in recognizing the arousal state and the positive and negative valence of what the participants saw on the screen. This is an interesting evidence of how efficient can be the use of Immersive Virtual Environments to elicit and automatically recognize different emotional states. (Marín-Morales et al., 2018).

Conclusions

Understanding students' needs through the correct interpretation of their emotions has now become one of the priority goals for teachers and educators. The contemporary educational landscape demands that teachers and educators are able to understand and to respond to the different emotional needs of their students. The integration of virtual reality (VR) in education represents a promising opportunity for enhancing emotion recognition and fostering more effective teacher-student relationships. Specifically, Virtual reality technology, with its ability to create immersive and interactive learning environments, has the potential to revolutionize how emotions are recognized and addressed in educational settings. By leveraging machine learning algorithms and biometric signals, training based on the use of virtual reality can facilitate the automated processes of emotion recognition, providing teachers with valuable information about students' emotional states and respond to them appropriately.

This essay explored the potential that virtual reality may have in “facilitating” the recognition of emotions in an automated manner, representing a valuable and potential tool capable of enriching educational settings and, at the same time, improving the educational relationship between teachers and students.

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