The use of digital setting in clinical ad learning applications

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Abstract

Nowadays there is an increasing use of the digital setting in various fields, including psychology and pedagogy. Author's purpose is to explore different forms of digital setting applications, describing their possibility of usage and eventually their limitations.

First of all, the authors are going to define the concept of Artificial Intelligence (AI) and the possibility of using it in clinical settings. Then, the authors will proceed to describe the application of Artificial Intelligence and Augmented Reality both in assessment and in prevention of cognitive function decline.

The application of digital settings for treatment in the field of mental health will also be discussed, both for adult people and for young people; in addition, the ethical issues, in particular for e-therapies, will be debated.

Lastly, another way of application of digital setting is for access to education; for this reason, the authors will explain the teaching approaches that use the virtual.

Keywords: digital setting, clinical setting, psychology, artificial intelligence, pedagogy

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Artificial intelligence as a diagnostic model

Artificial intelligence technologies have the potential to develop personalized models that are plausibly more accurate than traditional clinical care, using large amounts of multimodal real-world data about patients, including the influence of risk and protective factors. Artificial intelligence (AI) learns patterns in large multimodal datasets both within and across individuals (Wiens *et al.*, 2018) to help improve understanding of current clinical status. Artificial intelligence approaches can dynamically interpret these complex data and generate incredible data and insights to potentially improve clinical methods and outcomes. One facilitation offered by artificial intelligence is that it can allow conventional methods of diagnosis and treatment to be updated, making them more effective, accurate, and appropriate. The use of AI is having increasing application due to clinical data from everyday clinical psychology that can be used to build practical AI-based diagnostic tools useful in the application of psychology. AI can contribute to proactive and objective assessment of mental health symptoms to aid diagnosis and treatment based on individual needs, including long-term monitoring and care management. AI has the potential to revolutionize geriatric mental health care and research by learning and applying such individualized predictions to guide clinical decision making. One interesting application of artificial intelligence is to accurately predict who needs mental health treatment before anyone is aware of it or before symptoms become too severe by tracking early signs of a change in an individual's daily behavior. A small but growing literature has begun to apply artificial intelligence approaches to geriatric mental health assessment and diagnosis, especially in the context of depression (Graham *et al.*, 2019) and neurocognitive impairment (Graham *et al.*, 2020). Artificial intelligence techniques, such as Neurolinguistic Programming, can identify language features sensitive to cognitive decline and can better differentiate individuals with early deterioration than traditional neuropsychological assessment (Beltrami *et al.*, 2018). To date, one area of application is for cognitive impairment and Alzheimer's disease. Fujita (2022), in fact, has developed an artificial intelligence-based diagnostic model of Alzheimer's disease based on memory clinic patients' big data from routine clinical practice, and it has high precision and recall (sensitivity)

for the diagnosis of the disease itself (Amisha *et al.*, 2019). Using eye-tracking technology (Oyama *et al.*, 2019), it was possible to create a predictive model to identify cases that convert from mild cognitive impairment to Alzheimer's disease. Indeed, this model has the potential to solve the problem of poor access to dementia experts in a population where the number of dementia patients is increasing. In addition, artificial intelligence-based support can be used as a screening tool that can suggest the most appropriate time to obtain an imaging assessment. Artificial intelligence analysis of progressive changes in dementia can predict prognosis; adding an AI-integrated tool to a conventional questionnaire can open the possibility of personalized medicine for more accurate prediction. Thus, the innovation given by AI diagnostic support can improve the quality of life in dementia and can be widely used as a communication tool between non-specialists and specialists. The literature suggests that another area of application of AI is in the specific assessment of cognitive depletion in daily activities through the use specifically of Serious Games. Serious games are games that, in addition to the fun of play, have a serious added value. They are suitable not only for imparting knowledge, but also for prevention, therapy, and use in care (Nguyen *et al.*, 2017). Although studies have shown that older adults play computer games (Jahresreport, 2020), it is noted that there are only a few studies on serious games and older adults, with an even smaller number of studies including older adults in care facilities (again, availability is limited) and even fewer studies on nursing home residents with cognitive impairment (Saint-Mauruce *et al.*, 2018). Therefore, serious games for older adults are developed with special features. Specifically, MemoreBox, a serious game designed specifically for the elderly in care facilities, was studied. The results of this study contribute greatly to knowledge in this novel area, providing insights into potential developments and implementations of serious games that can be further explored in future research. Furthermore, the results indicate that serious games (in this case MemoreBox) can have a positive impact on the cognitive abilities of the elderly and should therefore be increasingly recognized and implemented to provide engaging health promotion opportunities. The literature, moreover, highlights the high potential of serious games as an effective and motivating component in prevention and health promotion (Lau *et al.*, 2016). Lau *et al.* (2016) also showed the

combination of cognitive challenge and physical activity stimulation, which makes serious games a multifactorial and extensive means of prevention. Because nursing homes require a significant amount of social, financial and health care resources, this study focused on the implementation of serious games to potentially help address the limitations of these resources.

It has been shown how the use of serious games can be effective for different motor groups, and that training cognitive and motor skills together with serious games provides synergistic effects that cannot be achieved with separate training of physical and cognitive skills (Smeddinck *et al.*, 2014). The implementation of a user-friendly serious game as an effective (prevention) tool and its integration into standard care in nursing homes could contribute considerably to the weakness of the health care system, where there tends to be a lack of activation offerings for the elderly in partially hospitalized care facilities (Blüher *et al.*, 2016).

Interventions with virtual reality and serious games in the adult population

Milgram and Kishino in 1994 talked about the concept of a "virtuality continuum" between the real and virtual worlds that can be experienced by users according to the degree of mixture with reality (Milgram & Kishino, 1994). With the term "real environment" the authors (Milgram & Kishino, 1994) define real environments consisting only of real objects including for example viewing of a real scene in real world but also conventional video display and virtual environment consisting only of virtual objects, like a conventional computer graphic simulation. In the middle of the continuum, we find the Augmented Reality (AR) referring to any case in which an otherwise real environment is "augmented" by means of virtual (Milgram & Kishino, 1994).

Ronald Azuma (2001) said that augmented reality should mix real world and virtual elements, allow real-time interaction, and being augmented in a three-dimensional space. According to this author a main goal of augmented reality is to increase the user's perception and interaction with the real world (Azuma *et al.*, 2001).

Rudimentary forms of AR were developed long before the term

"augmented reality" was coined in 1990, but primitive forms were developed long before; AR technologies have developed mainly over the past decade with the increase in mobile devices (Barsom *et al.*, 2016). In our opinion, it might be interesting to explore attempts to use augmented reality in clinical intervention practices. For example, some authors (Han *et al.*, 2021) proposed to use the augmented reality technology in the field of prevention of cognitive function decline in the elderly realizing new type of working memory training system that enables physical activities. To achieve this goal, they made a game-based cognitive training system based on mobile augmented reality (MAR) inspired by the TMT neuropsychological test assessment tool used in psychology (Han *et al.*, 2021).

In this serious game the augmented reality technology is used to provide exploration and interaction with virtual objects, with minimal physical activity, and can be easily played with a high-penetration smartphone at any time and in all age groups (Han *et al.*, 2021).

Experts who have given opinions on the effectiveness of this cognitive training program gave positive feedback on using this system as a tool for cognitive function training of the elderly and said that the serious game may be suitable for improving spatiotemporal perception abilities (Han *et al.*, 2021).

In addition to application of augmented reality to prevention of cognitive abilities decline, technologies based on artificial intelligence has been investigated in the field of mental health. AI could support the understanding of current clinical status of the person (Alaa *et al.*, 2019) or predict a future outcome (Pratap *et al.*, 2019) by storing patterns in vast multimodal datasets both within and across individuals (Wiens & Shenoy, 2018).

For example, an encouraging application of artificial intelligence in mental health is to recognize subgroups of patients with comparable expressions of symptoms to have guidelines for the treatment (Saria & Goldenber, 2015); this could gave more time to the therapist to focus on other therapeutic goals like the relationship with the patient, where the artificial intelligence turned out not to have many applications (Luxton, 2014).

During the treatment application, with artificial intelligence clinicians could also monitor feedback from patients, like response to treatment and symptom trajectory (Renn *et al.*, 2021).

Artificial intelligence has been analysed as support in other aspects related to the elderly and dementia; as an illustration, a number of artificial intelligence devices designed to facilitate caregiving, such as support for washing or dressing or fall detection, was described by a systematic review of 30 studies (Xie *et al.*, 2020); however, most of these studies were descriptive or exploratory, so very limited evidence were offered (Xie *et al.*, 2020).

In order to support the possibility of aging at home, some researchers have used artificial intelligence to modify home environment, creating "smart homes" to promote independence and safety of elderly but also of people with disabilities (Euronews, 2020).

Renn (2021) made an interprofessional perspective of approaches based on artificial intelligence for research and clinical care in geriatric mental health, providing an overview of possible applications and challenges of using.

Artificial intelligence tools were based on technology, a field that follows a rapid innovation, and this could lead to some problems, for example that older adults could be excluded from this revolutionary digital health, as well as that developments in artificial intelligence could not be easily translate into clinical or other real applications (Renn *et al*., 2021).

In the research field, this rapidity of innovation has led to paradigm change from traditional experimental studies (Chekrour *et al.*, 2021); much of research about artificial intelligence consist in proof-of-concept and in generating hypothesis from demonstrations, that contrasts with evidence-based practice used in empirical approaches (Renn *et al.*, 2021). The authors (Renn *et al.*, 2021) noted that future work about artificial intelligence will need larger and more varied samples, including elderly adults and to incorporate multimodal data streams in order to point out clinically relevant factors and distinguishing them from temporary mood states; in addition, discussion on privacy, ethics, structural inequalities and trust should be encouraged, and environmental and social factors should be address about as well as biological and psychological factors to artificial intelligence applications in elderly (Renn *et al.*, 2021).

Serious games also have many applications in mental health afferent treatments. Serious games use play as primary method for purposes defined "serious" like educate, or motivate users to change patterns of

behaviour, in various type of context (e.g. educational or therapeutic context) (Burke *et al.*, 2009; Chatman, 2007; Fleming *et al.*, 2014). Beginning studies about serious games mainly suggest potential advantages for psychological and behavioral modifications (Tarrega *et al.*, 2015). For example, some authors (Li *et al.*, 2014; Fleming *et al.*, 2014) focused their works about serious games in depression treatment and conclude that its usage is promising, but that further research is needed, although it should be further investigated with further research.

To address the need to use serious games effectively in a clinical context and not only in an experimental setting, an international group of authors established The Collaboration on Maximising the Impact of Electronic Therapies and Serious Games (COMETS) (Fleming *et al.*, 2016). This document identified some skills that serious games must have to maximizing its benefits in mental health. One of them is the application user centred approaches, that aims to consider the preferences of user in the design of serious game to meet their mental health needs.

Another characteristic that serious games should have is to implement successful and engaging interventions. Actually, even if an intervention is effective it will haven't the same impact on the users if they aren't engaging.

The authors that have dealt with these guidelines (Fleming *et al.*, 2016) underline that future works should focus on processes behind the usefulness as well as the involvement of the users.

Regarding to interventions' development, it might be useful to stimulate collaborations cross-sectoral to easily sustain the cost and to carry out research project for implementation following the rapidly evolving of user expectations (Fleming *et al.*, 2016).

Digital intervention in children and young people

Augmented reality could have a potential in therapeutic interventions, particularly related to substance-abuse and extinction-based exposure therapies (Vinci *et al.*, 2020).

Frequently, face-to-face interventions are adapted using digital technology to addressing some barriers like costs, access to the

services and difficulties on discussing personal issues (Wangelin *et al.*, 2016); actually, digital health interventions, offered, for example, via app or internet programs, seems to be helpful in maintaining anonymity, taking feedback, giving high fidelity to the treatment and reducing costs (Lahiri *et al.*, 2013).

Especially in young people, who are accustomed in internet use, digital technologies could increase the accessibility of mental health interventions (Pennant *et al.*, 2015; Richardson *et al.*, 2010).

In considering the effectiveness of these types of interventions, it may be important to consider user engagement with digital behaviour change interventions that Yeager & Beninghr (2018) defined in term of user-perceived state of flow, a subjective feeling of enjoyment, focused attention and temporal dissociation, and in terms of the amount of usage of digital technology interventions and adherence to treatment.

Some authors (Liverpool *et al.*, 2020) wrote a review describing main tools of delivery of digital health interventions directed to children and young people with mental health issues. More specifically, these modes are apps, website, games, computer-assisted programs, the use of virtual reality, robots and mobile text messaging (Liverpool *et al.*, 2020).

The retention rate of children and young people in digital mental health interventions emerged from the review of Liverpool and colleagues (2020) is higher than that reported in another work about mental health outpatient care for young people, which presented dropout between 20% to 60% of the cases (Melville *et al.*, 2010).

The level of engagement of young people in digital interventions turns out to be influenced by intervention-specific and patient-specific factors; by previous researches about the level of engagement in digital interventions and, more in general, about the technology acceptance model (Kayeser *et al.*, 2018; Yeager & Beninghr, 2018; Rahimi *et al.*, 2018) emerge that expectations about the outcome, symptom severity and engagement self-efficacy could be considered characteristics that influence children and young people engagement in mental health digital interventions.

In the context of digital interventions for young people with mental health issues, another aspect considered is the possibility to supervise the progress of the therapy and the outcomes; Sundram, with other

authors (Sundram *et al*., 2017) developed an e-monitoring tool for electronically monitoring adolescents with depression that were following a form of web based computerized cognitive behavioural treatment.

By this work (Sundram *et al*., 2017) turned out the complexity of implementing e-monitoring tools for digital interventions, that are highlighted also by other research; for example, in the study of Marquis and colleagues (Marquist *et al.*, 2017) one of the difficulties encountered in the implementation of e-monitoring system is integrate it with pre-existing electronic medical systems.

In addition, adolescents who are in a low sociodemographic level may be disadvantaged in e-monitoring system which is based on the possession of an internet connection (Sundram *et al.*, 2017).

However, with e-monitoring system clinicians could capture finer details than with face-to-face intervention and this could, benefit them in understanding how symptoms change over time (Sundram *et al.*, 2017).

In recent years, the use of digital technologies in mental health interventions has focused not only on treatment but also on prevention. In this regard, a group of authors (Sierk *et al.*, 2022) presented a digital mental health platform for well-being on workplace; this platform makes it possible to measure and increase the well-being and mental health of employees and also allows employers to get feedback on the level of well-being of their employees.

Typically, reactive strategies are underutilized in work environments, so the use of digital technologies is particularly beneficial in these areas (Azzone *et al.*, 2009).

Regarding health promotion and prevention of psychopathology, another variable that can be considered is that of resilience in order to encourage the adoption of a resilient healthcare by clinicians. Jackson and other authors (Jackson *et al*., 2020) in their research showed a serious game called Resilience Challenge with the aim to communicate resilient healthcare principles to clinicians. This serious game has proven to be engaging and useful for users (Jackson *et al*., 2020).

In these areas (e.g.: healthcare, emergency services) in which there are significant physical and psychological consequences for people, serious games can support active learning of operators, allowing players to challenge themselves in a protected setting (Whitton, 2014).

These areas of focus are defined by Hart *et al.* (2017) "safety-critical games" because potential errors can have serious consequences.

The use of serious games in the training of healthcare professionals is expanding (Sipiyaruk *et al.*, 2018); for example, serious games have supported training in surgical procedures or to enable nurses to practice assessment (Ricciardi & Paolis, 2014).

Serious games have also been found to be more engaging than other educational methods (e.g., e-learning modules) (Dankbaar *et al.*, 2017) and also more cost-effective (Field *et al.*, 2018).

E-therapies and ethical issues

The increasing use of technology in the field of mental health highlights how the use of apps can yield great benefits for mental health management; in fact, web and smartphone apps designed to offer treatment or support for common mental health problems, such as depression, anxiety, and stress, are collectively referred to as "e-therapies" (Bennion, 2019). As more developers are seeking to produce electronic therapies for the National Health Service (NHS), it is essential that they apply clinical and academic best practices to ensure the creation of safe and effective apps. The National Institute for Health and Care Excellence (NICE) has published a set of evidence standards for digital health technologies that include apps. Evidence standards have been implemented to ensure that new technologies are clinically effective and represent added economic value for the local NHS, with the goal of making it easier for innovators and principals to understand what good levels of effectiveness of digital technologies should look like (NICE, 2019). To evaluate the effectiveness of mental health apps, a systematic review estimating the effectiveness of mental health apps at all ages (Donker *et al.*, 2013). Only 27 percent of the smartphone apps reviewed had published or pending evidence of effectiveness. Bennion *et al.* (2019) provided a snapshot of the commercial landscape of e-therapy development and the areas that need more refinement to improve their suitability for NHS mental health services, pointing out that clinician involvement, academic involvement, research or other evidence, and use of a specific psychological approach or theory need to be included in the effectiveness evaluation process.

These indicators were selected because they are based on the premise that effective digital psychotherapy interventions arise because of rigorous theoretical and empirical work by experienced clinicians and academics using a known psychological approach. The lack of a consistent evidence base makes the process of finding effective e-therapy random.

Investigation of psychological AI has produced results suggesting that text-based chatbots can reduce symptoms of depression and anxiety. Two randomized controlled trials published over two years indicated that apps delivered through a messaging service, smartphone or other web platform have efficacy. "Woebot", a text-based agent that provided cognitive behavioral therapy (CBT), reduced symptoms of depression and anxiety (Fitzpatrick *et al.*, 2017). Digital technology, therefore, increasingly plays an important role in everyday life with people regularly relying on digital products to manage aspects of their lives, however, the literature does not often address either deontology or outcomes-based normative ethics. Such evidence is risky, as mental health counselors who do not understand artificial intelligence may violate their code of ethics. Counselors who use an AI-based service without understanding it expose themselves to the risk of practicing outside their boundaries of competence. Clinical counselors use the ACA Code of Ethics (ACA Code of Ethics; ACA, 2014), which devotes a section to "Remote counseling, technology, and social media" (ACA, 2014, Section H). For many professions, it may be years before their codes of ethics are updated, but technology advances daily. Codes of ethics in the behavioral sciences should begin to specifically address artificial intelligence. Although continuous updating may be impractical, constant monitoring of artificial intelligence by decision makers, such as the ACA Ethics Committee, is recommended. Yet, the definition of AI is still unclear in many studies and there is a noticeable absence of reference to or drawing on ethical codes. There is a growing body of research devoted to the effectiveness of psychological AI. Many of them concern clinical counseling, but few discuss the ethical parameters governing studies or AI in general.

Digital setting for education

The right to education is one of humanity's inalienable rights, enshrined in numerous founding documents of democratic societies. Everyone who is willing to learn must have access to education (Park & Shea, 2020). However, the right to education faces numerous obstacles even in democratic societies. Distance learning can be identified as a means to overcome the obstacles that the right to education may face in democratic societies (Larreamendy-Joerns & Leinhardt, 2006). Furthermore, blended learning, which covers face-to-face and online forms of learning, also supports the right to education in democratic societies. Blended learning ensures education by combining methodologies whereby students obtain knowledge through traditional and online learning (Siemens *et al.*, 2015). Online learning has specific characteristics compared to traditional learning (Spring & Graham, 2017). Among the most relevant aspects, we would like to highlight how knowledge on the web is more easily shared between students and between teachers and students. In the last two decades, many studies have tried to understand learning in online communities (Shea & Bidjerano, 2011).

According to Siemens *et al.* (2015), e-learning is defined as "a form of distance education in which technology mediates the learning process and teaching is delivered entirely via the Internet". Therefore, blended learning is defined as "the practice that combines traditional face-to-face instruction with online learning" (Siemens *et al.*, 2015). Distance learning refers to a methodology for improving knowledge that has close links with distance education, which "is planned teaching and learning in which teaching takes place in a different place than learning" (Siemens *et al.*, 2015). Students struggling to attend classes have had the opportunity to learn through distance learning. Advances in technology have made new learning tools possible or expanded the functionality of already popular technological tools (Park & Shea, 2020). In the 20th century, the spread of the computer and the network led to the development of online learning spread along with the computer network (Harasim, 2000). The effectiveness of online learning can be seen in both independent and collaborative learning. In particular, online learning has supported individual learning and provided opportunities to develop experiential learning methodologies through

group activities (Holmberg, 2005). The combination of online and face-to-face learning provided more fruitful channels for students to connect with peers and instructors (Shea & Bidjerano, 2011).

Mass open online courses and analyses of learner interactions on mass open online course platforms have been studied in numerous reviews and meta-analyses on distance learning (Park & Shea, 2020). In particular, in an early period, the characteristics analyzed by reviews and meta-analyses focused on the discourse patterns of learners in asynchronous discussions in the virtual community (Park & Shea, 2020). In a second period, reviews and meta-analyses studied learners' satisfaction and levels of self-regulation (Park & Shea, 2020). More recent studies have discussed informal learning in online platforms such as social media (Park & Shea, 2020).

Chen *et al.* (2010) pointed out that over the past 10 years, the understanding of the configuration of important topics and academic publications on online learning has improved through the network of grouped topics. In according to Park & Shea (2020), it is increasingly important to consider the characteristics of online students, including their type of learning online, self-regulation and motivation in online learning research. In recent years, the Internet has played a significant role in facilitating students' ubiquitous learning, along with their cognitive enhancement in formal and informal learning environments. Without an appropriate pedagogy for learning and teaching, the effectiveness of the use of educational technology will decrease. It is also important to facilitate interactions between students and students, students and instructors, students and courses, students and instructors, students and courses content/assessment tools with timely feedback and monitoring of student learning (Siemens *et al.*, 2015).

We believe that the recent literature review on the impact of digital learning during the COVID-19 pandemic deserves further investigation. The study by Zis *et al.* (2021) examined the impact of digital learning on mental health and burnout during medical studies. Zis *et al.* (2021) conducted a baseline assessment of the impact of digital learning on mental health and burnout a few weeks before the announcement of the severe measures due to the COVID-19 pandemic. These data were re-evaluated during the study period when the COVID-29 pandemic was declared in effect. They found a high response rate of 81.4%. They found a deterioration of mental health in

the sample during isolation. Other studies show a significant increase in depression levels as the pandemic progresses (Debowska *et al.*, 2020). These data could be confusing by suggesting digital learning alone as a risk factor for students' mental health. Instead, when analyzing studies that have considered the impact of digital learning on mental health during the COVID-19 pandemic, one should consider several other factors that may have contributed to the deterioration of mental health, such as family or interpersonal stress and/or personality traits characterized by tendencies towards social isolation.

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