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Research article

E-Learning in Geography: new perspectives in post-pandemic

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Abstract: Recent developments in low-cost information technology, fast internet, intelligent terminals, apps that can manage the most varied activities in a professional but simple way, have allowed their diffusion in sectors traditionally reluctant to rapid change. The pandemic crisis caused by Covid-19 and the consequent provisions of social distancing to curb its spread, have also forced the world of education to deal with this modality. Terms such as Distance Learning and Smart Working have forcefully entered the vocabulary and daily life of millions of people. The persistence of the pandemic due to the variants of the virus is convincing even the most reluctant to change that the new "normal" will have to rely on information technology to a greater extent than in the past. In much of the Western world, where culture has long been a thriving economic sector, much has been invested for decades to strengthen and disseminate distance learning activities recognized as economically and socially beneficial. The European institutions have moved in this direction more recently. The author's experience in the last two years in emergency remote education in geography at university level has not always been positive. He therefore felt the urgency to consider adopting existing standards and best practices in order to improve outcomes and achieve effective online geography learning. The evident advantages of adopting good quality e-learning for an extended community would facilitate understanding and acceptance even in the Italian school and academic environment, usually conservative and conformist. In this environment, up to now, many have in fact feared that it could lead to the endorsement of distance learning, viewed with contempt if not really with aversion as it is considered to be of poor quality.

Keywords: E-Learning; geography education; digitalisation; information technology

1. Introduction

The changes taking place in contemporary society require an adaptation of teaching that supports the development of critical thinking in order to allow the younger generations to deal with different cultures, acquiring an increasingly dynamic and complex knowledge.

The technological evolution of the last decades, thanks to the development of communication networks, has imposed new educational models for training and information that make interactivity the most innovative and characteristic aspect, favoured by the ability to easily find and update information. This allows users to interact while becoming users and content creators at the same time. This condition finds full realization in the digital revolution called Web 2.0 [1] where interactivity enriched over time by the growth of elements, by the resources in the cloud and by the spread of mobile devices, allows to speed up the training process that develops in the context of a community, place virtual where to interact, participate, learn and create.

The experience gained by the author in teaching geography online at university, in compliance with the social distancing measures imposed to prevent the spread of the infection from Covid-19, has highlighted some problematic aspects but also many positive ones. When the critical issues will be resolved thanks to the adoption of best practices for the design of a quality online geographical teaching, after having studied the specific technical and pedagogical problems, it will certainly be possible to consider this teaching method, nowadays adopted by necessity, as an effective solution both for the satisfaction of teachers and, above all, of students.

The aim of this study is to show, in line with the indications of the European Commission [2] in his "Digital Education Action Plan (2021–2027)" and following the educational experience gained by the author, that digital education in geography truly offers opportunities for quality, inclusive, resilient and accessible teaching, thanks to: (1) a quality assurance system based on objective evaluations to allow comparison of results with traditional methods; (2) a more active and participatory role of students as content builders and not just as users; (3) the reduction of inconvenience for students and teachers in the event of future phenomena that could impose distancing needs; (4) the reduction of geographical and socio-economic barriers that limit access to study and culture.

Specifically, taking into consideration the primary bibliographic sources on the subject, this paper will focus on digitization in the processes of acquisition, processing and transmission of geographical knowledge where, for several decades now, digital support has been used to analyse and represent spatial phenomena.

2. The pandemic and the world of education

The learning methods adopted today are the following: (1) Face-to-Face (F2F) or On-Campus—is the classic mode that provides for the simultaneous presence of the actors (teachers and students) in a physical environment specifically intended for teaching (classrooms, laboratories, meeting and study rooms) where they can meet for lessons, exercises, tutoring, exams; (2) Online—the actors do not interact in a physical but only virtual environment and carry out an accurate study and learning experience using Information Technology (IT) tools. Communication between the actors can take

place in a “synchronous” or “asynchronous” way. In the first, the actors are simultaneously connected and present on an IT platform through which to interact. In the second, the connection takes place at different times with lessons based on material prepared and made available by the teacher for later use by the students. The other interactions between the actors take place in the same way (questions, explanations, tests, etc.). Mixed mode is defined as a combination of synchronous and asynchronous learning in a virtual environment, which mixes synchronous interactions with asynchronous discussions, tasks and videos. (3) Hybrid (or blended)—is a combination of various percentages of F2F and online education, which gives students flexibility between the two types of learning interaction.

Creating an appropriate learning environment, regardless of delivery method (F2F, online or blended), requires a significant amount of preparation, planning and design.

The Covid-19 pandemic arrived unexpectedly in 2020, mid-year for most of the school and academic world, forcing a rapid migration from traditional F2F teaching to distance learning with online courses and exams in order to respect the distancing social safety system imposed to prevent the spread of the infection. The transition was therefore for mandatory safety reasons and not for a choice aimed at better learning, without, among other things, being able to foresee a time limit for this need that many have certainly considered temporary. Many educators and administrators, without proper planning and often without the necessary methodological knowledge and skills, have simply diverted all their educational background and skills to online platforms. Videoconferencing links, off-line recordings of lectures for live or deferred use by the student audience, electronically assigned exercises, tests and exam sessions with results assessed digitally instead of manually, in an approach based on student-content interaction versus traditional student-student and student-teacher interaction. The result was very often disappointing for students and educators as it was negatively conditioned by not being able to count on environments suitable for the traditional interaction between students and teachers such as classrooms, laboratories, libraries, field sessions, without the adequate compensation that would have required the adoption of proper methodological tools and technologies essential for quality online teaching.

Today the successive waves of pandemics continue to frustrate the hopes of those who expected to be able to return to teaching exclusively in the classroom. Online teaching, also in the light of the decidedly encouraging results of authoritative research [3,4], often financed by government agencies, therefore remains at the forefront of the possibilities to be adopted in a structural way. To do this, it is essential to avoid suffering it as an unfortunate experience of lower quality than the F2F mode [5], which we can forget when the problem of social distancing is overcome. By making a virtue of necessity and exploiting all its potential, we can make it a very different quality option from that significantly defined as “emergency remote teaching” (ERT) or “emergency remote learning” (ERL). Among the criticalities of the online mode adopted during the pandemic, which needs to be improved in view of a subsequent adoption as a reference mode, the students reported an aggravation of the social and economic differential for the less well-off classes due to the strong dependence on adequate availability of related resources to communication such as fast internet networks, high performance computers and SW.

Confirming this, the level of student satisfaction with the quality of their education has deteriorated following the need to switch to online mode for covid-19, from 87% satisfied students before the pandemic to 59% during the post-pandemic period in online mode [6].

With the adoption of the online mode, teachers are also asked to take on the role of expert guide in the use of the technological tool for teaching application. In this function, teachers often found themselves lacking the necessary technical support both in the preparation of the teaching material and in use, with a computer system that was not always reliable and performing, also due to the sudden overload of users.

From what has been mentioned, the difficulty of adapting to the online mode is evident for any teacher who has taught F2F in a classroom throughout his long career, during which he has almost never had to directly use technological tools and pedagogies suitable for virtual mode. Difficulties have often also passed on to students and their families despite the greater flexibility and readiness for change. Many have experienced a deep sense of isolation, quite different from the usual sense of belonging to a class "community", finding themselves unable to interact with the other members of the virtual class, losing the perception that behind the screen there was however a human being and not an avatar or a software and only having an effective assistance could they concentrate on learning, finding answers to doubts or questions if necessary.

Despite these certainly not exciting experiences that could lead to a negative judgment on online teaching, in many realities of the Western world, in particular in the UK and the USA where culture has long been a profitable business sector, the social as well as economic value is appreciated and recognized. Thanks to government funding, heavy investments have been made in this field, the value of which has more recently been recognized by the European institutions as well. In fact, online education has been the subject of studies for decades in which theories, models, standards and specific evaluation criteria have been developed [7] that allow the design and obtaining of quality online courses that ensure a high level of interaction in the three basic forms: student-content, student-student and student-teacher [8].

3. The state of the art in e-learning

As already mentioned, and as will be better described below, the reasons for considering investing in online learning go far beyond the obvious need to prevent the difficulties that its sudden and hasty emergency adoption has caused.

For this purpose, it is useful to start from the knowledge of the state of the art in the field of e-learning to evaluate its pros and cons.

Due to the pandemic event, or perhaps thanks to it, the online mode has been imposed on millions of students. In the US, for example, more than a third of university students today attend exclusively online courses while the remainder follows at least one course in this manner.

This mode is particularly widespread at private universities which represent 6% of the total students while they represent 24% of students completely online and 13% of students with mixed F2F and online modalities [9]. This type of education continues to attract a growing number of students who, compared to F2F, find it more convenient, accessible, inclusive, flexible, relevant, assisted and guided. It is also believed to provide the opportunity for a much larger population to

receive quality education from highly renowned institutions on a global scale [10], stimulating students' creativity, innovation orientation and entrepreneurial skills, enabling them to profitably enter a job market that will be profoundly different from the current one [11]. Transversal skills that connect individual knowledge, technological skills and intellectual and emotional characteristics will be increasingly required to activate cognitive processes and stimulate the capacity for critical and reflective thinking [12].

Similarly, many fields of knowledge and work, for which digitization has hitherto played a marginal role, will follow this trend, enhancing the use of new technologies to broaden and improve the spectrum of analysis and the dissemination of knowledge. In the coming years, in fact, it is estimated that the mixed offer of F2F and remote courses will be necessary to allow access to education from any place and device and at any time.

This is very far from the "emergency" distance learning experience often accompanied by a sense of intense frustration and isolation on the part of students and teachers. This vast and diversified audience, in order to transform itself into a real community, container and content of teaching and learning, must pay attention to all the components in order to guarantee the technological and methodological competence necessary for an active use. Only in this way can online teaching concretely represent a quality option, even more effective than F2F.

An adequate familiarity with IT tools and knowledge of the resources of the digital community are essential to benefit from the enormous potential of the web. Digital illiteracy, linked to territorial, generational, social or technological aspects, which cannot always be compensated for in the educational process, can constitute a structural gap and negatively affect the potential and effectiveness of the new e-learning tools.

For an effective proposal of contents in an e-learning context, the preliminary verification of a student's digital skills is therefore fundamental, which must go well beyond the use of the personal computer that was the primary resource in the previous generation of distance learning. The didactic objective can in fact be considered achieved when the student, in addition to understanding a content, has been able to re-elaborate it and enrich it with topics resulting from his own research activity to be shared with the interested community. To this end, the teacher increasingly assumes the role of coach and guiding the learner. The latter, overcoming spatial and temporal constraints [13], will be able to conveniently use the digital skills available to benefit extensively and profitably from the new training systems.

4. E-learning in geography

Numerous geospatial technologies are in fact already widely used in daily life and during classroom or other physical teaching environment (virtual globes, remote sensing, GIS, WebGIS, GPS, mobile geolocation apps and other geomedial and GeoICT resources) and have, in a way more or less official, transformed geography teaching practices over the past decade. The adoption of active teaching practices, such as inquiry-based learning and problem-solving activities, is also growing in secondary education classrooms, mainly in Europe [14] and the United States [15] as well as in some countries in South America and Asia [16].

The term Geospatial Technologies (GST) indicates the range of modern technological tools for geographic mapping and territorial analysis. These technologies are the evolution of the tools and techniques for the creation of the first maps in remote times. To ensure maximum understanding and integration of the vast amount of information produced thanks to GST, it was decided to adopt official standards and more recently the term Geomatics [17] was coined as part of the ISO/TC211 standard series.

This neologism indicates the discipline that deals with the "collection, distribution, storage, analysis, processing, presentation of geographic data or geographic information" as well as services, systems and platforms for the management of geographic information. Given the sensitivity of this information, many of these platforms have seen the strong interest of governments and large IT groups: the Californian GeoSpatial Technologies [18], consultant and supplier of numerous US government agencies and organizations for safety and security activities, has created a platform that has become a standard synonymous with GST.

The Californian IT giant Google LLC manages and distributes the well-known Google Earth program for free, which generates suggestive and detailed virtual images of our planet.

Among the GST applications, the best known and most widespread tool for spatial analysis in the academic field is the Geographic Information System (GIS) [19] which adopts the Global Positioning System (GPS) and remote sensing techniques.

Despite the strong resistance of the beginning of this century to the introduction of geospatial technologies in the classrooms of secondary schools, the current widespread availability of geospatial data, spatial data infrastructures, geomedial resources and WebGIS make their use natural in a geography lesson that want to be effective and updated.

As happens in other academic fields, even in geography, the adoption of online education techniques and methods is not, however, an established fact, having to suffer from an atavistic sense of distrust of the more traditional (and often influential) environments. To this contribute some clichés, a lack of technological knowledge and, above all, the lack of evaluation of the good qualitative results that it allows to obtain. Over the past few decades, while some have embraced and advocated online education in geography [20,21], others have flatly condemned online education by arguing that it is unsuitable for engaging students, attributing the reason for failure to the impossibility for teachers to making one's presence felt through the IT tool as well as due to inadequate and inefficient pedagogy "... online education has failed to reduce costs and improve outcomes for students ... faculties, academic managers, the public and employers continue to perceive online degrees less favourably than traditional ones ... ".

Contrary to the general perception that one has today in the more traditional academic world, the teaching of geography, in its various branches and in particular in the human one, has a decade of experience in quality online teaching. Numerous courses have been expressly designed, created and carried out with success and general satisfaction, benefiting from the great opportunities offered by online teaching. This was done in order to be able to adequately follow students residing in distant geographic areas or who have difficulty attending courses at a common and fixed time [22].

Spatial analysis is fundamental for geographical knowledge [23] and GSTs represent a valid help for teachers and students in clarifying and consolidating concepts, achieving more concrete knowledge and skills [24,25], developing critical thinking while maintaining a tangible connection

with the problems of the territory in its actual current configuration [26], feel involved in operations research and data-based investigation. Despite this, there is still a lack of good integration of GST applications in geographic teaching programs of high schools and universities. As evidence of the complexity of the phenomenon, despite the need for change and the related lively debate, analysts continue to wonder why teachers, apparently without finding it inadequate, explain what GST applications are rather than teaching with GST. Understanding the real motivations behind this attitude of teachers is essential to understand how to make the sector more efficient.

Numerous researches conducted in countries that have long since undertaken the use of GIS technologies have shown an improvement in learning at all levels of education that grows from university to high school level: spatial thinking ability, geographical knowledge and spatial citizenship.

Spatial thinking ability has been well defined by the National Research Council's Committee on the Support for Thinking Spatially as a capacity, independent of general intelligence and the result of the constructive combination of cognitive abilities [27]. It is based on three elements: concepts of space, tools of representation and complex reasoning processes. Spatial visualization, spatial orientation and spatial relationships are considered to be the three main spatial skills of cognitive geography [28].

The difference between spatial thinking and geographic thinking is that the latter implies the consideration of the social, economic, political and cultural aspects of the human dimension [29] rather than just the topological aspects. In other words, geographic thinking involves the application of spatial thinking to address complex geographic concepts or environmental and social problems [30]. Space, place and environment are key concepts for the acquisition of geographical thinking, integrated by other social concepts such as change, populations, sustainability, interdependence, ecosystems, physical and human processes, landscape and cultural diversity. These concepts are already traditionally covered in geography curricula of some countries, for example in the United Kingdom [31].

Geospatial technologies represent powerful tools for developing spatial thinking [32], geographic thinking, or inquiry-based learning, but they also provide significant geographic topics for students, as they help them understand the world by contextualizing global and local geographic issues. The international GeoCapabilities [33] project confirms that it is possible to acquire powerful scientific knowledge of the sector with the use of geospatial technologies [34].

Spatial citizenship constitutes a third essential component in geographic education along with spatial thinking and geographic knowledge. Consequently, geography educators must raise awareness of the world’s spatial and social problems so that students become critical thinkers and active citizens in the action of improving the environment in which we live. Another important educational goal [35] is the adoption of geospatial technologies in applications for traffic and transport, smart-city initiatives, environmental protection, social media and so on.

Recognizing that geospatial technologies foster SMART learning (Self-directed, Motivated, Adaptive, Resource-enriched and integrated by Technology) [36], their dissemination in training and professional development programs for qualified and already-in-service geography teachers is increasingly favoured [37].

In light of the vast wealth of skills and competences that digital geographic education allows to give to students compared to traditional analogue geographic education, many international studies have concluded that a comparison between the two types of teaching is decidedly reductive and therefore devoid of any meaning [38].

Further research on the effectiveness of the use of geospatial technologies in geography courses show that they promote easier and more lasting learning [39].

Numerous field researches, conducted with questionnaires and independent verifications, have shown that by adopting the Digital Atlas as a teaching tool, progress is achieved in learning spatial thinking, geographic knowledge relating to topics of urban and economic geography but also in spatial citizenship. Questionnaires on climate change and spatial imbalances for geographical and social problems, for example by comparing the impact on different territories of social imbalance or the increase in temperature, allowed to detect an improved spatial empathy among the students who had used Webmapping with the consequence of being able to consider it as a valid enhancement tool suitable for expressing and disseminating ideas, solutions or suggestions aimed at improving spatial conditions. Some maps of the Digital Atlas were also used later by teachers and students to raise awareness on the United Nations Sustainable Development Goals (Agenda 2030-Goal 11) [40] for the protection of the cultural heritage of the community territories and of the whole planet.

Within the geospatial technologies available today, WebGIS is perhaps the most powerful, analytical and overall useful tool for geographic education, particularly in secondary education [41]. Although learning GIS is not easy and immediate, the many successful use initiatives have shown that secondary school students are able to profitably use desktop GIS for highly technical and scientific work [42]. WebGIS has almost all the functionality of a desktop GIS and is much easier to use, as demonstrated by its increasing use [43]. WebGIS also has many benefits including accessibility, storage, ubiquity, and speed.

In the US, work is already being done for a more widespread teaching of GIS [44] on the basis of the provisions issued by the institutions responsible for geographic education programs in secondary schools and universities but, for a concrete result, it is necessary to adapt the training of teachers regarding these technologies, both for the technical as well as pedagogical and content aspects given that the current courses for teaching qualification in the United States do not consider physical and environmental geography, as well as technology among the necessary knowledge [45].

A recent article published in the Journal of Geography [46] reports the results of a study carried out in the US to evaluate whether geography teachers who show a more solid Geospatial Technology, Pedagogy, and Content Knowledge (G-TPCK) used GST more frequently than those teachers with a less developed knowledge base. The level of knowledge and competence was assessed by administering questionnaires to divide them into three groups: (1) GST-Ready: Suitable for theoretical and practical teaching of GST and with GST thanks to good technical-practical skills as well as pedagogical; (2) GST-Primed: Limited theoretical and practical competence on GST, especially with regard to data management technologies; (3) GST-Limited: Limited theoretical competence and poor practical competence on GST with sporadic involvement in technological activities.

Very significant was the revelation that the GST-Ready participants did not consider themselves adequate to evaluate the quality of their pedagogical approach having developed it on an empirical basis, often on personal initiative and in the most complete isolation, in order to make available to their students' knowledge of professional technologies that they considered useful if not absolutely indispensable. It would therefore be really appropriate to include the GST topic in continuing

professional development programs to achieve the desired levels of G-TPCK to integrate GST into geography teaching [47].

5. Best practices

Many illustrious universities and associations around the world, such as the Royal Geographical Society and the American Geographers Association, have invested in online training and education for over twenty years. The primary purpose is to support and improve traditional training offer and methods given the considerable numerical growth and cultural and linguistic heterogeneity of students expected in the next decade. These people will need a cultural product provided in a clear and interpretable form even without advanced knowledge of the teacher's language. This is possible thanks to the high quality of current IT techniques for instant translation as well as the ability to consult texts and references in various languages by relying on advanced and intelligent thematic cataloguing systems.

Among the modalities there are differences in pedagogy concerning the figures of the actors: in F2F the educator has a central position from which to provide education and contents to students who receive methods and information to be memorized in their knowledge base. In online learning, the use of the technological communication tool leads to focus on the individual student who must be guided according to learning models based on investigation, analysis and problem solving, acquiring a role of active responsibility in the construction of personal and common knowledge base.

A series of specific standards and studies on teaching and learning techniques [48] are now available to foster this integration of curricula and provide knowledge and skills adequate to meet the growing needs of the geospatial industry which is among the fastest growing in most socially advanced countries [49].

Recent studies and research conducted in 2020 in the US were aimed at identifying the pros and cons, often subjective and non-monetizable [50], for which a student chooses to follow a learning process in a certain way. In general, the most appreciated feature in the online courses was the greater flexibility in attending the courses against a strong penalty in the interpersonal relationship component with 42% of students who stated that it was difficult to remain adequately stimulated and motivated in attending courses in online mode. The economic aspect was declared decisive in the choice of an online path by 18% of students due to the lower cost of the tuition and the fewer difficulties in accessing financing procedures and making payments. This is also associated with the fact that 17% of colleges exempt those enrolled in online courses from paying for the fee related to F2F activities such as sports, fitness and other recreational activities, as well as some general costs of structure and operation (building and gardens maintenance, security, concierge, etc.). This choice motivated by commercial reasons of competitiveness, is generally compensated in part by increasing the tuition fees for all courses, regardless of the modality, in part by investing in promotion to maximize the online enrolment.

Among the positive aspects of F2F universities, students reported: (1) Greater freedom of choice in defining the curriculum; (2) More efficient programming of courses; (3) possibility to interact in real time with tutors and professors; (4) Physical availability of tutors for the benefit of less brilliant students who worsen their performance with an online course; (5) Possibility of using

premises and physical resources such as libraries and books; (6) Possibility of cultural and personal interaction with other students of the same and other faculties.

Among the positive aspects of online universities, students reported: (1) Fewer restrictions on access to regional subsidy programs and contributions for residents; (2) Greater availability of accelerated degree programs; (3) Better flexibility and autonomy in the planning of courses; (4) Immediate access to assistance resources (help-online); (5) Accentuated individual responsibility; (6) Limited or zero economic demand for F2F activities and facilities for online students; (7) Reduced environmental impact (travel, construction and maintenance of buildings).

Specifically, the International Geographical Union recognized the importance of these tools through the recent International Charter on Geographical Education stating that "geospatial technologies offer unique opportunities to make sense of the modern world" and constitute an invaluable skill set of the 21st century for geography education [51]. Other researchers consider changing the nature and paradigm of geographic education itself, simply renaming it digital geographic education or digital terrestrial education [52].

Considering the importance of the online education modality, which allows to guide the student through the learning process as a valid alternative to the F2F modality, the United States Department of Education, within the activities of the Fund for the Improvement of Postsecondary Education (FIPSE) funded the Maryland Online, Inc. program "Quality Matters: Inter-Institutional Quality Improvement For Online Courses" [53] for the efficient configuration of quality online and blended learning environments.

The result of this work is QualityMatters.org, an organization to assist in the conception and design of online courses suitable to fully meet the needs of students.

In terms of best practices for the development and design of online learning experiences, the most relevant characteristics of an online course have been identified [54]: modality, pace, student-instructor relationship, pedagogy, role of the online instructor, role of the online student, synchronization of online communication, the role of online assessments and verification systems.

The "live" online courses have often been accompanied or replaced by modules or deferred lessons that the student can see and review when he wants and with different devices, downloading the contents made available by the teacher, asking questions or queries through messaging systems direct or in chat, leaving suggestions or comments through notes or satisfaction questionnaires. The teaching of geographic thinking, once based on "traditional mental skills" such as memorization, must now be based on an approach based on the capacity of reasoning and investigation [55] aimed at solving problems and, therefore, geospatial technologies play a role basic.

The use of digital technologies favours a participatory and transdisciplinary educational approach, broadened across the entire sector STEM (Science, Technology, Engineering and Mathematics), through integration and interoperability with other geospatial technologies, including mobile devices (GPS and geolocation data, open data, multiscale data, real-time data and spatial data infrastructures).

Specific teaching methods for geography and GIS have been devised and evaluated with experimental tests for the various age groups and for different educational needs. Among these, the use of "Second Life" (defined metaverse or digital universe) is noted for its innovative aspect, as a platform for teaching GIS that "provides exciting possibilities for building learning communities,

enhancing social presence, and creating more shared intellectual landscapes than ever before" [56]. More recently, OERs (Open Educational Resources) have been used to encourage student participation in the virtual environment [57].

Numerous MOOCs (Massive Open Online Courses) have been carried out to disseminate knowledge on the new geographic contents and related specifications [58].

As it is easy to understand, there is no exact recipe for creating a good online course as there is no one for an equivalent good F2F course. In both cases, it is necessary to start from some basic concepts and good practices and then rely on the experience to be gained over years of practice. The aim will then be corrected on the basis of the feedback of the students and on the successes or failures they achieved during the courses and after their conclusion in their work activity.

Some aspects that may influence the adoption of digital methods compared to traditional ones will be considered below.

The ability to write notes with your own hand next to the text of a printed book is one of the most easily understood differences between analogic and digital reading. The annotation represents, as well as a reminder for the individual reader, a comment that he also leaves for the benefit of those who will use the same text and the subsequent comments will form a collaborative integration of the message of the original text, completing it or even enriching it [59]. This is especially true for professional readers whose goal is to produce reviews of the text and who therefore need as well as benefit from making marginal annotations. The annotation is also considered very useful for the process of assimilation and learning of the text and numerous studies lead to argue that manual annotation has a much higher effectiveness than word processing, probably as it educates the reader to pay attention to the substance rather than to the form, even taking advantage of the longer time required to produce the annotation in an acceptable and subsequently intelligible form: in video-writing a beautiful text is not always also of value and vice versa in a manuscript. In practice, the greater difficulty of handwriting compared to that on the keyboard leads to having to pre-elaborate the ideas to be reported on paper, allowing you to train yourself to derive the true meaning of the writing to be reported in the note [60]. To confirm this, many readers continue to annotate on paper even when they use digital reading, with the obvious difficulties of maintaining an immediate link between text and note, despite the fact that today there are many video-reading programs that allow you to annotate.

In video-reading, especially of on-line texts, it often happens to intersperse the study/comprehension process with navigation on other web pages to clarify unfamiliar concepts which then must be part of the student reader's knowledge. The possibility of "noting" the online navigation path or the part of specific interest will be for the future benefit of the individual student but also of the audience of other readers of the same text or piece of lesson/communication who, perhaps, have underestimated or overlooked the complexity.

In digital education a very useful and effective tool is provided by virtual and augmented reality techniques, already used for some time to improve the conscious use of tourist resources thanks to a more immediate access to information by travellers through their mobile devices, both in the planning phase of the trip and during the experience of the visit [61].

6. Conclusions

One of the fundamental objectives of quality distance learning that can represent a valid alternative to F2F, traditionally executive and guided training, consists in proceeding in a collaborative way, sharing and feeding information and contents in a continuously evolving and enriching process. It is based on the contribution of the various actors, part of an enlarged community of teachers, learners and professional users, who can exploit the enormous potential of the IT environment. Such an articulated information model requires suitable pedagogical tools to stimulate, in an extremely flexible context, awareness of the entire cycle, leading to the fusion of individual experiences into those of the community. In this way the socio-cultural gaps between students can be reduced and they will feel motivated to participate collectively in the construction of a cultural environment, as actors of a deep learning experience and no longer just spectators. At the same time, the teacher is asked to give up the role of "sage on the stage" to take on the role of facilitator and "guide on the side" of each student. The real goal is to ensure greater resilience to our educational system in the event of possible new distancing needs or difficulties in moving, while being able to benefit from the undoubted advantages that this method can now ensure thanks to the enormous progress that information technology presents.

In recent decades, thanks also to these research and experimentation initiatives, enormous progress has been made in terms of pedagogy, andragogy and eutagogy, obtaining excellent results that lead us to believe that the method is in many ways more effective than the traditional one as long as it is based on the adoption of best practices rather than on impromptu and empirical attempts.

Here are some aspects that the author has verified during his experience of distance teaching of geography in university courses. A numerically more consistent participation compared to face-to-face lessons, evidently favored by the lack of difficulty in moving from home to university. Difficulty in verifying the effective attention of students during the entire duration of the lesson due to the "camera off" mode of all the participants, often due to the need to share the teacher's video. Questions at the end of the lesson, proposed by a small number of students, compatible with correct attention. However, it was not clear whether the others who remained silent and online had actually been present or had moved away. Impossibility of effectively carrying out the reading laboratories of topographic maps that involved the use of analogue paper material that is difficult to propose online. Real difficulty in resuming lessons in person, once the safety restrictions were over, as the students proved to be awkward in interacting with the teacher, especially for those who, in the third year, had mostly followed at a distance up to that moment. All this has confirmed that the online teaching of the discipline allows high quality results only by adopting, even in our "traditional" universities, the most recent best practices in the sector. In fact, it is believed that by relying on adequate technologies and pedagogies, a quality and efficient e-learning system can be effectively adopted. In this way, educational traumas for the university community would also be avoided in the event of future distancing needs.

In fact, the geographical sector has always been a user of techniques for recording and representing large amounts of data and information, has a natural predisposition to benefit from the advances that information technology makes available for the storage and consultation of big data, their continuous updating and distribution in "collaborative" mode.

Conflict of interest

The author declares no conflict of interest.

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