



Design for visual literacy and metaliteracy competence course in higher education libraries

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ABSTRACT

This article addresses the design for a higher education metaliteracy competence course. The raw data for the study described were drawn from the findings delivered by a VOREMETUR I+D+i project on the use of media art works as digital learning (DLOs) and learning (LOs) objects. The scope of the course is higher education digital competence training, and its aim is the development of specific visual literacy and metaliteracy competence. The purpose is to broach such training in the context of university planning based on curricular design and online teaching materials. The chosen format is blended learning with digital educational platforms supported by m-learning techniques and in-person sessions (Wooclap). The course is based on a metamodel structured around four stages. The paradigms, model, and scope of application are formulated around a metaliteracy taxonomy: online communication and information competence for acquiring and editing knowledge in digital and virtual object environments are defined, and elements for assessing the competence course proposed. The conclusion drawn from the study is that the model is applicable to the formal, non-formal, and informal education incumbent upon academic libraries.

Keywords: metaliteracy; multiliteracy; visual literacy; new media art; competence courses.

INTRODUCTION

The scenario generated by the 2008 financial crisis necessitated a change in socio-economic and productive models to ensure sturdy progress. The covid-19 pandemic with its devastating effects on health and the economy and its fearful social impact, in turn, requires the major economic powers to adopt a new horizon for an eco-friendly model to ensure ongoing development. Whilst the timing for implementing the indispensable changes in response to the earlier crisis was spread over decades, the situation induced by covid-19 calls for much shorter-term solutions that substantially and dangerously raising the risk of digital divides and technological poverty pockets.

With its central planning, China (whose economy has been among those least battered by the crisis) established the grounds for a new model of its own in mid-2020, whereas in the United States the measures to support change and renovation of its socio-economic model were sketched out in an initial plan introduced in the second half of that year and reinforced with a supplementary plan put forward by the Biden Administration. In both cases, environmental considerations coupled with sound digitisation are among the most prominent factors for development.

In the European Union's uneven recovery from the 2008 crisis prompted deep existential fracture as a result of scattered and scanty effective measures that seriously challenged the philosophy underlying its structure and institutional system. The subsequently adopted pathway to recovery based on a fuller consensus has enabled the Union to more successfully reconvert its productive and socio-economic model to compete more effectively with nearby powers (including Russia). That pathway defines two essential pillars for reconstruction and renovation: the Union's Green and Digital Agendas.

The EU introduced the Digital Agenda in February 2020 for the five years running from 2019 to 2024, outlining two initiatives: the White Paper on Artificial Intelligence (Comisión Europea, 2020b), geared to regulating and investing in European AI, and the European Digital Strategy (Comisión Europea, 2020a), which aims to generate a single data market with the smooth, free, and safe flow of digital information and knowledge. The aim was the enactment of digital services legislation for the Union. The process, which was brought to a close on 8 September 2020, had begun with the Commission's publication of two consultations on 2 June 2020, one to collect information and stakeholder input on the nature of the proposed new act and the other on its implementation and application, which envisions the roll-out of a competition tool. The outcome was the draft Digital Services Act (DSA) submitted by the Commission to Parliament on 15 December 2020. Both consultations targeted the general public, digital service providers, digital companies and not-for-profit organizations to guarantee transparency, governance, and effective oversight to prevent disinformation. The effects of this act, which is supplemented by the Digital Markets Act (DMA), are of major consequence for the Union and its population.

The academic study reported on here was conducted against the backdrop described in the foregoing. The reconstruction planned calls upon the public as labour force and consumers to acquire the capacities (technical dimension) and skills (cognitive and intellectual dimension) needed in the technological environments imperative for today's way of life. The training strategy required, which should not be the same as the policies established to combat the digital divide and foster social inclusion when ICT progress first became universal, must be applicable to a wide spectrum of domains, each with its own peculiarities. In other words, such training must be differentiated from past practice, educationally, academically, technically, professionally, and informationally speaking. It should also envisage specific formal, non-formal, and informal education scenarios.

Those conditions determined the scope, purpose, hypothesis, and objectives of the research discussed hereunder. The scope is non-formal higher education digital competence training, for which academic libraries and their professionals are the domain and actors best suited to teach the entire university community from a crosswise, universal approach. The purpose is to position such training in the framework of university planning as a strategic action deriving from the enhancement of academic literacy and as a library service in support of academic excellence. The hypothesis poses the need for a specific course to develop specialized digital skills as a university library service, including its curricular design and online teaching materials. The objectives seek to optimize students' learning during their university training in pursuit of their post-graduate professional excellence.

The study was undertaken to introduce competence courses as a crosswise area of learning for the entire university community. The blended learning format is delivered on digital educational platforms in conjunction with m-learning techniques at in-person sessions (Wooclap). The ultimate objectives include the development of specific visual literacy- and metaliteracy-related digital skills. The fundamentals are obvious: knowledge and its representation will be delivered in the form of iconic codes in very different formats (data visualization and virtualisation are inevitable means for gaining a command of and practicing professions) and in a crosswise environment involving communication networks.

The raw data for the study were derived from the findings of an RandD+I research project, VOREMETUR, which proposed the use of media art works as digital learning (DLOs) and learning (LOs) objects.

LITERATURE REVIEW

In light of their communicative effectiveness, images are unquestionably the primary and most useful tools for conveying information among human beings. As human communication grew more complex in the wake of the species' cognitive and social development, the initial semiotic nature of paintings must have gradually acquired a semantic purpose. That is attested to by the evolution of images from signs on Paleolithic walls to petroglyphs and finally pictograms. The alphabet may have appeared to be a final destination given the

intrinsic relationship between grapheme (sign painted and written) and phoneme (audible sign referred to speech and its dialogical purpose), but in fact it divided the population into literate and (for many centuries, a vast majority of) illiterate people, for whom pictures were the sole vehicle for written communication.

Images were, then, a way to support oral tradition and literature (the comic book technique). They were afforded semantic power of their own with the coming of age of symbols, through developments ranging from a highly versatile narrative iconology to a very close relationship with sensorial and cognitive perception and hence close collaboration with publicity and propaganda. Through reportage, the dawning and extraordinary progress of mass media entailed a very substantial qualitative leap in the functionality and impact of images on people.

Such significant communicational and semantic impact confronted images with one of their most basic challenges, their polysemy, their multiple interpretations, a factor addressed in a special issue of *Qualitative Inquiry* edited by Traue, Blanc, and Cambre (2019). Images may differ not only in form (materials, techniques, processes, formats, resources) but also in substance (functionality, services, applications). Formal characteristics are the domain of professions and trades, whereas substance is geared cognitively toward knowledge, with its own 'reading' and 'writing' rules. That has necessitated suitable 'literacy' that requires a command of pictorial syntax and grammar to understand iconic content and messages to master 'visual discourse'. Of particular relevance to this matter are Van Leeuwen's studies on multimodality and, as co-author with Kress (2020), the deployment of the grammar of visual design to read images.

Van Leeuwen's monograph has had a powerful impact, among others, on research conducted by Wang (2014), who applied the Dutch author's multimodal discourse method for critical analysis to visual semiotics to build a holistic theory of critical discourse analysis. In a similar vein, along with the classroom use of multimodal literacies for reading assessment (Serafini *et al.*, 2020), an interesting line of research on visual narratives has appeared in recent years, as exemplified in Cohn (2020) introduction to his theory on sequential image processing via the interaction of representation, semantics, and narrative structure.

At the same time, the extraordinary burgeoning of ICTs and hence of the web has posed the need to develop specific competencies to master IT tools (skills) and ensure their effective use as instruments (abilities) for translating digital information into knowledge and know-how (competencies). That in turn calls for a substantial revision of new modes of literacy in digital space (Mills, 2010). The web should be an educational space, the effective use of which calls for the ability to process digital content depending on the scope, purpose, and objectives at issue. That in turn furthers the enlistment of multiliteracies to apply suitable reading-writing competencies, now known as digital competencies. Their impact and direct consequences for education, particularly higher education, have recently been researched

to optimise their development in educational contexts (Pettersen, 2018), while multiliteracy structures and models have begun to appear as educator guides for course design aimed at helping students acquire digital competencies (Falloon, 2020).

The present study opted to stress visual digital competencies geared to data visualization (which is becoming more and more necessary with the development and use of Big Data on the web) and object virtualisation on the web and in social networks (Solimine; Marzal, 2020a). As such, competencies are required to process knowledge, they necessarily carry consequences for education. The aforementioned choice was driven and informed by the need to 'order' the whole universe of multiliteracies presently in place, which has also prompted the proposal for a multiliteracy taxonomy (Marzal, 2020). The course on visual and communicational visual competences proposed here forms part of that taxonomy, in keeping with the objectives of the VOREMETUR RandD+I project. The grounds for the course proposed here should be viewed in light of their connection to social networks and data visualization and virtualisation.

The omnipresence of social networks has afforded them necessary value in education (Durak; Saritepeci, 2019). Beyond the need to develop mass media capacities (media literacy) and to convert the respective messages into knowledge (media and information literacy), a new need has arisen to generate content and knowledge in keeping with social web requirements, participate in collaborative standards, promote responsible and ethical behavior in those environments, and acquire the skills mix needed to competently build a digital identity, an issue that should be addressed as part of the new media literacy (Jenkins *et al.*, 2006). Jenkins *et al.* (2009) and later Lin *et al.* (2013) explored the evolution of such new media literacy and its applications in studies on the emergence of new digital divides. That initial emphasis on new digital competencies called, however, for an adaptation to ensure their applicability to new iconic environments: training to acquire informational 'behavior' in a participatory environment to develop 'metacognition' competencies (particularly useful in images) and critical thinking, the aims pursued in metaliteracy (Jacobson; Mackey, 2013).

Big Data, moreover, has huge potential, and while affording an impressive range of opportunities, also poses threats and challenges. Interactive digital narrative is being applied to visible benefit in both the economic and educational dimensions, especially through the use of gaming (Rizvic *et al.*, 2019). As data has become among the most valuable assets in today's society, interest in ascertaining their potential in education is growing (Aldowah *et al.*, 2019). Better public understanding enhances that value. Whilst the development of digital competencies to better convert data into knowledge is one of the purposes of data literacy, substantial effort must also be devoted to training designers able to make a variety of graphics and infographics appealing. The inclusion of the matter in educational curricula is consequently wholly justified (Altin, 2018). That has in turn spawned scientific literature dealing with data visualization as a learning object (Stopar; Bartol, 2019), with particular attention to data visualization and techniques, tools, and methods to improve academic performance (Etemadpour *et al.*, 2020). Those studies build on others geared to ascertaining

how visualization and infographics impact students' mental models. The aims are to optimize their success in acquiring and using knowledge (Schnotz; Kürschner, 2008) and encourage effective image consumption and processing where, as noted earlier, the interaction and collaboration characteristic of Web 2.0 adopt special significance (Graff; Clark, 2019).

The importance of digital competence training for data visualization has given rise to the expression 'visualization literacy', which differs from visual literacy in that it is much more semiotic (Börner *et al.*, 2016). It means the possession of the ability and the skill needed to read and interpret data and draw information from their visualization (Lee *et al.*, 2017). Visualization has added value for the present study insofar as its purpose and objectives consist in developing data visualization competencies in education (Lee *et al.*, 2019) as directly related to understanding graphics (Shah; Freedman, 2011) numeracy (Brooks; Pui, 2010) cognitive motivation, and the visualiser-verbaliser style (Kollöffel, 2012).

The third fundamental conceit addressed in this study, virtualisation, is governed by 3D technology, virtual reality, and web-based augmented reality. Three-dimensional technology enables the viewer to see a digitized object from all perspectives (360°), whilst virtual reality creates the perception of immersion in a simulation-, immersion- and interaction-induced parallel digital reality. Augmented reality, in turn, provides for physical, tangible, and immediate observation with the support of digital content that greatly enhances the viewing of physical objects. Such innovations unquestionably afford images and digital and multimedia content extraordinary potential to represent knowledge and support learning. The connection to education is undeniable. Three-dimensional technology, which provides for contemplative learning, has been absorbed by virtual and augmented reality, the two veritable vectors of educational innovation.

The first element in the connection between virtual and augmented reality and education is the pursuit of a pedagogical model to develop the respective applications. That has been attempted with a very appealing metaphoric model for abstract concepts (Sánchez *et al.*, 2000) based on Lakoff and Johnson's (1980) metaphoric cognition theory and the virtual learning environment (VLE) model, rooted in pedagogical immersion (Fowler, 2015). Significant scientific literature has been forthcoming on the inclusion of those two types of reality in education, whilst suitable learning objects are being sought as ideal teaching resources (Gudoniene; Rutkauskiene, 2019) without forgoing the development of suitable pedagogical methods per se (Hamilton *et al.*, 2021). As educators are unquestionably key elements in the effort to optimize the classroom impact of virtual and augmented reality, analyses are now needed of their behavior in that regard (Bower *et al.*, 2020) to propose methods to encourage the implementation of such approaches (Cobo Fernández, 2017). In the project at hand, by educators is meant professor-researchers and the librarians entrusted with competence education in the context of coordinated methodology in teaching.

The insertion of virtual and augmented reality in education has fathered scientific literature on case studies and new fields of educational applications, addressing both the various types of virtual learning environments (assistance in assimilating abstract conceits

and phenomena, simulation practice, and problem-solving-based learning) and areas of knowledge with more practical applications (engineering, medicine, science, mathematics, and special needs education) (Kamińska *et al.*, 2019). Bacca *et al.* (2014) in turn, published a highly systematic review of the trends in research on and applications for augmented reality, addressing the platitudes arising around the technique, analyzing the journals most actively publishing articles on the matter, the educational scopes of application, objectives pursued, innovations, limitations, and effectiveness of the application and assessment methods.

Research has naturally also analyzed the beneficial effects of applying virtual and augmented reality in education (Tang *et al.*, 2020), particularly in connection with the potential afforded by 5G technology, which will raise mobile device data transmission by over 10 Gb (Orlosky *et al.*, 2017). An interesting study was conducted on the indisputable benefits of this application for developing the skills deemed essential in the twenty-first century (Papanastasiou *et al.*, 2019): memory (Zarzo, 2015), motivation and attention span (González *et al.*, 2013), visual spatial skills (Potkonjak *et al.*, 2016), critical thinking (Chau *et al.*, 2013), ability to communicate and collaborate (Hew; Cheung, 2010), and creativity and emotional intelligence (López; Cáceres, 2010). The beneficial effect of emotional learning through virtual and augmented reality on cognitive capacity and academic performance has been dealt with in a number of studies as a stimulus for the entire education community (Vesisenaho *et al.*, 2019). Some research has corroborated the emotional value of immersive virtual reality in education (Makransky; Lilleholt, 2018), in particular in connection with a substantial improvement in academic achievement (Lee, 2014).

The discourse around the three factors that have driven the educational function of images substantiates how their impact on knowledge has called for two reading-writing competencies. The first, iconic reading, is based on a morphological (of iconic signs), syntactic (iconic text functions), semantic (overt and latent meanings), critical (interpretation of the iconic content) and emotional (cognitive effects) analysis. The second, visual reading, is understood to be the capacity to identify the elements comprising the image, what they represent, the symbolic system used and the description of the visual event. Such descriptions are closely related to competency acquisition in keeping with indicators such as published by ACRL under the title ACRL/IRIG Visual Literacy Competency Standards for Higher Education on 2 September 2011 (The Visual Literacy Standards Task Force, 2012) although others with an obvious educational bias have also been designed (Hattwig *et al.*, 2013).

Implementing iconic and visual reading competencies in education has necessitated the existence of an academic discipline able to reinforce the design of competence courses, known as visual literacy. Michelson (2017) conducted an excellent study of the evolution of that approach and its purpose in education by period and educational context. The objective in any case is to develop visual metalanguage in keeping with the grammar suited to visual discourse.

Whilst Blummer (2015) reviewed the literature on visual literacy for academic institutions, Sweeney and Hughes (2017) provided a very thorough overview of the role

and educational benefits of visual literacy in the digital era, very convincingly proposing the integration of the discipline in the academic curriculum. That proposal consists in designing visual literacy competence courses (Solimine; Marzal, 2020b) with a special emphasis on their collaborative delivery by professors and librarians.

Design for a metaliteracy competence course in higher education

Drawing from the theoretical approaches and models discussed, a competence course was designed under the auspices of the VOREMETUR RandD+I project, defining metaliteracy as an ‘academic speciality’ or factor of academic literacy associated with educommunication. The research, assimilated into VOREMETUR, deals with the literacy and competence training services rendered by academic skills centers. That in turn determined the general objectives pursued: digital competencies characterized by the convergence of communication, education, and new technologies, all essential to educommunication, i.e., infocommunication competencies based on the educational use of media art collections.

Project objective

The overarching and primary objective of the competence course is to formulate metaliteracy training in which technological art repositories are used as educational tools. The respective specific objectives required are: 1) to formulate the paradigms, model, and scope of application of metaliteracy by substantiating the categories defined in the metaliteracy taxonomy built for VOREMETUR; 2) to define the online communication and information competencies needed to acquire and edit knowledge in digital and virtual object environments; and 3) to assess the competence course itself.

METHODOLOGY

The course described hereunder is based on a metamodel that seeks: a) to generate a formula for integrating the Stordy (2015), Jacobson and Mackey (2013), Secker and Connan (2013), and Bawden (2002) taxonomies into the Marzal (2020) model by means of a ‘conceptual framework’ for understanding multiliteracies in general and metaliteracy in particular; and b) to provide a suitable ‘analytical structure’ apt for interpreting planning, plans and metaliteracy development and action programmes in keeping with the contexts and scopes of application defined.

- a) The Stordy (2015) model organizes metaliteracy on a ‘pre-coordinated’ conceptual matrix with two taxonomic dimensions (categories and models), each with two sub-dimensions (autonomous and ideological in the former; conventional and new literacies in the latter). Each literacy must be univocally and determinatively positioned on the resulting matrix.

- b) The Jacobson and Mackey (2013)/Secker and Connan (2013) model identifies three stages of evolution: multiliteracies (with their respective discrete and combined literacies), multimodal literacies (whose essence is explained in the table), and transliteracy (whose essence is explained in the table).
- c) In the Bawden model (2002), the taxonomic pillar is neither pre-coordination nor evolution but the way competencies have been interpreted with the evolution of the reading-writing context, thereby necessitating their own academic speciality or literacy.

These three conceptual and interpretative tiers can house metaliteracy from different perspectives, but always within a single metamodel.

The working method was structured around four stages.

1. *Stage 1: Development of a taxonomic model in metaliteracy.* With a view to establishing the 'state of the art' from which to propose the project's metaliteracy model, updated information (from 2011 forward, when visual literacy was regulated, metaliteracy appeared, and information literacy was redesigned) was exhaustively and selectively sought in specialized databases (Scopus, Web of Science, ScienceDirect, Abi Inform, ERIC, LISA, CAPES, IEEE, and Academic SP) using complex search strategies with the keywords metaliteracy, information literacy, new media literacy, and visual literacy (providing the categories proposed prove to be applicable). Particular attention was paid to monitoring new media literacy and metaliteracy practice that might identify their scope of application. The search was followed by data scrubbing and classification of the output under the VOREMETUR taxonomic categories. An exhaustive search for information on educommunication was likewise conducted using the aforementioned specialized databases (to position metaliteracy as one of its elements for a future course), defining the search strategies around that term along with digital competencies, metaliteracy, new media literacy, and visual literacy.

The search results and a review of the literature served as the basis for defining a conceptual metamodel for metaliteracy to integrate the conceptual and interpretative dimensions of the conceit in the existing series of multiliteracies (viewed from different perspectives, especially the ones implicit in the Stordy (2015), Jacobson and McKay (2013), Secker and Connan (2013), and Bawden (2002) models) into the Marzal model (2020). The aim was to establish a theoretical and conceptual model on which to design a course on metaliteracy competence, deemed in the VOREMETUR project to be an academic speciality designed and implemented in symbiotic conjunction with other multiliteracies: information, new media, and visual literacy. The metaliteracy conceptual model categories assumed in the VOREMETUR metaliteracy taxonomy model were established in keeping with such attribution of academic speciality status. Marzal and Martínez-Cardama (2020) provide an explanation of the respective taxonomic sources, the definition of taxonomy, and the conceptual categories along with the categories.

2. Stage 2: General design for the metaliteracy competence course in higher education.

The course objectives were defined in keeping with the stage 1 findings, as follows: to identify the conceptual outline for the course; to establish the elements comprising its formal structure; to develop those elements in line with the structure and subject content identified; to design or adapt the teaching materials associated with the various approaches to course delivery (lectures, digital learning objects, learning objects, assessment items); and to design or select the course assessment model. Course content was defined to include: a) knowledge in the web; b) open learning in digital environments; c) fundamentals for a competence model in education; d) education format; and e) development of a metaliteracy course for academic literacy.

3. Stage 3: Curricular design of the metaliteracy competence course in higher education.

1. Further to the general proposal for the course, its content was fleshed out taking the Stage 2 item 'open education in digital environments' as a basis for defining the respective sub-items as:

- a) Online teaching materials, from DLOs to MOOCs
- b) Intellectual property rights and copyleft licences
- c) Digital and virtual platforms carrying educational content
- d) Metadata systems and digital libraries
- e) University online open education initiatives and courses
- f) Museums' educational role and education
- g) Teaching materials and museum website resources as support for teaching-learning

The overall aims identified were:

- a) Digital competencies characterized by the convergence of communication, education, and new technologies, are all essential to educommunication.
- b) Infocommunication competencies based on the educational use of media art collections.

Teaching aims were established for all the stage sub-items geared to acquiring metaliteracy competencies, as follows:

- a) To review the development of online curricular materials in the context of the appearance of digital learning objectives (DLOs) and their uptake into massive open online courses (MOOCs)
- b) To interpret and define the intellectual property associated with a work
- c) To identify the characteristics and utility of copyleft licences
- d) To identify the primary characteristics of digital and virtual content platforms, stressing those geared to resources for teaching-learning in the arts
- e) To analyze the importance of metadata systems for smooth digital library operation
- f) To locate open and distance learning initiatives and trends
- g) To identify the strategies designed by museums to use virtual environments

- h) To analyze museums' supplementary role in children's and youths' education
 - i) To assess the contribution of museums' teaching materials to teaching-learning and the tools needed to understand, enjoy, and incorporate museums into one's routine.
- The following sections were formulated to optimize course benefits.

- a) Practical and applied comprehension
- b) The definitions and examples given for the items comprising course content were shared for full understanding and to ensure the learning objectives established were met.
- c) Competency practice:

The review and analysis of the teaching materials were followed by competency practice, the aim of which was to apply what had been learnt. Information was included on competency practice, grouped under the following sections: the action to be taken, step-by-step; supportive resources containing all the available materials that should be reviewed to ensure full understanding of the respective items; and activities covering the tasks available to acquire competence.

- a) Questionnaire
- b) A multiple-choice questionnaire based on course content was formulated, designed to display the results automatically upon completion, including information on the degree of comprehension and competence attained.
- 4) *Stage 4: Course implementation.* The full competence course, openly accessible online, was divided into the following sections:
 - a) Information on the purpose
 - b) Course structure
 - c) Usage rules
 - d) Content including objectives by subject; definitions and a theoretical and contextual framework for the topics; and exercises.

Course characteristics and their relationship to metaliteracy

One of the indispensable course inputs consists of visiting major international museums' websites and digital education platforms. The characteristics of those online platforms make them ideal for use in metaliteracy training to develop the competencies included in the course objectives defined above. One of the metaliteracy principles most clearly emphasized in the course as mirrored in the respective exercises is the application of competencies to foster the responsible, creative, and ethical consumption, production, and dissemination of digital images. The sub-items under each stage guide students' understanding and implementation of the main elements involved in teaching-learning the arts, the visual arts in particular, in online environments.

The value of intellectual property and ethical use of information

Inasmuch as metaliteracy encourages the consumption, creation, and dissemination of information using digital resources, the course includes a sub-item on intellectual property issues. Copyleft licences, like Creative Commons licenses, are essential to acknowledging the author of an original work in its subsequent versions. Consequently, understanding and implementing those instruments with examples available on websites exhibiting artwork contributes to ethical production and dissemination, favoring all involved: authors and information consumers. In an environment where thousands of digital artworks are openly accessible, consumers with competence in this area should be able to identify the characteristics of the major types of license available and understand the scope of each to use the information ethically. That would include, for instance, determining when a work can be reproduced for profit and when for strictly academic purposes; ascertaining whether a work can be adapted and the results disseminated; and understanding how to duly acknowledge authorship of the original work. The content and exercises included in this course sub-item are based on examples that enable students to deal with those issues.

The importance of metadata in information retrieval

The sub-item on metadata and digital libraries contributes to an understanding of how artistic digital resources are organized and how they can be most successfully retrieved. Metadata intrinsically specifies the characteristics of digital artistic works, enabling the informed user to adopt decisions on their use. Given the wide spectrum of formats available in a digital library of artistic objects, a command of such conceits affords anyone seeking that type of information greater insight, for it provides them with a fuller understanding of their own needs and helps translate such needs to search strategies that will deliver the expected results. The examples used in the course exercises denote the variety of metadata required in digital object collections of this type, illustrating the set of elements or fields comprising the record for a work of art.

Massive Open Online Courses (MOOCs) and learning objects

One of the substantive elements of metaliteracy training is metacognition. Individuals' self-awareness of how they think and learn leads to the definition of strategies to enhance their performance. In light of that, the course deems teaching materials, virtual and digital platforms with educational content, and online initiatives and courses to be useful teaching-learning elements in museums storing and disseminating knowledge on artworks. The activities proposed in each sub-item guide users as they explore, analyze, and determine the educational options best suited to their personal needs. The possibilities afforded by the hundreds of massive open online courses (MOOCs) available in nearly any subject area imply

that citizens must have the competencies and abilities required to make the best use of such a broad and often cost-free offering. When determining the best platform, the course best suited to their needs or even the best way to exploit the learning objects offered, web users must be able to draw from background knowledge to adopt suitable decisions, for MOOC training seldom comes with individualized guidance. The course consequently helps students analyze the characteristics found in two MOOC courses, emphasizing the peculiarities of the learning objects available on the respective platforms.

Digital and virtual platforms carrying educational content

The course also deals with the study of digital and virtual platforms with educational content, given their status as essential elements in teaching-learning. In addition to developing the competencies needed to create and disseminate digital content, metaliterate individuals must be able to assess them for their own consumption. In the process, they must evaluate content, the target audience, efficient content retrieval based on how it is organized and, most importantly, the use to be made of it. The exercises in this sub-item consequently draw their examples from platforms pertaining to museums such as The Metropolitan Museum of Art (The Met), the Museum of Modern Art (MoMA) and even the Library of Congress, institutions that offer online educational content for audiences of different ages.

Educational and teaching resources

Most museums, capitalizing on the opportunities afforded by new technologies, have invested substantial time and resources in the design of strategies to publicize their services and provide training for anyone interested in their works and collections. The online educational offering is plentiful, although users should be in possession of elements and competencies that enable them to identify the resources best suited to their needs. With the support of two lessons in the last two sub-items, the course guides students in their analysis of the resources supporting education and teaching, taking museum websites as examples. Museums' educational role has never been as broadly scoped as it is today because the availability of information and communication technologies, social networks, and services such as Google Arts & Culture enables these institutions to reach audiences who would have never had the opportunity to visit their premises in person. But distance and cost are irrelevant when downloading full-colour images of artworks in minute detail, along with their history, via 360° virtual visits to museum premises from computer screens or smartphones. Interested visitors can even enhance the experience with multimedia applications to feel as though they had viewed the actual works. Upon completion of this sub-item, students must give all these elements due consideration.

Educational materials and online resources

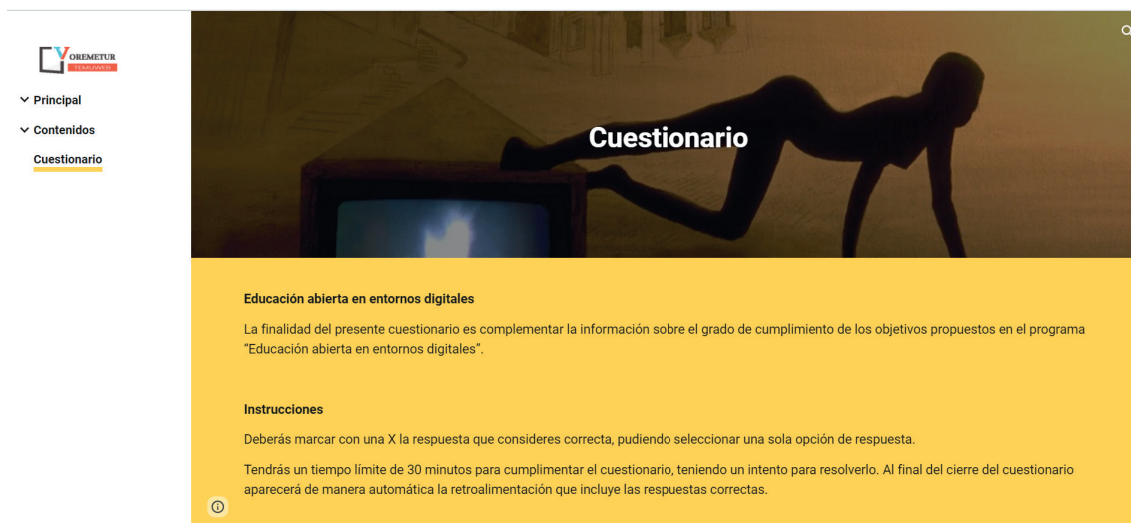
Technology in and of itself does not suffice to impact teaching-learning in people who visit museums primarily as a pastime, entertainment, a 'must-do' when traveling, or to satisfy the urge to have been in a given city's most renowned museum. The final course consists of a specific lesson designed to help students discover the educational materials offered by a series of previously selected museums. The greater the awareness of the history and details underlying a work of art, the ability to interpret its meaning, or the understanding of the artist's intentions, the more satisfactory the visit, whether in-person or virtual. One of the main challenges inherent in online educational materials is that they cannot be displayed in the same way as the works in a museum, even where works of the same type are concerned, for each painting, sculpture, or canvas has a different tale to tell. The lesson at hand encourages students to identify the details of educational materials that normally go unnoticed, such as the activities designed to convey information on certain characteristics of a work for individual or collective consumption. Another significant challenge to online educational materials is that they must be adapted to different levels of schooling. For instance, instruction on a given artistic movement cannot be delivered to a group of children in the same way as to youths or adults, who normally have background knowledge that makes it possible to omit certain contextual particulars when addressing a new concept.

Course assessment

Assessment of the assimilation of course content is envisaged to take no more than 30 minutes, after which students have access to the correct answers as feedback. The quiz comprises 20 multiple-choice questions that enable students to evaluate the competencies acquired in each sub-item comprising this stage. The questions, drafted bearing in mind students' course experience, encourage reflection on the concepts addressed. This opportunity to review the ideas and learning gleaned from the practical application of the competencies acquired is intended to consolidate the teaching-learning process (see **FIGURE 1**)¹.

¹ Available at: <https://sites.google.com/view/vorematur/cuestionario>. Accessed on: 22 Feb. 2021.

FIGURE 1 – Screenshot of the page to access the questionnaire



Source: Metaliteracy Vorematur (2020)².

The online competence course

The course proposal was initially introduced as a digital document entitled: *Teaching Design for Metaliteracy Competence Courses in higher education. Educommunication and academic literacy as factors*, which was one of the constituents of the project denominated 'Vocabularies for a network of files and collections on media art and its effects: Metaliteracy and knowledge tourism' (VOREMETUR). All the course elements were subsequently uploaded to an open-access website with Google Sites technology to make them available to anyone interested³ (see **FIGURE 2**)⁴.

2 Available at: <https://sites.google.com/view/vorematur/cuestionario>. Accessed on: 22 Feb. 2021.

3 Available at: <https://sites.google.com/view/vorematur/>. Accessed on: 22 Feb. 2021.

4 Available at: <https://sites.google.com/view/vorematur/principal>. Accessed on: 22 Feb. 2021.

FIGURE 2 – Course home page



Source: Metaliteracy Vorematur (2020)⁵.

CONCLUSIONS

The socioeconomic model emerging from the 2008 financial crisis and the systemic crisis induced by Covid-19 calls for new cognitive and professional qualifications that cannot be ignored in higher education. Universities, which are expected to meet very demanding standards of excellence, must mobilize all their assets to enable students to acquire those qualifications. The nature of digital competencies defines where they should deploy their most effective strategic planning: activation of the training delivered by academic skills centers in keeping with an educational plan geared to academic literacy. The competence courses fostered call for close collaboration between educators and librarians. The premise underlying such planning should arise from the conviction that in today's all-encompassing technological environment, people must acquire the technical capacities and cognitive and intellectual competencies needed to process digital content. That entails encouraging reading-writing competencies in circumstances where ICTs prevail, the primary challenge consisting in the translation of digital information into knowledge. Two academic specialities have consequently emerged. One, visual literacy, stems from the need to understand online iconic content and messages through visual semiotics and the visualization of the data comprising the development known as Big Data, where visual reading impacts people's mental models and hence image consumption and processing. The other, metaliteracy, together with other multiliteracies (information literacy, new media literacy, and visual literacy), favors independent collaborative work, metacognition, and critical thinking.

The scenarios identified to implement the strategies designed to develop digital competencies in higher education can be found in the formal, non-formal, and informal

⁵ Available at: <https://sites.google.com/view/vorematur/>. Accessed on: 22 Feb. 2021.

approaches to education. Academic libraries and librarians are acknowledged as strategic actors in the development of students' specialized digital competencies in such formats. The present article identifies the relevance of focusing the actions undertaken to generate such competencies, along with the need to position them in a structured course with a sound theoretical and practical base. According to this contextual analysis, the fundamentals informing the course introduced here include data visualization, virtualisation and connection to social networks. The aim is to develop competence courses that use technological art repositories for educational purposes. The conclusion reached around the method deployed in course design is that the first stage is necessary to establish the taxonomy and conceptual fundamentals for the course, furnishing the grounds for defining its general structure in the second stage and its curricular design in the third. The proposal concludes with a fourth and final stage, comprising course assembly and uploading to an open access website.

This course constitutes a contribution to media art-based visual literacy and metaliteracy and more generally to the development of digital competencies in higher education. As a versatile tool, it is applicable to a wide spectrum of domains, including museums and of course academic libraries.

REFERENCES

ALDOWAH, H.; AL-SAMARRAIE, H.; FAUZY, W. M. Educational data mining and learning analytics for 21st century higher education: a review and synthesis. **Telematics and Informatics**, [s. l.], n. 37, p. 13-49, Apr. 2019. DOI 10.1016/j.tele.2019.01.007.

ALTIN, N. C. Data visualization and infographics in design education. **Idil Journal of Art and Language**, [s. l.], v. 7, n. 45, May 2018. DOI 10.7816/idil-07-45-10. Available at: <http://idildergisi.com/makale/pdf/1523964490.pdf>. Accessed at: 22 Feb. 2021.

BACCA ACOSTA, J. L.; BALDIRIS NAVARRO, S. M.; FABREGAT GESA, R.; GRAF, S. Augmented reality trends in education: a systematic review of research and applications. **Journal of Educational Technology and Society**, [s. l.], v. 17, n. 4, p. 133-149, 2014.

BAWDEN, D. Revisión de los conceptos de alfabetización informacional y alfabetización digital. *In: Anales de Documentación*, 5., 2002, Espinardo. **Anales** [...]. España: Redalyc, 2002. p. 361-408.

BLUMMER, B. Some visual literacy initiatives in academic institutions: a literature review from 1999 to the present. **Journal of Visual Literacy**, [s. l.], v. 34, n. 1, p. 1-34, Jan. 2015. DOI 10.1080/23796529.2015.11674721.

BÖRNER, K.; MALTESE, A.; BALLIET, R. N.; HEIMLICH, J. Investigating aspects of data visualization literacy using 20 information visualizations and 273 science museum visitors. **Information Visualization**, [s. l.], v. 15, n. 3, p. 198-213, July 2016. DOI 10.1177/1473871615594652.

BOWER, M.; DEWITT, D.; LAI, J. W. M. Reasons associated with preservice teachers' intention to use immersive virtual reality in education. **British Journal of Educational Technology**, [s. l.], v. 51, n. 6, p. 2215-2233, Nov. 2020. DOI 10.1111/bjet.13009.

BROOKS, M. E.; PUI, S. Y. Are individual differences in numeracy unique from general mental ability? a closer look at a common measure of numeracy. **Individual Differences Research**, [s. l.], v. 8, n. 4, p. 257-265, 2010.

CHAU, M.; WONG, A.; WANG, M.; LAI, S.; CHAN, K. W. Y.; LI, T. M. H.; CHU, D.; CHAN, I. K. W.; SUNG, W.-K. Using 3D virtual environments to facilitate students in constructivist learning. **Decision Support Systems**, [s. l.], n. 56, p. 115-121, Dec. 2013. DOI 10.1016/j.dss.2013.05.009.

COBO FERNÁNDEZ, G. **Desarrollo de una aplicación móvil de realidad virtual para el aprendizaje en las aulas**. 2017. Trabalho de conclusão de curso (Grado en Ingeniería Informática) – Santander, Universidad de Cantabria, Facultad de Ciencias, 2017. Available at: <https://repositorio.unican.es/xmlui/handle/10902/12264>. Access on: 7 Jan. 2023.

COHN, N. Your Brain on comics: a cognitive model of visual narrative comprehension. **Topics in Cognitive Science**, [s. l.], v. 12, n. 1, p. 352-386, Apr. 2020. DOI 10.1111/tops.12421.

COMISIÓN EUROPEA. **Libro blanco sobre la inteligencia artificial**: un enfoque europeo orientado a la excelencia y la confianza. Bruselas: Comisión Europea, 19 Feb. 2020b. Available at: https://commission.europa.eu/document/download/d2ec4039-c5be-423a-81ef-b9e44e79825b_es?filename=. Access on: 13 Jan. 2023.

COMISIÓN EUROPEA. **Shaping Europe's digital future**. Bruselas: Comisión Europea, 2020a. Available at: https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age_es. Access on: 9 Jan. 2023.

DURAK, H. Y.; SARITEPECI, M. Modeling the effect of new media literacy levels and social media usage status on problematic internet usage behaviours among high school students. **Education and Information Technologies**, [s. l.], v. 24, n. 4, p. 2205–2223, 2019. DOI: <https://doi.org/10.1007/s10639-019-09864-9>. Access on: 22 Feb. 2021.

ETEMADPOUR, R.; ZHU, Y.; ZHAO, Q.; HU, Y.; CHEN, B.; SHARIER, M. A.; ZHENG, S.; S. PAIVA, J. G. Role of absence in academic success: an analysis using visualization tools. **Smart Learning Environments**, [s. l.], v. 7, n. 1, p. 2-7 Jan. 2020a. DOI 10.1186/s40561-019-0112-3.

FALLOON, G. From digital literacy to digital competence: the teacher digital competency (TDC) framework. **Educational Technology Research and Development**, [s. l.], v. 68, n. 5, p. 2449-2472, Oct. 2020. DOI 10.1007/s11423-020-09767-4.

FOWLER, C. Virtual reality and learning: where is the pedagogy? **British Journal of Educational Technology**, [s. l.], v. 46, n. 2, p. 412-422, 2015. DOI 10.1111/bjet.12135.

GONZÁLEZ, M. M. A.; SANTOS, B. S. N.; VARGAS, A. R.; MARTÍN-GUTIÉRREZ, J.; ORIHUELA, A. R. Virtual Worlds. Opportunities and challenges in the 21st century. **Procedia Computer Science**, [s. l.], v. 25, p. 330-337, 2013. DOI 10.1016/j.procs.2013.11.039.

GRAFF, D.; CLARK, M. A. Communication modes in collaboration: an empirical assessment of metaphors, visualization, and narratives in multidisciplinary design student teams. **International Journal of Technology and Design Education**, [s. l.], v. 29, n. 1, p. 197-215, Jan. 2019. DOI 10.1007/s10798-017-9437-9.

GUDONIENE, D.; RUTKAUSKIENE, D. Virtual and augmented reality in education. **Baltic Journal of Modern Computing**, [s. l.], v. 7, n. 2, p. 293-300, 2019. DOI 10.22364/bjmc.2019.7.2.07. Available at: http://www.bjmc.lu.lv/fileadmin/user_upload/lu_portal/projekti/bjmc/Contents/7_2_07_Gudoniene.pdf. Access on: 22 Feb. 2021.

HAMILTON, D.; MCKECHNIE, J.; EDGERTON, E.; WILSON, C. Immersive virtual reality as a pedagogical tool in education: a systematic literature review of quantitative learning outcomes and experimental design. **Journal of Computers in Education**, [s. l.], v. 8, n. 1, p. 1-32, Mar. 2021. DOI 10.1007/s40692-020-00169-2.

HATTWIG, D.; BUSSERT, K.; MEDAILLE, A.; BURGESS, J. Visual literacy standards in higher education: new opportunities for libraries and student learning. **portal: Libraries and the Academy**, [s. l.], v. 13, n. 1, p. 61-89, Jan. 2013. DOI 10.1353/pla.2013.0008.

HEW, K. F.; CHEUNG, W. S. Use of three-dimensional (3-D) immersive virtual worlds in K-12 and higher education settings: a review of the research. **British Journal of Educational Technology**, Oxford, v. 41, n. 1, p. 33-55, Jan. 2010. DOI 10.1111/j.1467-8535.2008.00900.x.

JACOBSON, T. E.; MACKEY, T. P. Proposing a metaliteracy model to redefine information literacy. **Communications In Information Literacy**, [s. l.], v. 72, n. 2, p. 84-91, Dec. 2013. DOI: <https://doi.org/10.15760/comminfolit.2013.7.2.138>. Access on: 22 Feb. 2021.

JENKINS, H.; PURUSHOTMA, R.; WIEGEL, M.; CLINTON, K.; ROBINSON, A. J. **Confronting the challenges of participatory culture: media education for the 21st century**. Chicago: The MacArthur Foundation, 2006.

JENKINS, H.; PURUSHOTMA, R.; WIEGEL, M.; CLINTON, K.; ROBINSON, A. J. **Confronting the challenges of participatory culture: media education for the 21st century**. Cambridge: The MIT Press, 2009. (The John D. and Catherine T. MacArthur Foundation Reports on Digital Media and Learning).

KAMIŃSKA, D.; SAPIŃSKI, T.; WIAK, S.; TIKK, T.; HAAMER, R. E.; AVOTS, E.; HELMI, A.; OZCINAR, C.; ANBARJAFARI, G. Virtual reality and its applications in education: survey. **Information**, [s. l.], v. 10, n. 10, p. 318, 16 Oct. 2019. DOI 10.3390/info10100318.

KOLLÖFFEL, B. Exploring the relation between visualizer–verbalizer cognitive styles and performance with visual or verbal learning material. **Computers and Education**, [s. l.], v. 58, n. 2, p. 697-706, Feb. 2012. DOI 10.1016/j.compedu.2011.09.016.

KRESS, G. R.; LEEUWEN, T. V. **Reading images: the grammar of visual design**. 2. ed. London: Routledge, 2020.

LAKOFF, G.; JOHNSON, M. The metaphorical structure of the human conceptual system. **Cognitive science**, [s. l.], v. 4, n. 2, p. 195-208, 1980.

LEE, S.; KIM, S.-H.; KWON, B. C. VLAT: Development of a visualization literacy assessment test. **IEEE Transactions on Visualization and Computer Graphics**, [s. l.], v. 23, n. 1, p. 551-560, Jan. 2017. DOI 10.1109/TVCG.2016.2598920.

LEE, S.; KWON, B. C.; YANG, J.; LEE, B. C.; KIM, S.-H. The correlation between users' cognitive characteristics and visualization literacy. **Applied Sciences**, [s. l.], v. 9, n. 3, p. 488, 31 Jan. 2019. DOI 10.3390/app9030488.

LIN, T.-B.; LI, J.-Y.; DENG, F.; LEE, L. Understanding new media literacy: an explorative theoretical framework. **Journal of Educational Technology and Society**, Taiwan, v. 16, n. 4, p. 160-170, 2013.

LÓPEZ, J. M. C.; CÁCERES, M. J. M. Virtual games in social science education. **Computer Education**, [s. l.], v. 55, n. 3, p. 1336-1345, Nov. 2010. DOI: <https://doi.org/10.1016/j.compedu.2010.05.028>. Access on: 22 Feb. 2021.

MAKRANSKY, G.; LILLEHOLT, L. A structural equation modeling investigation of the emotional value of immersive virtual reality in education. **Educational Technology Research and Development**, [s. l.], v. 66, n. 5, p. 1141-1164, 22 Feb. 2018. DOI 10.1007/s11423-018-9581-2.

MARZAL, M. Á. A taxonomic proposal for multiliteracies and their competences. **Profesional de la información**, [s. l.], v. 29, n. 4, 2020. DOI 10.3145/epi.2020.jul.35.

MARZAL, M. Á.; MARTÍNEZ-CARDAMA, S. Clasificación de la investigación académica en Metaliteracy. **Revista Española de Documentación Científica**, [s. l.], v. 43, n. 4, oct./dic. 2020. DOI 10.3989/redc.2020.4.1728.

MICHELSON, A. A short history of visual literacy: the first five decades. **Art Libraries Journal**, [s. l.], v. 42, n. 2, p. 95-98, Apr. 2017. DOI 10.1017/alj.2017.10.

MILLS, K. A. A review of the "digital turn" in the new literacy studies. **Review of Educational Research**, [s. l.], v. 80, n. 2, p. 246-271, June 2010. DOI 10.3102/0034654310364401.

ORLOSKY, J.; KIYOKAWA, K.; TAKEMURA, H. Virtual and augmented reality on the 5g highway. **Journal of Information Processing**, [s. l.], v. 25, p. 133-141, 2017. DOI 10.2197/ipsjip.25.133.

PAPANASTASIOU, G.; DRIGAS, A.; SKIANIS, C.; LYTRAS, M.; PAPANASTASIOU, E. Virtual and augmented reality effects on K-12, higher and tertiary education students' twenty-first century skills. **Virtual Reality**, [s. l.], v. 23, n. 4, p. 425-436, 2019. DOI 10.1007/s10055-018-0363-2.

PETTERSSON, F. On the issues of digital competence in educational contexts – a review of literature. **Education and Information Technologies**, [s. l.], v. 23, n. 13, p. 1005-1021, May 2018. DOI 10.1007/s10639-017-9649-3.

POTKONJAK, V.; GARDNER, M.; CALLAGHAN, V.; MATTILA, P.; GUETL, C.; PETROVIĆ, V. M.; JOVANOVIĆ, K. Virtual laboratories for education in science, technology, and engineering: a review. **Computers and Education**, [s. l.], v. 95, p. 309-327, Apr. 2016. DOI 10.1016/j.compedu.2016.02.002.

RIZVIC, S.; BOSKOVIC, D.; OKANOVIC, V.; SLJIVO, S.; ZUKIC, M. Interactive digital storytelling: bringing cultural heritage in a classroom. **Journal of Computers in Education**, [s. l.], v. 6, n. 1, p. 143-166, Mar. 2019. DOI 10.1007/s40692-018-0128-7.

SÁNCHEZ, Á.; MARÍA BARREIRO, J.; MAOJO, V. Design of virtual reality systems for education: a cognitive approach. **Education and Information Technologies**, [s. l.], v. 5, n. 4, p. 345-362, 2000. DOI 10.1023/A:1012061809603.

SCHNOTZ, W.; KÜRSCHNER, C. External and internal representations in the acquisition and use of knowledge: visualization effects on mental model construction. **Instructional Science**, [s. l.], v. 36, n. 3, p. 175-190, May 2008. DOI 10.1007/s11251-007-9029-2.

SECKER, J.; CONNAN, E. **Rethinking information literacy**: a practical framework for supporting learning. Chicago: Facet Publishing, 2013.

SERAFINI, F.; MOSES, L.; KACHORSKY, D.; RYLAK, D. Incorporating multimodal literacies into classroom-based reading assessment. **The Reading Teacher**, [s. l.], v. 74, n. 3, p. 285-296, Nov. 2020.

SHAH, P.; FREEDMAN, E. G. Bar and line graph comprehension: an interaction of top-down and bottom-up processes. **Topics in Cognitive Science**, [s. l.], v. 3, n. 3, p. 560-578, July 2011. DOI 10.1111/j.1756-8765.2009.01066.x.

SOLIMINE, G.; MARZAL GARCÍA-QUISMONDO, M. Á. Integrazione di programmi di information literacy e visual literacy nel curriculum universitario: una proposta di corso. **AIB studi**, [s. l.], v. 59, n. 1-2, 2020a. DOI 10.2426/aibstudi-11926. Available at: <https://doi.org/10.2426/aibstudi-11926>. Access at: 22 Feb. 2021.

SOLIMINE, G.; MARZAL GARCÍA-QUISMONDO, M. Á. Proposal of visual literacy indicators for competencies courses: an academic literacy perspective for academic excellence. **JLIS: Italian Journal of Library, Archives and Information Science**, [s. l.], v. 11, n. 1, 2020b. DOI 10.4403/jlis.it-12577. Available at: <https://doi.org/10.4403/jlis.it-12577>. Access at: 22 Feb. 2021.

STOPAR, K.; BARTOL, T. Digital competences, computer skills and information literacy in secondary education: mapping and visualization of trends and concepts. **Scientometrics**, [s. l.], v. 118, n. 2, p. 479-498, Feb. 2019. DOI 10.1007/s11192-018-2990-5.

STORDY, P. Taxonomy of Literacies. **Journal of Documentation**, [s. l.], v. 71, n. 3, p. 456-476, 2015. DOI: <https://doi.org/10.1108/JD-10-2013-0128>. Access on: 22 Feb. 2021.

SWEENEY, S.; HUGHES, D. Integrating visual literacy training into the business curriculum. a case study at dublin business school. **DBS Business Review**, [s. l.], v. 1, p. 61-97, 2017. DOI: <https://doi.org/10.22375/dbsbr.v1.7>. Access on: 22 Feb. 2021.

TANG, Y. M.; AU, K. M.; LAU, H. C. W.; HO, G. T. S.; WU, C. H. Evaluating the effectiveness of learning design with mixed reality (MR) in higher education. **Virtual Reality**, [s. l.], v. 24, n. 4, p. 797-807, Dec. 2020. DOI 10.1007/s10055-020-00427-9.

THE VISUAL LITERACY STANDARDS TASK FORCE. Visual literacy competency standards for higher education: approved by the ACRL board of directors, Oct. 2011. **College and Research Libraries News**, [s. l.], v. 73, n. 2, p. 97-104, Feb. 2012. DOI 10.5860/crln.73.2.8709.

TRAUE, B.; BLANC, M.; CAMBRE, C. Visibilities and visual discourses: rethinking the social with the image. **Qualitative Inquiry**, [s. l.], v. 25, n. 4, p. 327-337, Apr. 2019. DOI 10.1177/1077800418792946.

VESISENAHU, M.; JUNTUNEN, M.; HÄKKINEN, P.; PÖYSÄ-TARHONEN, J.; FAGERLUND, J.; MIAKUSH, I.; PARVIAINEN, T. Virtual reality in education: focus on the role of emotions and physiological reactivity. **Journal For Virtual Worlds Research**, [s. l.], v. 12, n. 1, Feb. 2019. DOI 10.4101/jywr.v12i1.7329.

WANG, J. Criticising images: critical discourse analysis of visual semiosis in picture news. **Critical Arts**, [s. l.], v. 28, n. 2, p. 264-286, 4 Mar. 2014. DOI 10.1080/02560046.2014.906344.

ZARZO, E. The Art of Memory in the digital age. **Procedia: Social and Behavioral Sciences**, [s. l.], v. 178, n. 10, p. 222-226, Apr. 2015. DOI 10.1016/j.sbspro.2015.03.185.

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