International Journal of Architectural Engineering & Urban Planning, Volume 32, Number 3, 2022
DOI: 10.22068/ijaup.681

Review Paper

Classification of the Abilities Needed for Visual Literacy: A Review of Abilities based on the Cognitive Learning Mastery Approach

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Received: August 2021, **Revised:** January 2022, **Accepted:** April 2022, **Publish Online:** May 2022

Abstract
The present study aimed to align the applied approaches to the concept of visual literacy to provide a new list of abilities needed to promote visual literacy. Visual literacy is a cognitive concept that can be promoted using Bloom's revised classification of the cognitive area that has targeted the mastery learning stages. The method of this study is descriptive-analytical conducted in a purposeful logical course using interpretive strategies and logical reasoning based on documentary studies and valid libraries. In this study, Bloom's cognitive classification was examined and four categories of the most important competencies and existing and valid visual literacy standards were analyzed separately. Finally, a new list of abilities needed for individual mastery of visual literacy was presented. Since most visual literacy researchers have described its nature as ability or set of abilities, a new list was called the classification of visual literacy abilities. The results showed that since each of the previous lists has a specific specialized view on visual literacy, they do not cover all levels of the cognitive process and Bloom's knowledge dimensions. Thus, by adopting a comprehensive approach, a list of abilities was proposed that includes six levels of cognitive process (remembering, understanding, applying, analyzing, evaluating, and creating) and each level includes four levels of knowledge (factual, conceptual, procedural, and metacognitive). This list can be used in the educational planning of disciplines that their main goal is visual communication. Finally, the topic of one of the architecture courses was examined as an example of the way of applying this classification.

Keywords: *Visual literacy, Visual abilities, Visual communication, Bloom's revised classification, Cognitive process, Architectural communication.*

1. INTRODUCTION

An image can convey information equivalent to thousands of words. Thus, exploring, interpreting, finding patterns, and visual communication require an appropriate level of visual skills (Burkhardt et al., 2003, p.24). In many areas, including architecture, medicine to agriculture, visual tools are used to provide information, and not paying attention to learning these skills in these areas can lead to gaps in knowledge and thus misunderstanding (O'Neil, 2011, p. 222). 'Visual literacy', which enables a person to understand and benefit more from the visual world, has attracted the attention of researchers since the mid-1950s with the advent of new technologies such as cameras and later television. Each person looked at and defined it from his or her own point of view and intellectual world. Based on the first definition, a person was visually literate who was able to distinguish and interpret visual elements, communicate with others, and visually enjoy works of art (Baca, 1990; Fransecky & Debes, 1972).

Subsequent definitions, in accordance with visual literacy and verbal literacy skills, assumed the existence of 'the language of images' (Baca, 1990; Braden, 1993; Dondis, 1974). However, later definitions paid special attention to the symbolic nature, understanding of meaning, understanding of

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the aesthetic value of visual elements, socio-cultural context, and the ability to critique and evaluate images (Alper, 1996; M. D. Avgerinou, 2001; Bamford, 2003; Cureton & Cochran, 1976; Felten, 2008; Stafford, 2011; Sutton, 1993). For example, the Association of College and Research Libraries (ACRL) defines visual literacy as a set of abilities that enable one to effectively find, interpret, evaluate, use, and create visual images and media. These skills equip the learner to understand and analyze the cultural, moral, aesthetic, intellectual, and technical contextual conditions related to the construction and use of visual elements (ACRL Board of Directors, 2011; Hattwig, Bussert, Medaille, & Burgess, 2013).

Reviewing the theoretical foundations of the subject of visual literacy suggests that research in the field of visual literacy can be classified into three groups: 1) trying to provide a definition, 2) seeking to provide a theoretical framework, and 3) aiming to apply the concept of visual literacy (Figure 1). The first category, which mainly included research in the early decades of the emergence of visual literacy in the scientific community, focused on defining and understanding what visual literacy is. In the second category, which almost covers research from the mid-1980s to the early years of the first decade of the 21st century, due to the multiplicity of definitions provided and the lack of effective application of visual literacy, the research community provided theoretical frameworks for this concept. The third category of research, which includes the most recent studies, has a pragmatic approach and also pays attention to cultural and social contexts. This group of studies often focuses on the application of visual literacy in a specialized field. Also, formal authorities, institutions, and institutes that have introduced the skills, abilities, and standards needed for visual literacy also fall into this category (Figure 1).

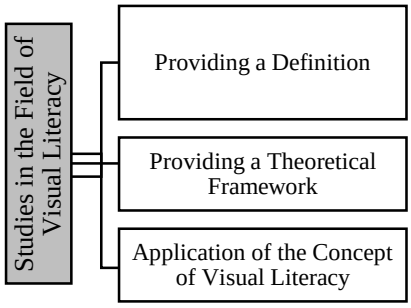

Fig 1. Various Studies in the Area of Visual Literacy

The studies of each of these categories show the diversity and multiplicity of views. For example, in studies that focus on defining visual literacy, the nature of visual literacy is different for researchers. A review of more than 30 definitions provided by researchers in various disciplines showed that some view visual literacy as an ability or set of abilities (Bleed, 2005; Braden & Hortin, 1982; Hortin, 1980; Lamberski, 1976; Metros, 2008; Schiller, 1987), some as a skill (Ausburn & Ausburn, 1978; Bamford, 2003; Debes, 1969; Feinstein & Hagerty, 1993; Messaris, 1994), and some as a form of action (Alper, 1996; Sinatra, as cited in Avgerinou, 2001; Majure, 1976). In all of them, visual literacy gives an individual the capabilities such as the ability to create a visual message, visual communication, visual thinking, visual learning, decoding and encoding, understanding the meaning of images, interpretation, criticizing and evaluation, visual creation, and so on. As seen in Table 1, the main views consider visual literacy as a kind of ability or a set of abilities (Table 1).

Table 1. The Nature of Visual Literacy in terms of Different Definitions and the Multiplicity of each of them

Nature of Visual Literacy	Number of Definitions	Researchers
Ability or Set of Abilities	15	Richard Lamberski (1976), Hortin (1980), Braden & Hortin (1982), Schiller (1987), Sucy (1986), International Visual Literacy Association (1989), Baca, J. C (1990), Curtiss (1993), Avgerinou (2001), Metiri Group & NCREL (2003), Bleed (2005), Felten (2008), Susan Metros (2008), Pettersson (2009), ACRL (2011)
Skill	6	Debes (1969), Ausburn & Ausburn (1978), Steiner & Messaris (1994), Feinstein & Hagerty (1993), Bamford (2003), Brumberger (2011)
A Form of Action	5	Bikkar S. Randhawa (1976), Ronald E. Sutton (1976), Majure (1976), Sinatra (1986), Alper (1996)
A Process	1	Stafford (2011)
A Tool	1	Peña Alonso (2018)
Not Mentioned in Definition	2	Sutton (1993), Lopatovska (2016)

This multiplicity is evident even in the presented theoretical frameworks and studies in the field of application of the concept of visual literacy. For example, the standards and skills provided by researchers, institutions, and authorities also have different approaches to the subject of visual literacy. Based on many researchers, this multiplicity and lack of a consistent approach have been due to various reasons, including the multiplicity of definitions, ambiguity and wide scope of the word 'visual', the different academic orientations of the people who used these words, and the existence of the word 'literacy' which has caused a kind of distortion and misunderstanding of visual literacy due to the similarity of words with verbal (M Avgerinou & Ericson, 1997; Brumberger, 2011; Cassidy & Knowlton, 1983; Dondis, 1974; Kaplan & Mifflin, 1996; Messaris, 1994; Peña Alonso, 2018).

Due to these reasons, visual literacy, despite its importance and years of research and development, has not grown significantly and has not been considered properly in education and specialized fields. Visual literacy is of particular importance in all disciplines and in the design of educational materials since most students will finally be employed in an environment where the use of visual elements is part of their daily work. However, visual literacy is implicitly taught during specialized courses in disciplines such as art and architecture (Bleed, 2005, p. 8; Ervine, 2017, p. 8). In these disciplines, due to their nature, visual communication is an integral part of the subject of education and the promotion of visual literacy is a must, but the subject of visual literacy is not viewed as one of the essential goals at the end of these teachings despite its importance. Since the wide scope and ambiguity of visual literacy have been considered one of its problems by researchers and since there are multiple approaches to the application of this issue, to further apply the concept of visual literacy in specialized fields and education, this study tries to provide a new list of skills needed for mastering visual literacy to align applied approaches to the concept of visual literacy. As visual literacy is a cognitive concept that can be learned and taught (Avgerinou & Pettersson, 2011), it can be improved by using Bloom's revised classification of the cognitive area that has targeted the mastery learning stages. It should be noted that as mentioned earlier, the nature of visual literacy for most researchers is an ability or set of abilities. Hence, a new list can be called a set of abilities. Finally, this research will seek to answer the following questions:

1) How can a comprehensive list of skills needed to master and improve visual literacy be provided?

2) What abilities must a person acquire to be considered visually literate?

3) How can these abilities be used practically?

2. RESEARCH BACKGROUND AND THEORETICAL FOUNDATIONS

Based on the research approach, the theoretical foundations of the research will consist of three separate sections. Firstly, the studies that have applied and tried to align the views will be introduced. Second, the lists provided by valid researchers and institutions, which will include a list of competencies, skills, and standards will be introduced. Then, Bloom's revised classification in the cognitive area will be presented.

2.1. Application of Visual Literacy

The beginning of efforts to apply visual literacy can be traced back to Baca's extensive research in 1990, which attempted to reach a theoretical consensus among researchers in this field through extensive Delphi research. The results of this study revealed that visual literacy is related to the use of images and visual elements for the purposes of communication, thinking, learning, meaning construction, creative expression, and visual pleasure (Baca, 1990, p. 65). After that, some researchers attempted to develop a conceptual framework for literacy while providing an operational definition. In their first attempt to provide a comprehensive theory of visual literacy, Avgerinou and Patterson suggested that visual literacy theory should be based on the following conceptual components: visual perception, visual language, visual learning, visual thinking, and visual communication (Avgerinou & Pettersson, 2011) (Figure 2).

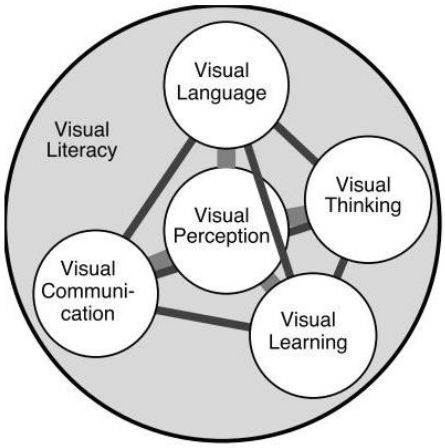

Fig 2. Conceptual Components of Visual Literacy Theory (Avgerinou & Pettersson, 2011)

However, from the first decade of the 21st century to the present, visual literacy studies have become more practical, and researchers have tried to suggest an educational method, strategy, and model for visual literacy and evaluate the effectiveness of a particular method, or in some cases, visual literacy in a specific field such as nursing or biology. The study population of these studies also ranges from children to university students (Beaudoin, 2016; Callow, 2008; Crowe, Dirks, & Wenderoth, 2008; Lopatovska, 2016; Lopatovska et al., 2018; Yenawine, 2003).

Callow (2008) introduced a framework called the "show me framework" to assess visual literacy in primary school students. Palmer (2015) provided visual literacy training as well as a set of exercises for a group of students. Finally, through a pre-test and post-test, it was shown that the training enables students to make stronger connections between what has been stated and visual evidence. In a research carried out to develop educational methods to improve visual literacy skills in a group of information science and librarianship students, in three exercises, students were asked to provide descriptive information for a class of historical photos and to record their perception through blog posts. Results revealed that students' skills in describing images increased somewhat during the three exercises (Beaudoin, 2016, p. 376).

In another research, the importance of scientific visual literacy and the need to understand scientific visual materials and subjects in the field of biochemistry and molecular biology were addressed (Offerdahl, Arneson, & Byrne, 2017).

In an attempt to improve and advance visual literacy education, Lopatovska et al. (2018) tested an educational method for children aged 2.5 to 4 in a public library. This method was implemented as part of a series of workshops for children in a public library, and finally analyzed how children learn and the principles of visual literacy in that teaching method. The review of these studies confirms the statement of Felten (2008) that despite many studies on the necessity of teaching visual literacy before university, its teaching is widely discussed at the university level. The development of seven visual literacy standards for higher education also confirms this issue.

In the new structure of education in Iran, learning culture and art is based on "art education" and we can say it has paved the way to teach visual literacy in the art curriculum. Gaining a rich and growing awareness of visual experiences, constructing and creating artistic phenomena, recognizing and critically evaluating visual symbolic forms, and learning skills related to artistic expression through various arts have been introduced as the main topics in art education (Amini, 2001, pp. 14–17).

2.2. The Most Important Skills and Competencies of Visual Literacy

Developing a concept measurement index and presenting a list of skills and competencies by relevant reputable institutions and explaining the importance of the issue can also ensure the further application of visual literacy, which is briefly introduced in the following four important lists:

Avgerinou's index to develop visual literacy measurement index: In extensive research, Avgerinou (2001) combined Gagne's educational objectives classification and Debe's modified classification as a theoretical basis to develop an index for visual literacy abilities (Avgerinou, 2001, 2007). By reviewing three decades of literature on visual literacy, he identified 11 competencies for a visually literate person:

Adobe Systems Pty Ltd.'s visual literacy whitepaper: Providing a comprehensive definition, it introduced the prerequisite skills for successful image and design work. In this list, the competencies according to which a person has visual literacy include understanding, analyzing, interpreting, combining and evaluating, and understanding the impact of visual images and elements have been considered (Bamford, 2003).

enGauge 21st Century Skills: Literacy in the Digital Age: In 2003, Metiri Group and the North Central Regional Educational Laboratory (NCREL) introduced visual literacy as one of the skills needed in the 21st century. The necessary skills for visual literacy were also developed and presented with the focus on the digital age and the need for interaction with the digital world in two groups: 1) knowledge about visual products in digital media, and 2) application of this knowledge (Burkhardt et al., 2003).

Seven visual literacy standards by the Association of College and Research Libraries: In 2011, this association developed a set of standards, performance indicators, and learning outcomes for visual literacy in higher education (ACRL Board of Directors, 2011; Peña Alonso, 2018, p. 35). Visual literacy is required in any academic discipline, and the important point of these standards is to pay attention to ethical, legal, social, and economic issues. The four lists of the above skills are presented in Table 2.

Table 2. The Most Important Skills and Competencies Provided for Visual Literacy

References	Year	Field	Visual literacy skills and competencies
Avgerinou	2001	Educational Technology; Instructional Design	1. Knowledge of Visual Vocabulary 2. Knowledge of Visual Conventions 3. Visual Thinking 4. Visualization 5. (Verbo-) Visual Reasoning 6. Critical Viewing 7. Visual Discrimination 8.Visual Reconstruction 9. (Sensitivity to) Visual Association 10. Reconstructing Meaning 11. Constructing Meaning
Adobe systems' whitepaper	2003	Visual soft wares	1. Understand the subject matter of images 2. Analyze and interpret images to gain meaning within the cultural context the image was created and exists 3. Analyze the syntax of images including style and composition 4. Analyze the techniques used to produce the image 5. Evaluate the aesthetic merit of the work 6. Evaluate the merit of the work in terms of purpose and audience 7. Grasp the synergy, interaction, innovation, affective impact and/or 'feel' of an image
enGauge 21st Century Skills: Literacy in the Digital Age	2003	Education; Learning Technologies	1. Have Working Knowledge of Visuals Produced or Displayed through Electronic Media: Understand basic elements of visual design, technique, and media- Are aware of emotional, psychological, physiological, and cognitive influences in perceptions of visuals- Comprehend representational, explanatory, abstract, and symbolic images. 2. Apply Knowledge of Visuals in Electronic Media: Are informed viewers, critics, and consumers of visual information- Are knowledgeable designers, composers, and producers of visual information- Are effective visual communicators- Are expressive, innovative visual thinkers and successful problem solvers
ACRL	2011	Information & Knowledge Management	1. Determine the nature and extent of the visual materials needed 2. Finding and accessing needed images and visual media effectively and efficiently 3. Interpreting and analyzing the meanings of images and visual media 4. Evaluating images and their sources 5. Using images and visual media effectively 6. Designing and creating meaningful images and visual media 7. Understanding many of the ethical, legal social and economic issues surrounding the creation and use of images and accessing and using visual materials ethically.

2.3. Bloom's Revised Classification in the Cognitive Area

Literacy is always associated with the act of learning and teaching. Researchers have considered visual literacy to be cognitive and learnable (Avgerinou & Pettersson, 2011, p. 4). Thus, the stages of learning this type of literacy can be adapted to cognitive levels. In this article, Bloom's cognitive classification was selected owing to its proximity to the subject of visual literacy and its wide application (Crowe et al., 2008, p. 369; Forehand, 2010, p. 1). Bloom's classification was developed in 1956 under the guidance of Benjamin Bloom by a group of experts in education and academic achievement evaluation. The cognitive area of this classification, which is considered in this article, is the most important area of learning and includes knowledge, information, and mental abilities and skills (Seif, 2014, p. 459).

The early classification provided extended definitions for the six main categories in the cognitive area. The categories included knowledge, perception, application, analysis, combination, and evaluation (Alipour, Faizi, Mohammad Moradi, & Akrami, 2016, p. 84). These categories have been arranged from the simplest to the most complex and from the most fundamental to the most abstract (Krathwohl, 2002, p. 212). However, in 2001, a group of cognitive psychologists, curriculum theorists, educational researchers, and assessment and testing specialists revised this classification and developed a new one (Armstrong, 2009, p. 3). The new classification, unlike the early classification, had two dimensions and was developed in the form of a "classification table" (Table 3). One dimension of this table was categorized as "cognitive process" (in columns) and the other as "knowledge" (in rows). This classification considers the goal and expectations of learning in each field of education based on a cognitive process and a category of knowledge. In other words, each cell of the table expresses an educational goal that includes a "verb" representing the cognitive process and a "noun" representing the expected level of knowledge (Anderson et al., 2001, pp. 3–5; Krathwohl, 2002, pp. 213–214) (Table 3).

The cognitive dimension (table columns) consists of six categories, including remembering, understanding, applying, analyzing, evaluating, and

creating. This dimension is based on the cognitive complexity, meaning that these categories range from the simplest to the most complex levels. For example, ‘understanding’ is more cognitively complex than ‘remembering’, and ‘applying’ is more complex than ‘understanding’. Then, the knowledge dimension (table rows) was conceptualized into four levels of categories, including factual knowledge, conceptual knowledge, procedural knowledge, and metacognitive knowledge. These categories are in the range from objective (factual) to abstract (metacognitive) levels (Anderson et al., 2001; Huitt, 2011).

With the development of cognitive psychology, in the new classification, the knowledge dimension was adapted to the specialized terms in this field, and the category of ‘metacognitive knowledge’, which was not well known in early classification, was placed at the most abstract level of this dimension. Metacognitive knowledge in general means knowledge about cognition and awareness about wisdom. Using this knowledge, a person can properly align his or her thoughts and actions (Center for Excellence in Learning and Teaching (CELT), 2011; Krathwohl, 2002). Learning goals, both explicitly and implicitly, include both dimensions of knowledge and cognitive process that can be included in table cells (Table 3). These four levels are distinguished by the cognitive psychology approach, and the well-known hierarchical levels, which divide knowledge into five levels of data, information, science, intelligence, and wisdom are somewhat aligned with these four levels. For example, the metacognitive level largely overlaps with the higher level of wisdom, and the procedural knowledge level can be aligned with both the intelligence and science levels. Also, the conceptual knowledge level is almost equal to science and information, and the factual knowledge level includes both data and science (Alipour, 2019, p. 163).

Table 3. The Revised Taxonomy Table for Educational Objectives (ACRL Board of Directors, 2011; Krathwohl, 2002)

		The Cognitive Process Dimension					
		Remember Recognizing (identifying) Recalling (retrieving)	Understand Interpreting (clarifying, paraphrasing, representing, translating) exemplifying (illustrating, instantiating) classifying (categorizing, subsuming) summarizing (abstracting, generalizing) inferring (concluding, extrapolating, interpolating, predicting) comparing (contrasting, mapping, matching) explaining (constructing models)	Apply executing (carrying out) implementing (using)	Analyze differentiating (discriminating, distinguishing, focusing, selecting) Organizing (finding, coherence, integrating, outlining, parsing, structuring) attributing (deconstructing)	Evaluate checking (coordinating detecting, monitoring, testing) critiquing (judging)	Create generating (hypothesizing) planning (designing) producing (construct)
The	Factual Knowledge knowledge of terminology knowledge of specific details and elements						
	Conceptual Knowledge						

	The Cognitive Process Dimension					
knowledge of classifications and categories knowledge of principles and generalizations knowledge of theories, models, and structures						
Procedural knowledge of subject-specific skills and algorithms knowledge of subject-specific techniques and methods knowledge of criteria for determining when to use appropriate procedures						
Metacognitive strategic knowledge knowledge about cognitive tasks, including appropriate contextual and conditional knowledge self-knowledge						

3. RESEARCH METHODOLOGY

The present research is applied in terms of purpose and descriptive-analytical in terms of nature and method. In descriptive-analytical research, the researcher needs strong reasoning and argumentation to explain and justify the reasons. It is provided by searching the literature and theoretical topics for research and developing existing propositions and general theorems such as laws and theories (Hafeznia, 2013, pp. 70-71). This study has been conducted in a purposeful logical course with the application of interpretive strategies and logical reasoning based on valid documentary and library studies. In the research strategy of logical reasoning, the researcher tries to pave the way for convincing the audience with logical and intellectual coherence in terms of both form and content by relying on verbal structures of interpretation (Mirjani, 2011, p. 49). In the process of implementing this study, the documentary information and research literature were first collected by the library method. Then, to provide a practical and comprehensive approach to the concept of visual literacy, after stating the theoretical foundations in a logical course, the most important list of visual literacy skills, standards, and competencies was adapted to Bloom's revised cognitive classification. Accordingly, the necessary competencies and abilities were reviewed and leveled in a new and a single classification. Finally, the researcher examined the topic of one of the courses in the field of architecture (Architectural Communication 1), in terms of improving the ability of visual literacy using the following list. Figure 3 shows the conceptual structure diagram of this research.

4. RESULTS AND DISCUSSION

Bloom's new classification table can be used not only in the classroom but also for more general and comprehensive goals (Krathwohl, 2002). Any educational goal that has cognitive importance can be inserted into the cells of this table (Anderson et al., 2001). Visual literacy also includes high-level thinking abilities and skills that can be learned through formal education or learning from the environment (implicit learning) (Alper, 1996; M. D. Avgerinou, 2001; Felten, 2008; Peña Alonso, 2018; Pettersson, 2009). Therefore, visual literacy, which is a cognitive subject, can be considered an educational goal and its promotion can be found in Bloom's classification table of leveling goals and applicability in education. For this purpose, the four lists in the research literature were inserted in Bloom's classification table (Table 4), given the explanations and definitions of each level and the existing examples. In other words, the criteria for inserting these skills or abilities in Bloom's classification were the definitions of each cognitive level and the explanations provided for each level (See Table 3). For example, in Table 3, cognitive activity at the "understanding" level means constructing the meaning of a message or

communication with the following activities: interpreting, exampling, classifying, summarizing, inferring, comparing, and explaining, and "conceptual knowledge" in the dimensions of knowledge means the knowledge of categories, classes, and relationships between them or the knowledge of the interrelationships between the basic elements in a larger structure that enables them to have a common function. After inserting, it will be revealed that the focus of the skills and abilities of each list is based on which level of cognition and knowledge.

The four lists, which included Avgerinou (2009), Adobe Systems' visual literacy white paper (Bamford, 2003), enGauge 21st Century Skills: Literacy in the Digital Age (Burkhardt et al., 2003), and the seven standards of the Association of College and Research Libraries (ACRL Board of Directors, 2011), were examined and their multi-part sentences were divided into smaller sentences and placed in appropriate sites. For example, the sentence "visual thinkers are creative and have the ability to solve problems successfully" was divided into two parts of problem solving and visual creative thinking. Some of the concepts mentioned in the lists needed to be broken down into sub-topics and inevitably placed into more than one cell. For example, the ability to solve a visual problem involves at least the following steps: defining the problem, analyzing the problem, creating possible solutions, analyzing the solutions found, selecting the best solution, and planning the next stage (Heppner, 1978; "The Problem Solving Process", n.d.). Creative thinking must also be adapted to at least several stages of creativity, including understanding the subject, collecting information, creating an idea, evaluating ideas, designing, and implementing it (Mumford, Medeiros, & Partlow, 2012). Also, to examine the distribution of competencies of each list in the table, abbreviations for each list were used. Avgerino (AV), enGauge 21st Century Skills: Literacy in the Digital Age (NC), Adobe Systems' visual literacy white paper (AD), and finally the Association of College and Research Libraries (AC).

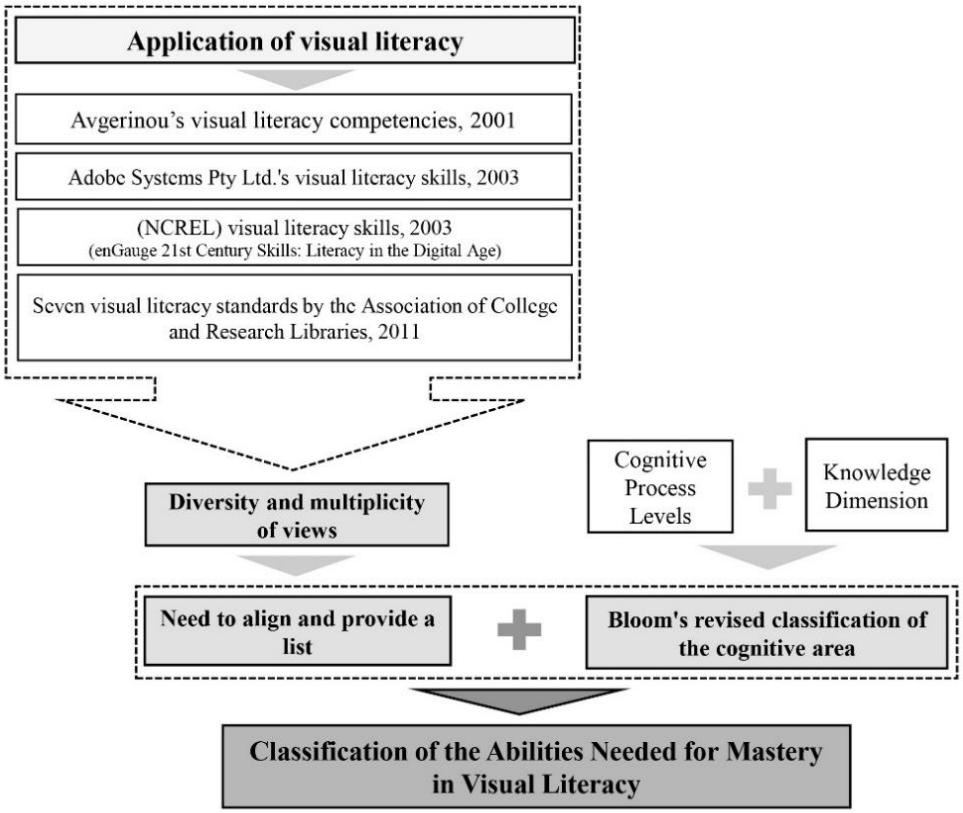

Fig 3. Conceptual Structure of the Present Study

Table 4. Adapting Visual Literacy Skills to Bloom's Educational Goals Classification Table

		Cognitive Dimensions					
		Remember	Understand	Apply	Analyze	Evaluate	Create
Knowledge dimension	Factual Knowledge	• Being familiar with basic visual elements and shapes (AV)	• Understanding the basic elements of visual design (NC)	• Using visual information (NC)		• Criticizing Visual Information (NC) • Evaluating images and their sources (AC) • view critically (evaluate information and tips related to the desired visual element) (AV)	• Reconstructing visual (AV) • Creating new ideas from information in the Creative Visual Thinking (NC) process
	Conceptual knowledge	• Being familiar with visual conventions, symbols, signs, stylistics, organizations, categories, etc. (AV)	• Understanding symbolic, abstract, elucidating, explanatory and visual images (NC) • Understanding the subject of images (AD) • Having a critical view (understanding the subject, and interpreting as well as inferring after evaluating) (AV) • Visual Thinking (AV)		• Syntax analysis of visual elements including style and composition (AD) • Interpreting and analyzing the meaning of visual elements (AC)	• Critical View (AV) (examining the relationships between elements and components in an image or visual phenomenon) • Evaluating the aesthetic values of the visual element (AD)	• Getting the meaning from a visual message (AV) • Reconstructing meaning (AV) • Creating new communication ideas across categories of Creative Visual Thinking Process (NC) • Visual Visualization (AV)
	Procedural knowledge	• Being aware of the different effects of visual elements (NC) • Identifying the type of need and the amount of need for visual information (AC) • Finding and accessing the images and video media needed effectively and efficiently (AC)	• Understanding the amplification, interaction, innovation, and emotional impact of an image (AD) • Visual (Verbal) Reasoning (AV) • Visual Thinking (AV) • Understanding Visual Design Techniques (NC)	• using visual elements in line with the intended purpose effectively (AC)	• Visual Differentiation (AV) • Being sensitive to commons and communication between visual elements (AV) • Analyzing techniques used to produce an image or visual element (AD) • Being able to correctly analyze solutions to solve a visual problem (NC)	• Evaluating the value of the visual elements according to their purpose and audience (AD) • Evaluating images and their sources (AC)	• Creating a new approach to the creative visual thinking (NC) process • Designing and fabricating meaningful images and visual media (AC) • Communicating effectively through visual elements (NC) images

Metacognitive knowledge	Finding and accessing the images and video media needed effectively and efficiently (AC) • Being aware of the ethical principles associated with images and visual elements (AC)	• Understanding ethical, legal, social, and economic issues related to the creation and use of images and visual media. (AC)	• Using of visual material ethically (AC)	Analyzing and interpreting visual elements to obtain meaning in the context of the culture in which it is made and exists (AD) • Looking critically (review of context and context) (AV)	Being able to evaluate problem solutions and selecting the appropriate solution in visual problem solving (NC)	Designing and fabricating meaningful images and visual media (AC) • Using visualization in the direction of creation (AV) • Creating and adapting to all conditions in the process of creative visual thinking (NC) • Being able to create visual information based on cognition (AD)

As shown in Table 4:

- At the intersection of "conceptual knowledge" and the cognitive category of "application", no skill or characteristic for visual literacy has been mentioned. "Conceptual knowledge" means knowledge of categories, classes, and the relationships between them, as well as knowledge of theories, structures, and models. From another point of view, it also includes knowledge related to signs and symbols. In many definitions of visual literacy, the ability to make visual connections and understand visual symbols has been expressed as a result of having visual literacy (Bamford, 2003; Metros, 2008). However, for this cell of the table, there is no equivalent for these four categories. Therefore, the set of skills in applying the categories, symbols, the relationship between visual elements, structures, etc. has shortcomings, and the ability to "apply categories and concepts" can be added to the present set to complete the list of visual literacy abilities.

- At the intersection of the dimensions of "factual knowledge " and the cognitive category of "analyzing", the equivalent skill was not found in the four categories of skills mentioned. "Analyzing" means describing relationships, differentiating, and organizing the elements or components. Thus, describing and analyzing, organizing, and distinguishing between the main elements, basic concepts and specialized terms are not seen in the lists. Since being aware and correctly distinguishing between the main visual elements and the main components of the subject is necessary to evaluate the visual elements and creativity and to solve visual problems, it is also necessary to consider this section. Thus, the ability to "analyze and distinguish between visual information" in this cell should be added to the table of visual literacy goals.

- However, in general, the distribution of skills and competencies in Table 4 shows that the highest number of skills is in the dimension of "procedural knowledge" (specialized methods and techniques and knowledge of criteria to determine the proper process), "conceptual knowledge" (knowledge of categories, classes and the relationships between them, in other words, knowledge of the interrelationships between the basic elements in a larger structure), and "metacognitive knowledge", respectively, and the least focus is on the factual knowledge. It suggests that in the skills and competencies defined for visual literacy in the literature, one is visually considered literate who has intellectual abilities at more complex and abstract levels. Also, if we consider creation as the most complex cognitive category, and metacognitive knowledge as the most abstract category of knowledge, the seven standards provided by the Association of College and Research Libraries (AC) rightly focus on the highest levels of thought and knowledge, since these standards are designed for students at higher levels of education. At these ages, a person's cognitive and intellectual development has evolved and the person will be able to learn skills at high intellectual levels.

- The number of skills and competencies of each list in the classification cells is different from the other, indicating the different approaches of each list and the priorities of its compilers according to its desired goal. The priorities of each list can be seen in both the cognitive level and the knowledge dimension in the following table:

Table 5. Priorities of each Visual Literacy List

List Name	Field		Order of Priorities in the List →
(AV) Avgerinou- 2001	Educational Technology; Instructional Design	Knowledge Dimension	1. Conceptual knowledge, 2. Procedural knowledge, 3. Factual Knowledge, 4. Metacognitive knowledge
		Cognitive Process	1. Create 2. Understand 3. Analysis 4. Remember 5. Evaluate
(NC) NCREL - 2003	Education; Learning Technologies	Knowledge Dimension	1. Procedural knowledge, 2. Factual Knowledge, 3. Metacognitive knowledge, 4. Conceptual knowledge
		Cognitive Process	1. Create 2. Understand 3. Evaluate
(AD) Adobe systems whitepaper- 2003	Visual soft wares	Knowledge Dimension	1. Conceptual knowledge, 2. Procedural knowledge
		Cognitive Process	1. Analysis 2. Understand 3. Evaluate
(AC) ACRL-2011	Information & Knowledge Management	Knowledge Dimension	1. Metacognitive knowledge, 2. Conceptual knowledge
		Cognitive Process	1. Remember 2. Apply 3. Evaluate 4. Create

As seen in Table 5, in NC and AV lists, the creation of visual elements, understanding of visual elements, and evaluation, respectively, have a high priority of cognitive levels for visual literacy. With this difference in terms of the knowledge dimension, AV has the highest priority over conceptual knowledge and NC has the highest priority over procedural knowledge.

Also, in the AD list, priority at cognitive levels is on the ability to analyze and understand visual elements. Also, in the AC list, the lowest level of cognition, including remembering and then applying and evaluating, has been prioritized. In terms of knowledge dimension, the AD list focuses on the conceptual dimension of images and then procedural knowledge (how images are used), and the AC list puts the highest emphasis on the metacognitive level of knowledge, which is the most complex level of knowledge. It should be noted that the least focus of these lists is on the cognitive level of "application", and this could be another reason why these lists are not widely applied. In other words, these lists did not emphasize the fact that one should be able to master the application of visual elements.

Examining the four existing lists of visual literacy, each of which provided competencies, skills, and standards for the concept, showed that these lists did not have similar approaches to the subject of visual literacy. Thus, to answer the first research question of how to obtain a comprehensive list of skills and competencies needed to master and promote visual literacy, first Bloom's cognitive classification for mastery of learning, as a criterion for reviewing and analyzing this list, was selected.

Then, the priorities of each list and their shortcomings were considered (Table 5). Based on Table 3, the general sentences of each level were aggregated and merged, and some items were suggested for the levels that were not considered. These two abilities are suggested at the level of "applying the knowledge of concepts" as well as "analyzing the factual knowledge". Therefore, two abilities of "applying visual categories and concepts" and "analyzing and distinguishing between visual information" were added, respectively, to complete the classification of the necessary abilities for visual literacy. Thus, a new leveling based on knowledge and the cognitive process was developed and categorized (Table 6). The reason for naming this new leveling as "visual literacy abilities", given what was stated in the introduction, is that visual literacy is considered as an ability or set of abilities by most researchers.

As seen in Table 6, to fully master visual literacy, a person needs to have six levels of cognitive ability, from the simplest to the most complex level of thinking, and appropriate to their field of expertise, and these cognitive abilities must also equip the individual with the most objective to the most abstract dimension of knowledge. Thus, to answer the second question of the research, Table 6 will be useful. Thus, based on the desired goal in each field, expertise or educational level, it can be planned in a way to achieve the desired level of visual literacy, or to determine the necessary prerequisites and take action. Based on the studied conducted, the abilities of remembering, understanding, and applying are considered at simpler cognitive levels and the abilities of analyzing, evaluating, and creating are considered at the most complex levels (Crowe et al., 2008; Zoller, 1993). Hence, high levels of cognitive process and dimensions of knowledge can be planned for higher levels of education, and vice versa.

Table 6. Leveling the Visual Literacy Abilities based on Cognitive Levels and Dimensions of Knowledge

Knowledge Dimensions of Visual Literacy Abilities (From the most objective to the most abstract dimension)		Cognitive Levels of Visual Literacy Abilities (From the simplest to the most complex level)					
		The simplest →					The most complex
		Remember	Understand	Apply	Analyze	Evaluate	Create
The most objective	Factual	Getting familiar with basic visual terms, elements, and forms	Understanding the basic elements of visual design	Using visual information	Analyzing and differencing between available visual information	Criticizing and evaluating visual information	Visualizing existing information and completing an incomplete information-based message
↓	Conceptual	Rememberin g visual styles, categories, and conventions (symbols and signs)	Understanding the subject, abstract aspects of visual elements, and visual thinking	Applying categories, visual concepts, and categories	Analyzing the composition and meaning of visual elements	Evaluating the relationships and aesthetic values of visual elements	Creating a new connection between categories and visual concepts and getting the meaning of visual messages
↓	Procedural	Knowing how to influence, need, and then effective use of visual elements	Making visual reasoning, understanding the interaction of visual elements and visual design techniques	Using visual elements in line with the intended purpose	Distinguishin g between visual elements, using techniques, and different options available	Criticizing visual element according to its purpose and audience	Visualizing plan and design of visual element and creating a new visual process
The most abstract	Metacognitive	Getting familiar with the position and context of visual elements and related ethical principles	Understanding the moral, legal, social, and economic issues of visual elements	Using visual materials ethically	Analyzing visual elements and their meaning according to different contextual conditions	Evaluating the solutions of a visual problem and selecting the solution of the problem according to the contextual conditions	Turning visual design into reality, creating communicatio n through visual elements according to the context

5. CONCLUSION

As mentioned before, there has always been multiplicity and ambiguity in research in the field of visual literacy due to reasons such as the diversity of disciplines related to visual literacy and the wide scope of this issue. Thus, adopting a comprehensive and consistent approach can be effective in better application of visual literacy.

In this study, unlike the previous lists, visual literacy was viewed from two dimensions: visual literacy as knowledge and visual literacy as levels of the cognitive process. This new classification has targeted four dimensions of knowledge, quality, type, and content of what a visually literate person should master. From this point of view, the person's mastery of specialized terms and words, basic visual forms and elements, and the recognition of the reality of images and visual elements will be related to the factual knowledge in visual literacy. Visual conventions such as different classifications and stylistics, signs, and the meaning of symbols are related to the conceptual knowledge of visual literacy. The procedural dimension of visual literacy

knowledge also includes how to do or design and examine the relationships between the various visual elements. Finally, self-awareness and mastery of the process of visual thinking, awareness of ethical principles and rules, as well as the relationship and appropriateness of visual work to contextual conditions, and the context of its formation is the metacognitive dimension of visual literacy knowledge.

Also, the levels of the cognitive process of visual literacy determine the nature of the mental and intellectual skills necessary to master visual literacy. These dimensions are classified into six levels. Remembering and recalling information from the mind will be at the simplest level. From this point of view, like in any other area, it is necessary for people to master many terms, categories, and procedures and rules in the area of visual literacy skills. The most complex level of the cognitive process of visual literacy belongs to the creation of a visual work that is achieved through other levels such as understanding, applying, analyzing, and evaluating elements and images. These mental levels can be considered steps in training and mastering visual literacy learning. Hence, the simplest ability arises from the intersection of the cognitive level of 'remembering' and then the 'actual knowledge'. This skill is 'familiarity with basic visual terms, elements and shapes'. The most complex skill is placed at the intellectual level of 'creation' and then 'metacognitive knowledge', which is equivalent to the skill of 'turning a visual design into reality and the skill of communicating through visual elements according to the contextual conditions'.

To answer the third question of this research regarding the way of applying this list, since one of the steps in curriculum planning is to determine the goals and then the content of education, this new classification could be a step towards the extensive application of this concept. Thus, with the help of this list, it is possible to improve the visual literacy of students in related disciplines such as architecture, graphic design, and media, which is one of the main goals of learning visual communication in these disciplines as a specific and classified goal. Finally, to provide an example of the application of this list, the syllabus of Architectural Communication course (1), in the approved curriculum of the undergraduate course in architecture at the University of Tehran, is examined.

In the mentioned curriculum, the topics of architectural communication course (1) include familiarity with drawing, its types, and its application in architecture, familiarity with geometry and its application in a three-dimensional drawing of volumes and strengthening imagination, improving the freehand drawing skill, familiarity with different types of perspectives, drawing different shapes and their shadows, drawing complementary elements (such as a human, tree), familiarity and practice with drawing tools (Ministry of Science Research and Technology, 2014). In the next stage, these topics are adapted with the new classification of visual literacy abilities (Table 6), the results of which can be seen in Table 7. As seen, in the topics of this course, the three cognitive levels of remembering, understanding and applying, and in terms of knowledge, the dimensions of factual knowledge and procedural knowledge have been targeted. Thus, at the end of the architectural communication course (1), the student's visual literacy abilities in relation to drawing and architecture visual communication will be improved in these cognitive levels and dimensions of knowledge. The corresponding ability can be seen in the following table.

This example showed how much and to what extent in the curriculum, an undergraduate student of architecture will achieve the visual literacy abilities by passing the course of architectural communication, one of the courses designed to improve visual communication skills in architecture. Accordingly, by adapting and analyzing the course topics and general goals of the undergraduate course in architecture, using the above list, it can be stated that, in which levels and dimensions, the architecture curriculum will improve students' visual literacy abilities and at what levels will there be shortcomings and what programs can be recommended. Thus, it seems that curriculum analysis of disciplines such as architecture from this point of view can be a good subject for future studies.

Table 7. Correspondence of the architectural communication course topics (1) with the table of visual literacy abilities

	Course topics (syllabus)	Corresponding visual literacy abilities based on table 5	Cognitive Process level	Knowledge Dimension
Architectural Communication Course (1)	Familiarity with geometry, Familiarity with different types of perspectives Familiarity with drawing tools	Getting familiar with basic visual terms, elements, and forms	Remember	Factual
		Remembering visual styles, categories, and conventions (symbols and signs)	Remember	Conceptual
		Understanding the basic elements of visual design	Understand	Factual
	Application of geometry and perspective in drawing three-dimensional volumes	Knowing how to influence, need, and then effective use of visual elements	Remember	Procedural
		Using visual information	Apply	Factual
		Using visual elements in line with the intended purpose	Apply	Procedural
	Develop freehand drawing skills	Using visual information	Apply	Factual
		Understanding the basic elements of visual design	Understand	Factual
		Making visual reasoning, understanding the interaction of visual elements and visual design techniques	Understand	Procedural
	Drawing all kinds of shapes and their shadows	Getting familiar with the position and context of visual elements and related ethical principles	Remember	Metacognitive
		Understanding the basic elements of visual design	Understand	Factual
		Making visual reasoning, understanding the interaction of visual elements and visual design techniques	Understand	Procedural
		Using visual information	Apply	Factual
	Drawing complementary elements (such as a human, tree)	Getting familiar with the position and context of visual elements and related ethical principles	Remember	Metacognitive
	Practicing with drawing tools	Using visual information	Apply	Factual
		Making visual reasoning, understanding the interaction of visual elements and visual design techniques	Understand	Procedural

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HOW TO CITE THIS ARTICLE

Ghadirinia, M., Mehdizadeh Saradj, F., Mozaffar, F. (2022). Classification of the Abilities Needed for Visual Literacy: A Review of Abilities based on the Cognitive Learning Mastery Approach. *Int. J. Architect. Eng. Urban Plan*, 32(3): 1-17, https://doi.org/10.22068/ijaup.681

URL: http://ijaup.iust.ac.ir