Review

Visual Thinking Strategies—Theory and Applied Areas of Insertion

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Abstract: Twenty-first century learners live in a highly visual world, being constantly surrounded by visual, technologized stimuli and the educational system, be it general or specialized—as in the case of higher education—needs to creatively meet and answer these learning requirements. Among the plethora of new or updated approaches, the concept of Visual Thinking Strategies (VTS) designed by Philip Yenawine and Abigail Housen has gained extensive popularity due to its capacity of being adapted to a wide range of specialized fields with notable improvement results. The main purpose of the present review is to synthetically and critically present relevant scientific work related to the application of the VTS procedure and to further identify possible study areas that would highly benefit from the insertion of this procedure. Thus, the theoretical perspective is tackled from a cognitive-psychology standpoint, followed by a rendering of the research variety in applied VTS contexts pertaining to different study domains, as well as online VTS web clustering. These contexts have shown a predilection for VTS usage, which improves higher-education students' specialized vocabulary and speaking skills in the same target language, but not in the case of ESP (English for specific purposes) classes.

Keywords: visual thinking strategies (VTS); higher-education-specialized VTS applications; VTS web clusters; English for specific purposes (ESP); technical vocabulary; sustainable communication skill

1. Introduction

Education facilitators, as well as students, the direct beneficiaries of the work they conduct, live in a world that completely surrounds them with visual stimuli emerging from the sphere of technology [1]. This aspect cannot be avoided by the above-mentioned educational actors, only efficiently integrated into the process they orchestrate. It is also maximized in the case of English-language learners, wherein specific educational efforts take into account students' learning traits [2]. One of the most complex concepts that fit such an (educational) environment is that of Visual Thinking Strategies, as it is based on fully exploiting the enhanced characteristics of visual learning and on combining them with cognitive processes meant to develop students' associative skills when acquiring vocabulary, grammar structures and syntactic sequences, an intricate process that has been theorized by Yenawine [3] and will be presented in detail in the current review.

Consequently, this review aims at identifying higher-education areas in which the application of the VTS procedure is rather lacking, although students would highly benefit from it if this were not the case. In order to do so, and having as a starting point VTS theoretical conceptualization, the relevant research work has been considered from the point of view of applied VTS situations, taking into account not only published research articles in various fields of higher education (such as pharmacy [4]), but also VTS web clustering [5]. Moreover, another aim of the review is that of underlying the main benefits of using VTS for developing students' different abilities, especially in the case of university levels,

with significant emphasis on communication and observation skills that could be further transferred in the specific domain of the students' future professional communities [6], as well as on developing specific vocabulary and cohesion structures. Thus, the reviewed literature is meant to serve the above-mentioned purposes, although not in an exhaustive manner, and it has been grouped in several categories, as detailed below. Furthermore, the present study also led to recommendations based on the research results, recommendations that target applying VTS activities within the larger frame of ESP (English for specific purposes) higher-education classes, combining English language and communication skills with specialization-related skills. A further research article is thus advisable in this context.

2. Materials and Methods

The present review started from the Visual Thinking Strategy theoretical conceptualization in order to set its main characteristics and to offer a solid background for its scientific validity. Further on, it tackled the main VTS applied cases, mostly in a wide range of higher-education domains, although there are several instances of secondary-education contexts of insertion. The main reason for proceeding in such a manner resides in the fact that the review aims at identifying higher-education areas in which the application of VTS has not yet been researched.

3. Results

The results of the current review are organized according to three sections, comprising the main aspects of VTS theoretical conceptualization, applied cases of Visual Thinking Strategies in various education research fields and VTS web clustering.

3.1. VTS—Theoretical Conceptualization

VTS (Visual Thinking Strategies) and VUE (Visual Understanding in Education) were developed as a response to a change occurring in the standards of students' achievements assessment connected to their learning needs and soft-skill development, thus targeting aspects such as critical thinking; effective problem solving; logical reasoning; constructive listening comprehension and convincing language productive skills, namely, speaking and writing; as well as meta-cognitive awareness of the knowledge-acquisition process and contents [3]. Philip Yenawine, Director of Education at the Museum of Modern Art (MOMA) in New York in the late 1980s and researcher Abigail Housen (Ed.D. Harvard Graduate School of Education), in answer to a major MOMA donor's question of whether museum visitors' undergo personal and cultural growth after specific activities at the museum [5], managed to design a multi-layered VTS protocol in the 1990s aiming at developing both individuals and groups in the following directions and in direct correlation to the Common Core Standards [7]: deepen thinking, increase participation (engagement), deepen language abilities, writing and speaking skills along with visual literacy, and improve listening and collaborative problem-solving skills [3]. Moreover, teachers and any other VTS facilitators were targeted by a complementary VTS protocol meant to increase engagement from shy students, level the field, introduce a topic and scaffold peer-learning abilities, focusing on constructivist actions such as help, encourage and achieve, preparing the students for further college studies and for the employment stage to follow [3].

The main concept underlying the VTS specific and extended activities, according to Yenawine is "permission to wonder" [3,5] and it was largely presented in 2013 in what he described as being the most comprehensive book documenting VTS from a theoretical and practical point of view [8]. Working with cognitive psychologist Abigail Housen, they devised an idea according to which effective learning does not happen when one presents students/learners with answers, but when they are given the opportunity and thinking time to go through the discovery process themselves, have the option of making individually meaningful connections and associations that will internalize the acquired contents over longer periods of time and can also subject it to extensive application frames, namely, the practical know how of visual literacy inserted in any other life sequence of

the learner, without any guided help a professional might offer [8]. Therefore, learners are given the opportunity of benefiting from gaining learning independence and VTS emerges as a combination of needs (to observe, to wonder, to understand and decipher perceptions, to recognize and to use them independently), methods and contents, thus empowering audiences at large [8].

The work conducted by the MOMA team and Abigail Housen also led to coining the term "viewing skills", based on consciously manipulating the familiar when trying to comprehend, to puzzle out the unfamiliar by employing actions such as observing, interpreting, probing, reflecting and acknowledging alternative meanings along the lines of developmental learning [8]. Moreover, there is the complex process of procedural transfer that Housen researched, detailing aspects such as critical-thinking transfer (of context and content), sequence effects, developmental effects and developmental growth [9].

According to Housen, there are five types of viewers: accountive viewers, rooted in narratives of all sorts; constructive viewers, using the logical framework of reasoning; classifying viewers, who filter reality and experiences through an analytical and critical prism; interpretative viewers, who relate critical thinking to feelings; and re-creative viewers, who are the category of professionals trained in the field of visual literacy [10]; the majority of people fall simultaneously into the first two categories [10]. Using this categorization as a starting point, the VTS procedure has been applied within specific contextual-learning examples, underlining the fact that thinking skills such as vocabulary, grammar, pronunciation, conversation and engagement represent the basics of externally expressed cognitive processes, whereas metaphor usage, abstract thinking, speculating and inferring are allotted a higher status [10].

In addition, Yenawine centers the VTS process on a three-sided unit: look (at the image, quietly, for one minute)–think–talk (answer open-ended questions, debate points of view) [11]. Based on Housen's research, the three major questions in VTS are: "What is going on this picture?" (appealing to the narrative identity of the learner), "What do you see that makes you say that?" (connecting perceptions, logical thinking, causality and language) and "What more can we find?" (meaningfully enlarging the picture without making the learners feel like they need to give a standardized, correct answer) [11].

When it comes to applying VTS by ESL facilitators, Yenawine emphasizes that VTS is an efficient language-development assistant both by pointing (translated as "visual paraphrasing" by Diane Zimmerman [11]) and paraphrasing activities which target aspects such as expanding vocabulary, improving grammar (modal and modular thinking, launching hypotheses), increasing language accuracy, coherence (syntactic structures) and cohesion (linking devices and reflective dialogue), and heightening students' confidence, thus generally modelling thoughts and language use [11].

It has also been noticed that, when applying VTS activities to other subjects, the students showed an increased level of engagement, deep thinking and enthusiasm; examples of applying VTS during Mathematics classes, social studies classes, sciences classes, and language classes have been closely analyzed [12]. When assessing thinking through writing via VTS, the observations made are more detailed and the evidence-supported inferences are more clearly constructed; thus, the VTS facilitator can also track changes in thinking by writing-sample comparisons [13]. In the case of language development and ELL (English-language learners), Yenawine presents several language theories, underlining Lev Vygotsky's work to which he adds, in a complementary view, his and Housen's VTS findings: the direct benefit of discussions on the capacity of writing, the use of art's intrinsically intriguing qualities, the ability of formulating questions, direct access to new vocabulary and ideas through paraphrasing, and creating meaning by combining perceptions and words [14]. The VTS facilitators' role is given extensive analysis [15] and the concept of effective teaching is considered from a double standpoint, not only teachers, but also students helping in the construction of knowledge [16].

3.2. VTS Applied Cases

The multitude of theoretical and practical facets rendered by Yenawine and Housen's concept of VTS have been broadly enlarged upon by different researchers throughout the world, pertaining to various specialized research fields, detailing particular cases of the advantages of inserting VTS educational sequences into the general and specialized learning processes, starting with primary levels and ending with higher education and adult levels. However, the present review focused mostly on research articles targeting higher education, in accordance with its main aim.

In a comprehensive but not exhaustive view of this specific research work, several pragmatic case-study directions have been identified as containing the bulk of quantitatively and qualitatively analytical ramifications of applied VTS, preponderantly clustering around the topics of art, medicine, nursing, English language and core-subjects classes and courses, at different educational levels. Moreover, the applied VTS cases do not present any new theoretical development and are strictly circumstances of observing and determining the benefits of VTS activities at the level of improving students' specific skills in the same target language.

Thus, Agarwal et al. discuss the overall effect of first-year medical students taking part in VTS workshops based on the analysis of clinical images, followed by numeric and vocabulary measurements and time-lapse analysis, as well as the quality of vocabulary in a written form, underlining a significant increase in the case of all these three aspects [17]. Mukunda et al., on the other hand, remark on the fact that most data referring to inserting humanities and art training into medical-school curricula have been mainly focused on preclinical students and developing skills such as specialized observation and diagnose, but also empathy, team building, communication skills, resilience and cultural sensitivity; although the quantity of measurable data in this body of research is not that encouraging, further evidence-based studies are highly recommended [18]. In their 2021 study, Chisolm, Kelly-Hedrick and Wright argue a similar line of research, noting the tremendous importance VTS has in enhancing health-care professionals' clinical excellence (communication, interpersonal skills, diagnostic skills, clinical reasoning) [19]. Klugman, Peel and Beckmann-Mendez argue, as far back as 2011, that, in the case of selected students of the University of Texas Health Science Center in San Antonio, there was a relevant increase in the amount of time looking at art and patient images, the number of words used to describe these and the number of observations related to them, with a significant positive difference in the case of female students as compared to male students [20]. Moorman et al. explore the transferable skills that nursing students may employ in their field of specialization after being subjected to VTS activities, highlighting the gain in observational, cognitive, and interpersonal and intrapersonal skills, although they were exposed only to one hour of a VTS workshop led by a trained facilitator [21]. The topic is also discussed by Moorman in a previous article, identifying the meaning VTS develops in nursing students [22]. However, the need for further research, in the case of the Moorman et al. article, was also acknowledged by the authors themselves [21]. From another standpoint, Nanavaty explore the effects a VTS activity had on the enhancement of nursing students' assessment skills in the case of a group of sixty nursing students, and expand upon the connection between reflection abilities and clinical practice [23]. Applying a comparative frame to these studies, it should be noticed they are representative for several directions, namely, vocabulary increase-rate measurement (in the same target language), developing communicative skills and cultural sensitivity, increased observation time with differences according to gender, improved rate of transferable-skills application and enhanced assessment/diagnostic skills.

Predictably, the fastest and, for that matter, one of the first VTS-specialized field transfers is identified as being made by researchers working in the domain of general education with students going through subject-related VTS activities at primary and secondary levels [24,25], with various VTS class activities or lessons being subsequently provided [26], with subsequent insertion at the level of higher-education. A refreshing perspective is revealed by Cappello and Walker's study that focuses on teachers as visual-literacy facilita-

tors across different disciplines and underlines the fact that they support the insertion of VTS into vocabulary teaching sequences as well as for developing speaking skills while, at the same time, creating a comfortable environment for students to acquire and practice 21st century communication skills and modes [27], an aspect also enlarged upon by Yenawine in several blog articles [28]. In addition, English teachers have been also advocating and making the procedural aspects of VTS available in various posts and articles on EFL (English as a foreign language)/ESL (English as a second language) specialized sites, such as the case of Judie Haynes, a TESOL columnist with experience of 28 years as an ESL elementary teacher who offers a succinct, manageable view on the steps to integrate VTS into learning activities designed for English learners [29]. Moreover, Angela Anderson, an art-enrichment specialist at the Dual-Language School West View Elementary in Burlington, Washington, supports the idea that oral language acquisition highly depends on VTS, underlining the connection between oral language development and ELL (English-language learners), the ways in which VTS can help improve the oral language development of ELL, simultaneously promoting higher level thinking and building deeper comprehension [30]. In addition, studies of CLIL (content and language integrated learning) and VTS have also been conducted, especially in the case of the science classroom [31]. Although primary and secondary levels of education are tangential in the case of the current review, the purpose of mentioning them is that of underlining the advantages of VTS insertion in relation to English language and skill improvement.

Another ESL/ELL-related field in which using VTS has proven efficient is that of writing workshops. Stephanie Hampton gives a detailed written account of how one can apply VTS during writing workshops for ELL in a 2018 blog posted on her website, *Writing Mindset* [32]. She preponderantly emphasizes specific applications targeting VTS in a written-messages-production environment, such as writing leads to photos; giving titles; sensory, character and plot descriptions; creating a newspaper article; and accounting for different points of view [32]. Some of the advantages she mentions are rooted in helping students elaborate individual questions, rendering various perspectives and making others aware of them, and sharing ideas in a communicative medium [32], aspects that are also taken into consideration when modeling the methodological application of VTS within the ESP framework put forward by the current review.

Yenawine and Miller expose the main items to be taken into consideration when it comes to VTS and the learning process during college years, adapting the VTS protocol to the more complex educational and social circumstances of college studies, wherein intentional consistency in professionally determined environments is more challenging, as well as to the particular cases of developing critical-thinking skills (and the complex grammar and syntactic structures needed for cognitive processes and their corresponding external expression) and active classroom engagement [33]. They also tackle the traits of the 21st century students who need to comprehensively process interdisciplinary, ever-changing data by grouping and regrouping updated information (content and context of usage) in practical, shifting clusters [33]. Thus, the students' skills are focused, through VTS facilitation, on applying previously acquired knowledge in unfamiliar contexts, contextually and adequately expressing oral language, collaborative sharing of ideas and observations, debating possibilities, identifying ambiguities, developing individual identities within a group identity and gaining confidence through active engagement [33]. Another issue addressed by the researchers is that of the way in which the VTS protocol answers science needs and actively transforms the learning process [33].

Exemplifying the strong relationship the VTS procedure helps create between different culture and knowledge institutions, Amelia Nelson dwells on practical examples of using VTS as an integral part of an information-literacy instruction program resulting from the collaboration of a library and a museum, stressing the fact that the VTS protocol offers new ways of connecting these institutions with 21st century students and any other type of information seekers [34]. A VTS artistic perspective is given by Iris Yirei Hu, emphasizing the importance of developing active, thoughtful listening skills not only as a VTS facilitator,

but as a knowledge facilitator of any kind; her explanations stem from answers to the question of effective learning (how to learn) and are mediated by the VTS function of empowering students throughout the entire learning process, while ensuring their freedom of expression [35].

Conducting their research in the field of art education through art viewing within the larger frame of art history, Ishiguro et al. focus on quantitatively measuring the amount of time a group of undergraduate students spent viewing artwork; they were given 10 artwork items to look at and the elements assessed were eye movement and image evaluation [36]. The researchers conclude that there was a significant increase in the amount of viewing time spent by students exposed to the VTS procedure compared to those exposed to the typical lectures on art [36]. In addition, even if these results are presented as being new to the field of art education, other researchers have come to the same conclusions, though in different domains (Mukunda et al., Agarwal et al.). Furthermore, Poirir, Newman and Ronald also comprehensively consider the tremendous advantage VTS offer students when it comes to minutely developing observational skills meant to be used in a manner that is transferable into their specialization field of health care [37]. While Choi et al. have recently elaborated on the feasibility and advantages of introducing VTS activities in the case of undergraduate health assessment courses [38], Lee, Cronin and Gibbon stressed the increased frequency of complex linguistic features with speech- and language-therapy students after applying the VTS procedure [39].

3.3. VTS in Comprehensive Websites

The review of the specialized VTS websites is not necessarily conducted in a critical manner, as the main aim of this section is to underline the high degree of accessibility this concept has within the online environment. These websites, thus, become open resources, sustainable both from the perspective of obtaining reliable scientific information and practical examples of applied VTS procedures.

Philip Yenawine, the initiator of the VTS concept, has also carried out considerable research work in collaboration with Alexa Miller and Dabney Haily, work that has found expression in a two-way direction: on one hand, they published a collaborative article (in 2015) on understanding the concept of visual literacy and the VTS approach with theoretical and practical insights alongside examples and further research suggestions [40]; on the other hand, they offer the audience at large the possibility of reliably becoming informed from constantly updated professional sources by designing and/or collaborating to the several major sites in the field: *Permission to Wonder* (Yenawine's personal website), *Arts Practica. Observation in Practice* (founded by Alexa Miller), *The thinking Eye* and *What's going on in this picture*?

Permission to Wonder, Philip Yenawine's website, is structured so as to offer a thorough perspective on his work as a researcher, largely explaining the concept of VTS, his personal credentials and professional work (closely related to VTS and his teaching experience), as well as comprising study articles on theoretical and practical aspects of VTS; the importance of art language in schools; thoughts on visual literacy; image selection; responding to the individual needs of teenagers; the process of combining visual thinking, images and college learning traits; and the overall and particularized advantages of image-based discussions and of fully grasping the concept of visual literacy from both the facilitators' and students' viewpoint; there is also an *in memoriam* article for Abigail Housen and brief accounts for the Watershed Collaborative and Haily Group projects he is involved in [5].

Arts Practica. Observation in practice was founded by Alexa Miller, a visual artist, facilitator and co-creator of Harvard's Medical School course *Training the Eye: Improving The Art of Physical Diagnosis* and is focused on themes such as life-giving leadership of diagnosis, how to approach uncertainty and activating inclusive learning environments with Visual Thinking Strategies; there are five main sections, namely, VTS, uncertainty, speaking, publications and blog, the latter being constantly updated with informed articles about various subjects, among which the life-changing experience of looking at art, creating

the worlds one needs to survive and the concept of uncertainty are some of the most important [41].

The Thinking Eye was created by Janneke van Leeuwen, visual artist and neuropsychologist, VTS facilitator and trainer, with Philip Yenawine as a consultant; the research area is directed towards the Culture Connection project, whereas the publications regard artistic brain connection networks, social brain interactions, the capacity of zooming out meaning and the elements leading to the construction of open minds; it also offers various connected services according to the public calendar, but, the most significant aspect is that it has an individual section dedicated to VTS exercises, with an interesting palette of images to choose from [42].

What's going on in this picture?—This site, named quite suggestively, is designed according to various layers, catering to different learning and scientific/research needs and comprising information about the 17-member team behind the site, their vision, mission and values; featured collaborators; the services, certification and subscription they offer; a calendar of future events; and, most importantly, constantly updated research and theory (aesthetic development, methods, research reports and publications), as well as access to their VTS Journal [43]. Moreover, there is also an important collection of Abigail Housen's editorial and research work related to the importance of art in schools, visual imagination memory, the connection between art viewing and aesthetic development, as well as creative and critical-thinking development, other related theoretical and practical aspects and methods to apply in order to understand museum audiences [44].

An interconnected site of VTS and ELL is *English Language Learners and Visual Thinking Strategies*, which presents the importance of speaking skills and visual literacy, as well as amassing vocabulary, highlighting the usage of higher-order thinking involving complex grammar and syntactic structures, deepening meaning access, as well as analysis, reasoning and questioning skills, while also offering problem-solving models [45].

4. Discussion

The range of study domains (all educational in their form and contents) in which the VTS procedure has been successfully applied is very wide and it is not the aim of the present review to render these in their entirety, but to underline the main aspects and fields predominantly tackled by the body of the research work within the frame of higher education and to identify future higher-education areas. From this standpoint, the higher-education area of medicine seems to contain the bulk of research articles. Moreover, it can be noticed that the applied research work of VTS within different specialization areas, although extensive and comprehensive, has been focused solely on the specifics of the respectively targeted areas, the VTS protocol has been conducted in the native language of the students, and, even when English language was the focus of VTS activities, it is GE (general English) or ESL/EFL forms that were dealt with.

In addition, in a virtual meeting held in 2021 in the larger framework of the ASEE (American Society for Engineering Education) Annual Conference, a very interesting paper was presented exposing the way VTS have been used for encouraging students studying in the field of engineering to engage in reflection activities, also noting the results from the graduate-students' standpoint [46]. Campbell et al. show the elements that the students themselves consciously retained and accounted for in a written manner regarding gained knowledge and skill development through VTS in the coordinated, semester-long course of Developing Reflective Engineers through Artful Methods; listening and paraphrasing, observation, creativity and critical thinking, as well as awareness towards the others' points of view were listed among the most relevant aspects [46].

However, it has been revealed that research work regarding the advantages of using VTS activities within ESP (English for specific purposes) higher-education classes is close to non-existent, although ESP students would extensively benefit from them, mostly due to the specificity of these ESP courses. As such, one of the ESP challenges in these domains is related to effectively teaching technical and semi-technical vocabulary [6,47,48], as students

not only need to have a high level of general English, but, most importantly, they need to acquire new vocabulary related to their field of specialization, and to identify specific contexts, as well as lexical differences between GE and ESP usage. Their acquisition skills are, thus, extensively involved in this educational process and inserting the VTS procedure into ESP courses will greatly increase vocabulary-retention rate, as VTS functions on association principles, allowing thinking time and a better internalization of words and phrases (aspects that have also been clearly evidenced by previous studies, even if not related to ESP classes). Moreover, by flexibly using technical vocabulary, students' chances of suitably integrating into their specific professional community will be higher. Another aspect the guided insertion of the particularized VTS protocol can offer during ESP classes refers to ensuring long-term results by increasing FLE (foreign language engagement) and reducing FLA (foreign language anxiety) [49], these being significant issues to take into consideration when tackling ESP, mostly by offering a sustainable basis for further specific English-language and skill acquisition.

Moreover, one valid observation refers to the fact that VTS can be employed in various contexts, offering efficient support in individual and group skill development with further effects or repercussions at the level of professional communities and even in society at large. As such, in her 2022 research, Cooper underlines the importance of using visual thinking for developing design students' visual argumentation skills and for enhancing their creativity related to applying design timescapes [50]. Lynch, in her 2022 article on the importance of visual thinking strategies in the field of social-work education, emphasizes the fact that the application of the VTS concept in this particular educational field will lead to enhanced job opportunities, as the skills positively impacted by VTS are observation, communication, and decision making, all of which are extremely useful in any type of future professional practice [51]. Another perspective on a similar train of thought is offered by Rawlinson et al., who underline the influence of visual materials on raising awareness related to different social issues [52]. Savenkova, on the other hand, conducted a more elaborate study on establishing the pedagogical basis for using VTS and developing visual literacy when determining an individual's best strategies for coping with information sources and processing them in a creative manner; the highlight of her article resides in the pedagogical determinants and condition of inserting the VTS model into educational training proper [53]. Ryznar, Kelly-Hedrick, Yenawine and Chisolm discuss, at large, the complex ramifications of VTS within the domain of psychiatric training and practice, highlighting the fact that abilities regarding comprehensive examination and particularized diagnosis greatly benefit from the transferable skills provided by the introduction of VTS [54].

As an example of methodologically applying VTS within the ESP course frame (higher-education level), one could easily refer to using garden design images to ensure technical vocabulary assimilation (English for specific purposes), as well as developing speaking skills (English as a foreign language), not only at a productive level, but also at an interactive one. A VTS–ESP educational sequence would involve providing ESP students specializing in Landscaping with a word bank of technical vocabulary related to plants used for designing a border garden, so as not to infringe upon the cognitive processes implied by the subsequently added VTS procedure; students are then given a limited amount of time to take a look at the selected image and notice whatever elements draw their attention. The VTS specific question will then be asked by the ESP facilitator, "What's going on in this picture?", and because it is a VTS meant to also increase the technical-vocabulary retention rate through associative, active usage, the viewing time will be followed by a writing sequence to descriptively render the given image by also including the provided word bank. It should be noted that this is an optional stage, according to the students' contextualized language self-assessment—they could choose not to tackle the writing task, but to mentally organize their oral intervention. The ESP facilitator invites the ESP students to express their image-related thoughts using the given technical vocabulary and also including the last question in the VTS procedure, namely, "What more can you see?".

A detailed further research article is needed in order to factually record the input and output of this methodological VTS–ESP application at the level of higher education with students specializing in Landscaping.

5. Conclusions

The current review has focused on the concept of VTS (Visual Thinking Strategies): theory, contextualized cases, further research and corresponding model of methodological application.

From a theoretical point of view, visual thinking strategies have been proven to have significant advantages related to enhancing communicative skills and meta-cognitive awareness, with the latter adding to the knowledge-acquisition process and contents. The VTS protocol elaborated by Yenawine, though simple to put into practice, is supported by complex cognitive mechanisms, triggered by, but also triggering, language, interpersonal rapport, contextualized communication and association of ideas. As all these thinking systems need external expression through the language medium, there has been a wide range of applied cases of VTS pertaining to different education-related levels and domains, with researchers delving into fields such as medicine, ESL/EFL, writing workshops, engineering, arts (education in art, design, etc.), and information literacy. The functioning principle is that of transferable skills from the VTS procedure into the respective specializations, with important results regarding increased viewing time (thus, better informational input processing); qualitative improvement in grammar, lexical and syntactic structures when sharing ideas; and enhancement of assessment skills. Moreover, there is also a review of VTS websites meant to underline the fact that one can efficiently become reliably informed about visual thinking strategies.

The research articles taken into consideration by the present review focused mostly on higher education. This has also been identified a further research field, namely, the application of VTS at the level of higher-education ESP courses and a methodological model of application is provided based on the VTS–ESP particularities of students specializing in Landscaping.

However, it is recommended that closer attention should be given to similar methodological insertions in the case of many other ESP higher-education specializations such as Horticulture, Land Survey, Geography of Tourism and Veterinary Medicine, as these include extensive technical-vocabulary acquisition and they also heavily rely on visual educational input.

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