

Visual Thinking Strategies for Speech and Language Therapy Students.

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Abstract.

Visual Thinking Strategies (VTS) is an art-based education programme that originally aims to teach visual literacy, thinking, and communication skills through facilitated discussions of visual art. It has been introduced to healthcare programmes in higher education, such as medicine and nursing, but little has been reported for speech and language therapy (SLT) education. This study examined the effect of VTS as assessed by the quality of observations and linguistic structures used in written descriptions of an art image by SLT students. The pre- and post-VTS written samples of 82 final year SLT students collected over five different years were analysed. The written samples were generated by asking the students to view an art image and write down their observations in accordance with three prompting questions. Parameters related to observation skills and linguistic structures of written text were identified, coded, and counted. The results showed that there was a significant increase in the number of words used to discuss the image post-VTS, with a decrease in detailed observations but an increase in supported inferences noted. For the linguistic structures, there was a significant increase in the use of subordinate clauses and cohesive devices, indicating an increase in sentence complexity and cohesion of the narratives. The results suggest that VTS may stimulate more frequent use of linguistic features associated with critical thinking, reasoning and general observation skills in students.

Keywords: Art-based curriculum, Linguistic analysis, Observation skills, Speech and language therapy, Visual Thinking Strategies.

1. Introduction.

There is an increasing application of arts-based learning in the curriculum of healthcare courses in higher education (Osman et al., 2018; Reilly et al., 2005). Arts-based learning involves the “*purposeful use of artistic skills, processes, and experiences as educational tools to foster learning in non-artistic disciplines and domain*” (Boston University n.d.). It has been used to complement the academic curriculum to enhance the development of different skills,

such as observation, communication, critical thinking, empathy, and teamwork, in a safe and non-judgmental environment (e.g. Acai et al., 2017; Karkabi et al., 2014; Mukunda et al., 2019; Potash et al., 2014). These skills, together with professional expertise and competence, are essential for healthcare professionals (e.g. doctors, nurses, speech and language therapists) to carry out their role in assessment and treatment in a holistic, patient-centred manner.

One arts-based programme that is being used increasingly in the education of healthcare professions is Visual Thinking Strategies (VTS), particularly with medical and nursing students. Previous research studies have used surveys and individual interviews or group discussions to explore the students' views regarding the benefits of VTS and self-reported changes in skills, such as communication. In this study, we applied analysis of language structures, which is a novel approach in the VTS literature, as well as an analysis of the quality of observations that have been used before to investigate the changes in linguistic structures and observation skills in speech and language therapy (SLT) students before and after a course of VTS. A brief history of VTS and what it entails, a review of literature regarding the application of VTS in healthcare programmes and the benefits of VTS reported are presented in section 2 below; and the methodology, results, and discussion of the present study are detailed in sections 3 to 5.

2. Literature review.

2.1 What is VTS?

VTS was co-developed in the late 80s by Philip Yenawine, former Director of Education at the Museum of Modern Art (MOMA), and Abigail Housen, a cognitive psychologist who specialised in aesthetic development (Landorf, 2013; Reilly et al., 2005; Yenawine, 2013). According to Housen (2002), the curriculum was based on her "*theory and research about aesthetic development and was designed to match images and questions to the aesthetic developmental needs and naturally occurring capacities of beginner viewers*" (p. 100). The original aim of VTS was to use discussion of art to enhance the development of visual literacy, thinking, and communication skills – both listening and expression – in children (Yenawine, 2013; Yenawine & Miller, 2014).

In a typical VTS session, the facilitator first asks the students to take a quiet moment to look at an art image. Once the students have had time (about a minute) to observe the image, the

facilitator asks the first of three prompting questions: “*What’s going on in this picture?*”. As the student talks, the facilitator acknowledges that by pointing to the areas on the image being described, followed by paraphrasing succinctly and neutrally the student’s comments. If needed, the facilitator seeks clarification from the student to ensure that the paraphrase has captured the comments accurately. Also, if appropriate, the facilitator links the present comment to related previous comment(s) to illustrate the similarities or diversities in the observations or interpretations made by the group. The facilitator’s paraphrases are essential as they can offer an organisation or a frame of the students’ thoughts, give the students a feeling of being understood, and introduce richer vocabulary and sentence structures for narrative (Yenawine, 2013). Depending on the content of the first response, the facilitator may follow up and ask the second question: “*What do you see that makes you say that/...?*”. This question prompts the student to provide reason(s) or evidence(s) to justify what they have said (Yenawine, 2013). Then the facilitator asks the third question: “*What more can we find?*”, to encourage the students to look for more within the image, explore alternate meanings and interpretations of the image, and to invite others to take part in the discussion (Hailey 2014; Moorman & Hensel, 2016; Yenawine & Miller, 2014). All participants listen to and consider the view of the others – they may agree, disagree or build on each other’s comments (Yenawine & Miller, 2014). The discussion of a single image usually takes about 15-20 minutes (Moorman & Hensel, 2016). At the end of the entire session, the facilitator concludes by thanking the contribution of the students (Yenawine, 2013; Yenawine & Miller, 2014).

2.2 Use of VTS in healthcare courses.

VTS was initially used by many schools across the US (kindergarten to 12th grade) in mainly classroom settings and/or art galleries and museums (Reilly et al., 2005). It was then used in higher education settings, for example, by about 20 medical schools in the US and Ireland (Keogh et al., 2020; Rice, 2016). Some of the arts-based programmes that utilise VTS have been reported in the literature and the participants have mostly been medical or nursing students, with one study including dental students (Allison et al., 2017; Bentwich & Gilbey, 2017; Bramstedt, 2016; Hensel & Moorman, 2017; Huang et al., 2016; Jasani & Saks, 2013; Karwowski et al., 2014; Katz & Khoshbin, 2014; Kidd et al., 2016; Klugman & Beckmann-Mendez, 2015; Klugman et al., 2011; Moorman, 2015; Moorman et al., 2017; Naghshineh et al., 2008; Nanavaty, 2018; Visscher et al., 2019). One recent study described a VTS curriculum across different healthcare disciplines in the College of Medicine and Health

(CoMH) of an Irish University and reported in detail the initiative for SLT students (Keogh et al., 2020). The amount of time or number of VTS sessions varies between these initiatives, from as brief as a one-off session of about 20 minutes (e.g. Allison et al., 2017) to eight weekly 75-minute sessions (e.g. Naghshineh et al., 2008). For the types of artwork used, most of them were paintings, followed by photographs, with some also using sculptures (Nanavaty, 2018) and film and poems (Bramstedt, 2016). The paintings used included classic fine art paintings (e.g. Keogh et al. 2020; Moorman et al., 2017; Jasani & Saks, 2013) or classic or modern paintings that depict physicians' activities or duties (e.g. Reilly et al., 2005; Visscher et al., 2019).

While some of the arts-based programmes reviewed above used VTS as the only activity (e.g. Bentwich & Gilbey, 2017), a number of them included other events alongside VTS. For example, the Medical Humanities Curriculum at Bond University Medical School includes VTS, a mixed media assignment on any topic pertinent to healthcare and a final art exhibition to showcase these assignments (Bramstedt, 2016). Whereas the course – Training the Eye: Improving the Art of Physical Diagnosis – at Harvard Medical and Dental School consists of eight weekly sessions, each includes a 75-minute observation exercise employing VTS, followed by a 60-minute lecture to link the visual arts concepts with physical diagnosis. In general, the programmes reported in the literature followed the principles and procedures of VTS described by the developers (see e.g. Yenawine, 2013; Yenawine & Miller, 2014), although some included additional prompting questions in order to help achieve the specific objectives of their own courses (e.g. Allison et al., 2017; Jasani & Saks, 2013).

2.3 Impact of VTS.

Overall, previous studies have reported that students from different healthcare disciplines gave positive feedback for VTS sessions or their entire arts-based programmes and found the experience enjoyable or comfortable (Hensel & Moorman, 2017; Kidd et al., 2016; Visscher et al., 2019). They generally saw VTS as a useful tool for enhancing the development of their observation skills, reflective thinking, inter-personal skills; and through the exercise they gained insights about teamwork, realised the possible multiple interpretations and its importance, and the significance of avoiding jumping to conclusions (Bentwich & Gilbey, 2017; Bramstedt, 2016; Hensel & Moorman, 2017; Jasani & Saks, 2013; Keogh et al., 2020; Kidd et al., 2016; Klugman & Beckmann-Mendez, 2015; Moorman, 2015; Moorman et al., 2017; Nanavaty, 2018; Visscher et al., 2019). Some of the participants commented about feeling

safe in the learning environment offered by VTS, specifically through the facilitators' neutral and non-judgmental attitude and paraphrases; the use of active listening, which made them feel they were being listened to; the questions that prompted more observations encouraged openness to different ideas; and the venue being an art museum instead of a classroom or hospital also added to the feeling of safeness in learning (Moorman, 2015).

Although VTS was well received in general, it is not surprising to see some less-positive comments from some participants. For example, the final year medical students in Karwowski et al.'s (2014) study indicated that they struggled to link VTS with the objective of teamwork skills that they were learning at the time. Some of the final year SLT students in Keogh et al.'s (2020) study commented that they would have benefitted more if they had experienced VTS earlier in their 4-year SLT training and that some students felt that five VTS sessions were too many. But Naghshineh et al. (2008) found that the number of accurate observations made about images was significantly greater for those who attended eight VTS sessions or the entire programme compared to those who had seven or fewer sessions. In spite of this less favourable feedback, many participants would recommend VTS or their arts-based programmes that included VTS to other medical students and schools (Huang et al., 2016; Kidd et al., 2016; Visscher et al., 2019).

The impact of VTS on skills development for practitioners or students of healthcare programmes has also been evaluated using a quantitative approach. Klugman and colleagues (Klugman & Beckmann-Mendez, 2015; Klugman et al., 2011) examined whether there was a change in the participants' level of tolerance for ambiguity and attitudes towards communication skills learning as a result of undertaking a course of VTS sessions using a version of Budner's Tolerance of Ambiguity Scale (Budner, 1962; Geller et al., 1993) and the Communication Skills Attitude Scale (Rees et al., 2002) respectively. They found a significant change in the scores for both scales in a group of 14 undergraduate and graduate nursing students and 18 Year 1-3 medical students who underwent three 90-minute VTS sessions at an art museum in their first study (Klugman et al., 2011), indicating an increased tolerance for ambiguity as well as a more positive attitude and increased interest in learning about communication. However, there was no significant difference in the scores pre- and post-VTS for the group of seven nursing and 12 medical students in the second study (Klugman & Beckmann-Mendez, 2015).

The effect of VTS on participants' observation skills post-VTS has also been evaluated

through analysing their free text descriptions of images (fine art paintings and/or patient photographs) as elicited by the three VTS prompting questions. One frequently used quantitative measure has been the number of (accurate) observations (Huang et al., 2016; Jasani & Saks, 2013; Klugman & Beckmann-Mendez, 2015; Klugman et al., 2011; Naghshineh et al., 2008). Four of these five studies (i.e. except Jasani & Saks, 2013) found a significant increase in the number of observations post-VTS. Naghshineh et al. (2008) reported no significant change in the frequency of accurate observations for the control group, whereas the VTS participants showed a significant increase in the number of observations when compared to their pre-VTS scores and to the control group post-VTS. When the data was analysed separately for the male and female participants, some differences in their performance were observed (Huang et al., 2016; Klugman & Beckmann-Mendez, 2015; Klugman et al., 2011). Huang et al. (2016) reported that the male house officers showed a significant increase in the scores for medical images only, whereas the female house officers showed a significant increase in scores for the art images only. In the studies by Klugman and colleagues, the female participants had significantly higher scores than the male participants in the number of words used and the number of observations made for both art and patient images post-VTS (Klugman & Beckmann-Mendez, 2015; Klugman et al., 2011). The female participants also spent a longer time looking at the images compared to the male participants (Klugman et al., 2011). As for the possible reasons for the differences in some of the outcomes between the two groups, the authors did not offer any suggestions.

Aside from using a quantitative analysis approach, the quality of the free text descriptions was also evaluated in three of the studies reviewed above. Naghshineh et al. (2008) found that, compared to the control group, their VTS participants showed: more use of evidence to support their interpretations; an increase in speculative thinking to suggest multiple interpretations; greater awareness of absence of observations, and an enhanced application of fine arts concepts when describing the physical findings in the clinical images. An increase in speculative thinking was also reported in Jasani & Saks (2013). They also found a reduced use of subjective terminology, increased use of visual analogies and a broader scope of interpretations of the clinical images post-VTS. However, Klugman & Beckmann-Mendez (2015) found their participants discussed medical observations more and emotion and personal narratives less for the patient images after VTS; probably due to a combination of reasons including the emphasis of justifying one's observations in VTS.

2.4 Application of language analysis to evaluate impact of VTS.

As shown in the literature review above, analysing the free text descriptions seems to be a promising way to access the changes in thinking and communication skills that occur during learning using VTS; however, the analysis methods used so far have not included an analysis of the language structures used by participants in their written responses. A language analysis has the potential to add to our knowledge about learning using VTS because higher level language skills and the use of more complex sentences is required in order to give a comprehensive and coherent account of a visual image. It has been shown that complex sentences that are rich in information usually involve the use of a range of different clauses when expressing different ideas in a clear manner (e.g. Nippold et al., 2005). To link similar points or discuss contrasting ideas, different types of cohesive ties (e.g. and, but) are needed to convey messages (e.g. Halliday & Hasan, 1976; Youse et al., 2001). Furthermore, research has provided evidence that some interpersonal attitudes and skills as well as emotional status are associated with the use of specific linguistic features (Cannava et al., 2018; Crawford et al., 2019; Nook et al., 2017). For example, the use of subordinating conjunctions (e.g. so, because) might act to enhance collaboration by indicating agreement with another person's point of view (Crawford et al., 2019).

2.5 Aim of the study.

In addition to the analysis of the quality of observations, the present study applied linguistic analysis, an evaluation method that has not been used in the VTS literature, to analyse and compare the pre- and post-VTS written samples by SLT students, which is a group less researched in the VTS literature. The linguistic analysis includes sentence complexity analysis (Nippold, 2014; Nippold et al., 2005) and cohesive analysis (Youse et al., 2001). Based on the published findings regarding the benefits of VTS and our previous informal observations of the students' performance over the course of VTS, we hypothesised that the students would show more application of observation skills and critical thinking, as reflected by an increase in the value of the parameters analysed in this study, when they discussed a visual image post-VTS.

3. Methodology.

The research was conducted following the World Medical Association Declaration of Helsinki regarding research ethics. The data analysed in this study came from a bigger project carried

out by the VTS facilitators who were also academic or clinical teaching staff members in the CoMH, University College Cork (UCC), Ireland. The project was approved by the Social Research Ethics Committee of UCC prior to data collection and written consent was obtained from each participant before participation. For this study, the Social Research Ethics Committee of the School of Clinical Therapies, CoMH, UCC approved the access of data by the second author.

3.1 Participants.

The participants were final year (Year 4) SLT students on the undergraduate programme, BSc (Hons) Speech and Language Therapy, in UCC, over five different years. All spoke English as their first language. For the purpose of this study, only students who completed both pre- and post-VTS written samples were included. Thus, a total of 82 paired pre- and post-VTS written samples (i.e. 69.5%) were analysed with the breakdown between the five years shown in Table 1. Inclusion of a control group or delayed intervention was not possible, as VTS is part of a mandatory module in the final semester of the study (see Keogh et al., 2020). An attendance record was kept for the module, but it is no longer available after the end of the academic year.

Table 1: Number and percentage of students included in this study.

Academic year	Total number of students	Number of students included in this study	Percentage of students included in this study
2012-2013	22	21	95.5%
2013-2014	27	17	63.0%
2014-2015	22	19	86.4%
2015-2016	27	15	55.6%
2016-2017	20	10	50.0%

3.2 Data Set.

The pre- and post-VTS written samples were elicited using the painting, 'The ascension of Simon Bolivar on Mount Jamaica', by Everal Brown (1983), shown on a projector screen. Each participant was told to write down their responses for the image accordingly to the three VTS questions: "What's going on in this picture?", "What do you see that makes you say that?" and "What more can you find?" The pre-VTS written samples were gathered at the start of the first VTS session and the post-VTS data at the end of the last session. To match the pre- and

post-VTS data, the participants were asked to write down the last four digits of their mobile phone number on their response sheets. No other identifying information was collected.

The class then undertook a course of VTS sessions, which were delivered following the general format described in section 1.1. There were some small year-to-year variations in the delivery due to the availability of resources, manpower and the timetable of the students and VTS facilitators. The first two cohorts (2012-2013 and 2013-2014) were facilitated by one staff member (the third author). For the remaining cohorts, the class was divided into two smaller groups of similar number of students and parallel VTS sessions were ran by two staff members (the first and the third author). The two staff members were speech and language therapists by background and had attended two 2-3 day training workshops on VTS facilitation given by certified trainers and members of the VTS team based in the USA (see Keogh et al., 2020). A total of 12 images – paintings (e.g. ‘July 7’ by Frederick Jones, 1958) and photographs (e.g. ‘In-laws’ by Jessica Todd Harper) – were used. The images were selected by the first cohort of VTS facilitators of the CoMH during their VTS training workshop (for image selection, see Yenawine, 2003). The VTS programme was carried out as 4-5 1-hour sessions, once a week, over a period of 4-6 weeks depending on the students’ or facilitators’ schedule. About 15-20 minutes were spent discussing each image. At the end of each session, a brief discussion (about 5 minutes) on how VTS learning could be applied to SLT clinical practice was included. In the final session, an article on the connections between aesthetic skills and clinical practice by Miller (2012) was read and discussed.

3.3 Data analysis.

Three aspects were analysed for each of the written samples: (1) quality of observations; (2) sentence complexity analysis; and (3) cohesive analysis. The quality of observations was defined and measured by adopting an analysis template provided by the trainers of the US-based VTS team mentioned above. The parameters analysed included the total number of words and the number of five types of observations: simple observation, detailed observation, unsupported inference, supported inference, and speculation. Simple observation is judged to be at the lowest level amongst the five skills because it usually involves simply listing the items that one can see. Detailed observation is also a description of items shown in the image but some specific details of the items (e.g. the colour or size) are provided as well. Inference is an assumption that the viewer made about an observation, either supported or unsupported by evidence(s) from the image. Speculation is the highest level of observation skills and is

defined as the “*thoughts about a possible meaning or outcome based on evidence*” (Housen, 2002, p. 106), reflecting the application of critical thinking. The six parameters are summarised, defined and illustrated with examples from the data of this study in Appendix A.

The sentence complexity was analysed by following Nippold’s (2014) protocol. Terminable unit (T-unit) and subordinate clauses (relative, adverbial, and nominal) were identified and the total number of each was counted. This result was also used to calculate an index, “*clausal density*”, which is a ratio of the total number of subordinate clauses to the total number of T-units in a written sample. A T-unit contains a main clause with or without subordinate clause(s) or any non-clausal structure(s) attached to it (Nippold, 2014; Nippold et al., 2005). The four types of clauses and the index are explained with examples in Appendix B.

For cohesive analysis, six of the parameters from Youse et al.’s (2001) study, based on the work by Halliday and Hasan (1976), were used. They were personal reference, demonstrative reference, additive conjunction, adversative conjunction, causal conjunction, and temporal conjunction. Reference “*establishes a semantic relation in order for the listener/reader to retrieve from preceding text the information necessary to interpret a written or verbal message*” (Youse et al., 2001, p. 107). Hence, personal reference is the use of personal and possessive pronouns (e.g. she, her) to refer back to a person(s), a thing or any matters owned by a person; and demonstrative reference is the use of demonstrative pronoun (e.g. this, that) to refer back to an idea or object that has been mentioned. Conjunction “*establishes a relation of linguistic information by joining sentences or clauses*” (Youse et al., 2001, p. 107), with additive conjunction for adding similar information; adversative for contrasting information; causal for reasons or purposes; and temporal for information related to time. See Appendix C for the definition of the six cohesive devices with relevant examples.

The analysis schemes described above were first piloted on 10 pre- and post-VTS written samples by the first and second authors to ensure their clarity. The independent analyses made by the two authors were compared. Any disagreement or uncertainties about the definitions of the parameters or analysis procedure were discussed and a consensus was reached before the data analysis. The analysis of the remaining 154 written samples were then completed by the second author who was not involved in VTS facilitation. To evaluate the inter-judge reliability, a researcher with speech and language therapist background, who was not an investigator of this study, was asked to analyse 16 written samples (i.e. 10% of the data) that were randomly selected by the second author. A training on the analysis procedure

was given to this researcher by the second author beforehand.

3.4 Statistical analysis.

Statistical analysis was carried out using IBM SPSS Statistics Version 26. The mean, standard deviation (SD), and range were calculated for each parameter. Paired t-tests were planned for examining the difference in the scores pre- and post-VTS for each parameter. Results of the Tests of Normality showed normal distribution of the scores for three variables: total number of words and number of T-units measured at pre-VTS and total number of words at post-VTS. As the violation of this assumption can be tolerated with a sample size of over 30 (Pallant, 2005), paired t-tests were used as planned. A significance level of $p = 0.05$ was set for the total number of words. Bonferroni correction was applied to the groups of similar parameters to avoid Type I error (Pallant, 2005): $p = 0.01$ for the five parameters on observation skills and the same for the five on sentence complexity; $p = 0.025$ for the two on reference, and $p = 0.0125$ for the four on conjunction in the cohesive device analysis.

4. Results.

The mean, standard deviation (SD), and range of scores for each of the 17 parameters before and after VTS for the 82 SLT students are summarised in Table 2. The result of a paired t-test showed a significant increase in the number of words post-VTS ($t(81) = -4.605, p < 0.05$). For the five types of observation skills, the results of t-tests revealed that there was a significant decrease in the number of detailed observation ($t(81) = 4.199, p < 0.01$) but an increase in supported inference ($t(81) = -5.672, p < 0.01$) after VTS. But the change in the number of simple observations ($t(81) = 2.117, p > 0.01$), unsupported inferences ($t(81) = -2.071, p > 0.01$), and speculation ($t(81) = 0.716, p > 0.01$) before and after VTS was not significant.

For sentence complexity, there was a significant increase post-VTS in the number of T-units ($t(81) = -2.981, p < 0.01$), adverbial ($t(81) = -5.379, p < 0.01$) and nominal ($t(81) = -3.190, p < 0.01$) clauses, and clausal density ($t(81) = -2.861, p < 0.01$); however, there was no significant finding for relative clauses ($t(81) = -1.631, p > 0.01$). For cohesive devices, there was a significant increase in the use of personal ($t(81) = -4.335, p < 0.025$) and demonstrative ($t(81) = -2.962, p < 0.025$) references, and causal conjunctions ($t(81) = -3.972, p < 0.0125$) after VTS. No significant difference was found for additive ($t(81) = -0.977, p > 0.0125$), adversative ($t(81) = -2.480, p > 0.0125$), and temporal ($t(81) = 0.000, p > 0.0125$) conjunctions.

Table 2: Mean, standard deviation (SD) and range of scores for the parameters of observation skills, sentence complexity, and cohesion for the 82 SLT students pre- and post-VTS, with asterisk(s) indicating a significant difference.

Parameter	Pre-VTS			Post-VTS		
	Mean	SD	Range	Mean	SD	Range
Observation skill analysis						
Total number of words*	97.6	39.8	11-214	114.9	39.4	18-216
Simple observation	0.5	1.8	0-10	0.1	0.3	0-2
Detailed observation**	3.0	2.6	0-11	1.6	1.7	0-7
Unsupported inference	1.7	1.6	0-10	2.4	2.8	0-23
Supported inference**	1.3	1.4	0-6	2.5	1.7	0-8
Speculation	0.6	0.9	0-3	0.5	0.8	0-4
Sentence complexity analysis						
T-unit**	6.3	3.8	0-17	7.4	3.4	0-15
Relative clause	0.7	1.0	0-5	1.0	1.2	0-5
Adverbial clause**	0.8	1.0	0-4	1.8	1.9	0-9
Nominal clause**	0.2	0.5	0-2	0.6	1.1	0-5
Clausal density**	1.2	0.5	0-2	1.4	0.4	0-2
Cohesive analysis						
Personal reference***	3.2	3.1	0-14	4.8	3.8	0-17
Demonstrative reference***	0.9	1.3	0-5	1.4	1.8	0-8
Additive conjunction	1.7	1.5	0-6	1.9	1.6	0-7
Adversative conjunction	0.2	0.5	0-2	0.5	0.7	0-3
Causal conjunction****	0.3	0.6	0-3	0.8	1.1	0-5
Temporal conjunction	0.1	0.4	0-3	0.1	0.3	0-2

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.025$; **** $p < 0.0125$

5. Discussion.

This study applied a linguistic analysis approach in addition to an analysis of observation skills to investigate whether the use of linguistic structures and observation skills changed following a course of VTS sessions in five cohorts of SLT students. In general, the results showed that the students used more words, more complex sentences and provided more exhaustive observations with justifications post-VTS.

5.1 Quality of observations.

The finding of a significantly higher total number of words used by the SLT students post-VTS is in accord with the results reported by Klugman et al. (2011) and Klugman and Beckmann-Mendez (2015) for their medical and nursing students. The two Klugman studies and the present study used similar types of images (most were paintings); and the total duration of

VTS sessions in our programme was 4-5 hours, which is within the range of total duration of the two Klugman studies: 4.5 hours (three 1.5-hour sessions) in Klugman et al. (2011) and 10 hours (four 2.5-hour sessions) in Klugman and Beckmann-Mendez (2015). Hence, the findings of the three studies together point to the suggestion that after VTS students tended to give a more detailed description of their observations about a visual image as reflected by a significant increase in the number of words used. However, the total number of words is probably a rather general measure, as it does not necessarily mean a clinically meaningful improvement in the overall quality of observations. Hence, other specific types of observation skills were also investigated in this study.

The number of detailed observations significantly dropped by nearly half post-VTS. This is an interesting finding because detailed observations were the most prevalent type of observation skill evident pre-VTS. This change might be explained in part by the significant increase in the number of supported inferences post-VTS. Probably the students started to use more supported inferences than detailed observations when they were asked to write about an image after VTS. There also seemed to be a trend of reduced use of simple observation, but the difference was not significant, possibly due to the low level of use of this skill pre-VTS. As simple observation is mainly listing items seen in a picture, one would expect to see less of this basic skill in university students for the given writing task even before VTS. The general increased use of inferences and reduced use of observations are signs of improvement in observation skills. This probably indicated that, post-VTS, the students spent more time in interpreting or making meaning of what they saw, which is an essential visual literacy skill (Kędra, 2018). As VTS encourages students to justify their observations and interpretations, a significant increase in the number of supported inferences post-VTS possibly meant that the students had adopted the format of thinking facilitated in the VTS sessions and were ready to use it with minimal prompting in the post-VTS writing task.

The present study, however, did not find an increase in the use of speculation which contradicts the findings reported in Jasani and Saks' (2013) study. A major difference in the VTS sessions implemented in these two studies was that, in Jasani and Saks' (2013), it was carried out in the form of a large group discussion using eight fine art images in a one-off 3-hour session. Whereas both large group and smaller group discussions were used in our programme and the 4-5 1-hour VTS sessions were delivered over a period of 4-5 weeks. Another main difference between the two studies was that the facilitator in Jasani and Saks' (2013) study used a number of questions to stimulate interpretation and reflection, in addition

to the three VTS prompting questions, whereas our programme followed closely the original VTS facilitation protocol. It is unclear whether an intensive approach and additional prompting questions might have caused a difference in the finding regarding the use of speculation, as a direct comparison between the two studies is not possible. However, for a VTS curriculum to be delivered on a weekly or biweekly basis, it is likely that more sessions are needed in order to see a sizable improvement in observation skills. This notion concurs with the finding reported in Naghshineh et al. (2008) where they found a significantly higher number of accurate observations in students who attended eight VTS sessions or the entire programme compared to those who attended seven sessions or less. This is also in general agreement with findings from VTS research with children and that is why 10 hours of VTS a year is designated in the VTS curriculum for school children (Yenawine & Miller, 2014).

5.2 Sentence complexity.

In terms of sentence complexity of the written samples, the students in this study used significantly more T-units, adverbial clauses, and nominal clauses in their post-VTS writing, which also resulted in significantly higher scores for clausal density. The increase in T-units indicated that the students used more complete and complex sentences in the written work following the VTS programme. This was also noted on informal inspection of the written data as about seven participants, who merely listed the items observed in the image pre-VTS, used full sentences in their written samples post-VTS. This result echoed the general findings reported for school children that they were more likely to write in complete sentences as a result of VTS (see review by Landorf, 2013). As said, the number of adverbial clauses used in the post-VTS writing was significantly higher and this type of subordinate clause was the most frequently used in the writing task by the students. The adverbial clauses are for expressing information related to time, manner, cause, and purpose in a sentence (Nippold, 2014). Hence, it is not surprising that more adverbial clauses were used to provide supporting evidence from the image to justify their observations which is one of the skills encouraged in VTS. Similarly, the use of nominal clauses significantly rose following VTS despite this type of clauses being used the least pre-VTS. As nominal clauses are for expressing thoughts, attitudes, and beliefs (Nippold, 2014), the increased use of these clauses suggested that the participants expressed more of their opinions and interpretations, reflecting a possible increase in applying creative thinking in the art discussion.

5.3 Cohesive devices.

This study found that the students increased their use of personal and demonstrative references, with causal conjunction being the only conjunction used significantly more post-VTS. To use references, the speakers must first mention the subject or object before it can be referred to using the relevant pronoun. The significant increase in the number of personal and demonstrative references post-VTS suggested that the students expanded on the discussion of a subject matter and used more sentences to describe the topic, hence, references were used to link up the sentences. For causal conjunctions, since they are used for explaining reasons or purposes (Youse et al., 2001), an increased use of this type of conjunctions was expected especially when the students had to address the second prompting question, '*What do you see that makes you say that/...?*'. The significant increase in the use of causal conjunctions could be the result of applying critical thinking and reasoning skills in the written description of the art images.

5.4 Suggestions for further research.

The communication skills and observation skills appear to be intrinsically linked. That is, in order to express more complex ideas generated by more advanced observations skills, it is necessary to use more complex sentence structures with different types of subordinate clauses and longer narratives linked together using cohesive devices. Further studies including participants with a wider range of language skills and observation skills would be useful to investigate how the growth of one skill supports the development of the other. Aside from the undergraduate healthcare programmes in the CoMH in UCC, VTS is currently available to some primary schools in Dublin through an initiative called "*Project 20/20*" (Visual Artists Ireland, 2017). If the effect of VTS on the school children is to be evaluated, the analysis schemes used in the present study could be applied to document the change in observation and communication skills in the children. There is also the potential of researching the value of VTS for individuals with communication disorders, such as children with language delay or disorders associated with different conditions or of unknown causes, and adults with acquired communication difficulties (e.g. aphasia, dementia).

This study used only one art image to obtain the pre- and post-VTS written samples. It would have been useful to include additional clinical images or patient photographs (e.g. Huang et al., 2016; Klugman & Beckmann-Mendez, 2015; Klugman et al., 2011; Naghshineh et al.,

2008) to evaluate whether the practice in observation skills and communication skills during VTS using fine art image and artistic photographs can be generalised to clinical and patient images. As an example, clinical images of an oral cavity with subtle atypical features or a static fluoroscopic image of a swallowing assessment would be relevant to SLT practice.

So far, none of the previous VTS studies on health care professionals or students has included a follow-up evaluation to measure the maintenance of the skills acquired through VTS; hence, the long-term effect of VTS is unknown. Future studies should endeavor to explore if the skills that the VTS curriculum stimulates are still evident or being used at a year's follow-up, for example. Finally, for practical reasons a control group was not possible in this study. The inclusion of a control group was only used in one previous study – the one by Naghshineh et al. (2008). This research design would allow us to draw stronger conclusions regarding the benefits of VTS.

5.5 Conclusion.

To conclude, the present study expanded on previous research that had found that VTS promotes critical thinking and observation skills by applying an analysis of quality of observations and linguistic analysis, which is novel in the VTS literature, to assess the observation and communication skills in SLT students. This study showed that the positive changes that have been reported in the literature for students of other healthcare programmes (mainly medicine and nursing) were also evident in SLT students. The improvement in observation and reasoning skills are important as speech and language therapists implement these skills when interpreting and analysing assessment results or when devising treatment and management plans for patients or clients. The communication skills are also crucial for communicating the relevant information to colleagues in a multidisciplinary team, for example, and to the clients.

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