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## Research article

# Integration of visual thinking strategies to undergraduate health assessment course: A mixed-method feasibility study

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## ABSTRACT

**Background:** The COVID-19 pandemic has accelerated demands for a shift from traditional face-to-face learning to online learning. Visual Thinking Strategies (VTS) is an inquiry-based teaching method using various visual artworks to improve critical thinking and interpersonal skills. VTS has been studied in health professional education mostly in art gallery settings. Implementing VTS during online learning in nursing education has not yet been investigated.

**Objectives:** This study evaluated the feasibility of incorporating VTS into an undergraduate nursing health assessment course and explored students' perceptions and experiences of VTS.

**Design:** A single-group, posttest-only, concurrent mixed-methods design was used.

**Setting:** This study was conducted in an urban nursing college in Seoul, Korea.

**Participants:** A convenience sample of 60 second-year undergraduate nursing students enrolled in a health assessment course.

**Methods:** We integrated VTS into three skills lab sessions (assessment of older adults, skin assessment, and musculoskeletal system assessment) via on-site sessions or real-time online videoconferencing sessions. Through an online survey, we obtained sociodemographic information, previous VTS experience, measures of teaching orientation, perception of arts-based learning, and VTS evaluation. Additionally, participants were asked to comment on their VTS experiences through free-response questions.

**Results:** Participants rated VTS as an interesting and easy-to-concentrate learning method compared with traditional classes during a COVID-19 pandemic. In participants' narratives, being able to learn diverse perspectives, expanding the scope of thoughts and observations, and sustainable learning were the most commonly positive experiences. A lack of familiarity and the open-ended nature of observations were reported as the most common challenges.

**Conclusion:** Applying VTS in undergraduate nursing education may help students develop critical thinking, communication, and collaboration skills. As an alternative to traditional teaching, implementing VTS via online may have potential to motivate students' engagement to active learning. Future randomized controlled trials are warranted to build evidence on the benefits of VTS.

## 1. Introduction

Arts-based learning is an approach that applies direct experience and

observation from various fields of art, such as visual art, music, and theater, to promote learning experiences in other academic areas, including health professional education (Haidet et al., 2016). Visual

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Thinking Strategies (VTS) is an arts-based learning method designed by Abigail Housen and Phillip Yenawine, which fosters student-centered learning by encouraging thoughtful observations and inclusive discussions (Visual Thinking Strategies, 2021). Using VTS teaches students how to observe, feel, and discuss various visual artworks (e.g., paintings, photographs, sculptures) outside the scope of photos or figures in traditional textbooks (Visual Thinking Strategies, 2021). Initially introduced as a teaching tool for primary education (Nanavaty, 2018), VTS has been widely implemented in educating health care professionals, including nursing, medicine, pharmacy, and interprofessional education (Klugman et al., 2011; Monahan et al., 2019; Moorman, 2015; Moorman et al., 2017; Poirier et al., 2020; Rana et al., 2020). Studies have reported that implementing VTS in health sciences education can help students strengthen their capacity for (1) observing and analyzing the patient during clinical rotation, (2) communicating with teams, (3) empathy, and (4) accepting diversity and ambiguity (Chisolm et al., 2020). These capacities are essential for nursing students because assessing using human senses and empathetically communicating the assessed data are among the core competencies expected of nurses (Monahan et al., 2019; Moorman et al., 2017).

## 2. Background

In undergraduate nursing education, the primary purpose of the health assessment course is for students to acquire the knowledge and skills of physical examination techniques to develop their ability to assess the health status of the client and communicate the results of the assessment to healthcare providers (Fennessey and Wittmann-Price, 2011). To achieve and sustain the learning outcomes of this course, along with the acquisition of theoretical knowledge, students need to develop the ability to explore, analyze, and communicate the state of the client by optimizing the use of senses such as vision, touch, and hearing. Specifically, the ability to observe through inspection is the first step of health assessment, and is crucial for deriving meaningful clinical data from the beginning of the nurse's face-to-face encounter with the client. Teaching assessment skills includes providing a theoretical background and clinical exemplars during lectures and lab practice with students (Hornvedt et al., 2018). In addition, activities to learn inspection skills using visual artworks may help students acquire diverse and in-depth psychomotor and critical thinking skills to better achieve the goals of health assessment (Poirier et al., 2020).

VTS has been applied to health assessment lectures and lab practice for medical students and advanced practice nurses in art gallery settings (Rana et al., 2020). Although VTS' value in education for medical students and healthcare professionals is recognized, particularly in the United States and Australia, there is limited knowledge on the acceptability of VTS in nursing education globally, especially in East Asian countries. Since the COVID-19 pandemic emerged at the end of 2019, education systems worldwide have faced a huge challenge (Scott et al., 2021). In response to the COVID-19 pandemic, the Korean government and nursing schools forced a rapid shift from traditional face-to-face learning to distance or online learning (Kim et al., 2021). More recently, various types of online learning have been studied in the COVID-19 context (Kim et al., 2021; Scott et al., 2021). However, implementing VTS during online learning in health professional education has not yet been investigated. Therefore, we conducted a mixed-method study to (1) evaluate the feasibility of incorporating VTS into a health assessment course for second-year undergraduate nursing students in Korea and (2) explore students' perceived learner-centeredness, perception, and experience of VTS.

## 3. Methods

### 3.1. Study design

For this feasibility study, we used a single-group posttest-only

design. We conducted a concurrent mixed-methods study by simultaneously collecting quantitative and qualitative data. Qualitative data were used to enhance our understanding of the quantitative survey's findings (Creswell and Clark, 2017; Leech and Onwuegbuzie, 2009).

### 3.2. Sample and setting

We recruited participants from a cohort of second-year students in a four-year Bachelor of Science in Nursing (BSN) program at a private university in Seoul, South Korea. The inclusion criteria were: undergraduate nursing students who (1) were aged 19 years or older, (2) were enrolled in the health assessment course for the fall term in 2020 (September 1 to December 18), and (3) provided informed consent to participate in the study. Among the 93 students who registered for the health assessment course and experienced VTS during the course, a convenience sample of 60 students consented to participate in this study.

Health assessment is required for second-year BSN students and consists of 2-credit didactic and 1-credit skills lab sessions. During the fall of 2020, due to the COVID-19 outbreak, all didactic content was delivered through pre-recorded online lectures. Each week, students were provided access to an online lecture from a day prior to the skills lab session and lasted for a week. Skills lab sessions were delivered either via on-site sessions or real-time videoconferencing sessions using a commercial platform (WebEx online meeting platform by Cisco). On-site skills lab sessions (approximately 30 students per session) were led by one faculty member and two teaching assistants (TA). Students were paired with each other and practiced the health assessment steps for a specific topic (i.e., inspection, palpation, percussion, and auscultation). One faculty member led real-time videoconferencing sessions (approximately 30 students per session). The course instructors were faculty members with a PhD in nursing and specialized in pulmonary, neuroscience, and critical care nursing. The TAs were registered nurses with 3–5 years of clinical experience in critical care settings and teaching experience in the skills lab.

#### 3.2.1. Intervention: integration of VTS in the health assessment course

While most previous studies involved VTS sessions led by specialized art instructors in art galleries, in this study, VTS was implemented by the current course instructors using online art resources (e.g., Google Art and Culture, <https://artsandculture.google.com/>). Our primary aim was to test the feasibility of incorporating VTS within the existing course structure without requiring additional resources (i.e., time and expenses for taking students to art galleries). Our intention to use VTS was to diversify students' experience in learning and practicing inspection and communication skills, which are the foremost competency to be gained during the undergraduate health assessment course.

Prior to the start of the term, the instructors reviewed the goals and principles of VTS and the skills required to lead VTS activities using an online VTS resource (i.e., Visual Thinking Strategies, 2021). Instructors selected pictures or photos to be used in the class by searching online art resources using search words relevant to the topic of learning (e.g., older people, body movements). Instructors also searched references of the images listed in previous publications on VTS in health science education. After selecting pictures or photos to be used for students, instructors practiced discussions on the selected artworks.

Operating VTS sessions was based on the formats used in published studies (Monahan et al., 2019; Poirier et al., 2020; Visscher et al., 2019). Students were instructed to focus on making close observations, verbalizing their observations and rationales, and actively listening to and holding discussions with their peers. While observing the paintings or photos, students were asked to pose the following questions: "What is going on this picture?" "What do you find?" "What do you see that makes you say that?" and "What more do you think we can find here?" For each picture, approximately 12 to 15 min were allocated for observation and discussion. After observation, students were asked to verbalize what they had observed with rationales. For the sessions

delivered using online videoconferencing, students were allowed to present using a microphone or write on a real-time chat board. Students were also encouraged to expand on the shared observations of others. During the discussion, the instructor mainly functioned as a facilitator: paraphrased each comment and often paused to allow students to reflect; tried to link related comments; and encouraged students to build on ideas from one another. At the end of each observation, the instructor also added what she observed with her rationales. Throughout the session, the instructor was expected to stay neutral and treat each comment in the same way.

We integrated VTS into the skills lab sessions for three topics: assessment of older adults, skin assessment, and assessment of the musculoskeletal system. To provide a general overview of the approach, the instructor spent approximately 5 min in the first session presenting background, goals, and underlying philosophy of VTS. We considered this introduction was a necessary step to facilitate engagement of our students who were mostly new to VTS. Details of the topics by session, references to the images, and VTS activity formats are listed in Table 1. These topics were chosen based on the following rationale: in the first session, as an introductory topic, we chose the assessment of older adults because photos of older adults can easily stimulate students to identify and discuss aging-related physical, cognitive, and emotional changes. Therefore, through this topic, students were gently immersed in the VTS activity. For the second topic, we chose skin assessment because skin is the most visible organ, and thus, inspection is the main skill to practice for it. The task of inspecting abnormal skin conditions is rarely performed in the undergraduate skills lab, but implementing VTS with a diverse set of images can provide rich opportunities to practice skin inspection. Students were asked to describe their observations based on the ABCDE (asymmetric, borders, color variation, diameter, and evolution) assessment tool. For the last topic, we chose musculoskeletal system assessment to promote students to an advanced level, which requires evaluation of the picture by applying their knowledge of anatomy and functions of the musculoskeletal system. Once students observed pictures posing typical VTS questions, we asked students to describe their observation based on anatomy of muscles and bones, the joint range of motions and the directions of muscle strength observed from each picture.

### 3.3. Measures

To measure quantitative data, we obtained sociodemographic information, previous VTS experience, perceived learner-centeredness of VTS, and students' perceptions of arts-based learning and VTS experience. For qualitative data, we obtained written comments on students'

VTS experience using free-response questions.

#### 3.3.1. Teaching orientation questionnaire

This 7-item instrument was designed by Kim et al. (2014) to evaluate the extent of learner-centeredness of teaching and learning methods. Each item consists of a bipolar scale. In this study, students rated whether the design and implementation of VTS activities were more instructor-centered (e.g., the instructor's role was to provide knowledge) or learner-centered (e.g., the instructor's role was to facilitate the activities). We employed a Korean-translated version of this questionnaire, which was used in studies with medical (Lee and Kim, 2018) and nursing students (Choi et al., 2021) in Korea. The scores for each item were averaged; higher scores indicated greater learner-centeredness in VTS activities. The Cronbach's alpha values reported by earlier studies with engineering, humanities, medical, and nursing students ranged from 0.71 to 0.79 (Choi et al., 2021; Kim et al., 2014; Lee and Kim, 2018). Cronbach's alpha for the present study was 0.65.

#### 3.3.2. Students' perception of arts-based learning and VTS experience

**3.3.2.1. Perception of arts-based learning.** This was an investigator-developed 4-item questionnaire based on the VTS literature (Haidet et al., 2016). Students were asked to rate their perspectives on arts-based learning activities. Students rated their general interest in and value of observing and learning from artwork on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

**3.3.2.2. VTS experience survey.** Students were asked to rate their VTS experience using an investigator-developed 11-item questionnaire. For the first 6 items, students evaluated their VTS experience on a 5-point rating scale, ranging from 1 (strange and uncomfortable) to 5 (familiar and comfortable) or from 1 (not interesting) to 5 (interesting). For the next 5 items, students were asked to rate the extent to which the VTS experience helped them develop the competencies emphasized in the VTS literature (Chisolm et al., 2020), including empathy for others, observation without prejudice or bias, analysis of observations, verbalization of observations, and openness to diverse perspectives, using a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

#### 3.3.3. Free-response questions

We included three free-response items for students to comment on their VTS experience: (1) positive experiences with VTS, (2) negative experiences with VTS, and (3) suggestions to improve VTS-based learning activities. In this study, free-response questions were used

**Table 1**  
Topics, image references, activity format used for VTS.

Topic	Image references	Activity format			
		Setting	Number of images	Time allocated (minutes)	Student participation
Introduction to VTS Assessment of older adults	Timlin, Gregor J. Eating, Design & Dementia. 2011. <a href="https://artsandculture.google.com/asset/eating-design-dementia/OAFyH2yUHLvPgA">https://artsandculture.google.com/asset/eating-design-dementia/OAFyH2yUHLvPgA</a> Mydans, Carl. Elderly people eating a meal. 1959. <a href="https://artsandculture.google.com/asset/iQFUnBWbzvRfmA">https://artsandculture.google.com/asset/iQFUnBWbzvRfmA</a>	Online video-conferencing: Instructor-facilitated discussion	2	30	Volunteer to talk on the microphone or write in a real-time chatting message board
Assessment of skin	Yale School of Medicine, Dermatology. Accessed in June 10, 2021 <a href="https://medicine.yale.edu/dermatology/education/obvskills/Patients%20from%2099-00_232588_284_27022_v1.pdf">https://medicine.yale.edu/dermatology/education/obvskills/Patients%20from%2099-00_232588_284_27022_v1.pdf</a>	On-site skills lab: Pair observation and discussion followed by instructor-facilitated discussion	5	60	Pair discussion and volunteer to present to the class
Assessment of musculoskeletal system	Unknown. Wrestlers, 1899 <a href="https://artsandculture.google.com/usergallery/jALyTy91IAEKw">https://artsandculture.google.com/usergallery/jALyTy91IAEKw</a> Portinari, Candido. Caenauba. 1944 <a href="https://artsandculture.google.com/asset/carnauba/NwHhdArGAup3yw">https://artsandculture.google.com/asset/carnauba/NwHhdArGAup3yw</a>	Online video-conferencing: Instructor-facilitated discussion	2	30	Volunteer to talk on the microphone or write in a real-time chatting message board

instead of face-to-face interviews to minimize in-person contact during the COVID-19 pandemic. We also chose free-response questions over other options (e.g., interviews using a videoconferencing platform) to increase inputs from more students by minimizing their time burden.

### 3.4. Data collection

A recruitment flyer with a quick response code to the online survey was posted to an online student bulletin board. A trained research assistant who was not involved in undergraduate teaching was available via telephone to explain the study’s purpose and protocol and answer questions from potential participants. After signing an informed consent form, the students completed the online survey developed using Google forms which took approximately 15 min. No Google account was necessary to access or complete the questionnaires. All survey data were de-identified prior to data analysis. The recruitment and survey period began one week after the last class meeting of the term and lasted for a month.

### 3.5. Ethical considerations

The study protocol was approved by the AA (blinded for review) University Health System Institutional Review Board (No. Y2020-0152). Informed consent was obtained from all participants prior to beginning the online survey. To protect students’ rights in research participation, recruitment and data collection were conducted by a trained research assistant who was not involved in undergraduate teaching.

### 3.6. Data analysis

IBM SPSS 25.0 statistical package (IBM Corporation, Armonk, NY, USA) was used for quantitative data analysis with descriptive statistics. With the qualitative data, we conducted a manifest content analysis using phrases and sentences as units of analysis (Bengtsson, 2016). After two research team members (JC, SC) independently reviewed and coded all the text, coding schemes were shared and discrepancies were resolved. Subsequently, data were categorized according to a matrix (helpful experience, difficulties encountered during VTS activities, and areas of improvement) based on details reported by the students.

We used the following approaches to preserve the trustworthiness of our analysis. To ensure credibility and coherence, two research team members (JC, SC) independently reviewed and coded the data, compared and contrasted coding schemes, and reached a consensus on data analysis. The third researcher (YJS) also reviewed the results of the analysis. Any differences in interpretations were discussed until a consensus was reached. We also maintained an audit trail of analytical decisions to ensure dependability. For transferability, we obtained qualitative data via free-response questions that were open to all students who consented to both quantitative and qualitative data collections. Instead of a traditional approach (i.e., face-to-face interviews, purposeful sampling methods), we used free-response items to minimize recall bias and maximize objectivity and neutrality in students’ responses.

## 4. Results

### 4.1. Participant characteristics

In total, 60 students participated in the survey (mean age: 22 years, range: 20–32 years). A significant majority of the students (98%, n = 59) stated that they had no previous experience of VTS.

### 4.2. Teaching orientation

The total mean score of the teaching orientation survey was 3.68 (SD = 0.60); the mean and SD of each item are presented in Supplementary

Fig. 1. For all items, the mean score was greater than 3. The three highest ranked items were: “reflection on the comments and ideas of peers and the instructor” (Mean = 4.33, SD = 0.66), “the instructor asked students to answer questions, make comments, demonstrate comprehension, and give options” (Mean = 3.90, SD = 1.10), and “making real world connections” (Mean = 3.77, SD = 1.11).

### 4.3. Perceptions of arts-based learning

Regarding students’ perception of learning with visual arts (see Supplementary Fig. 2), 23.3% (n = 14) of the participants agreed that they had been interested in learning with visual arts prior to the VTS experience. A majority of the students agreed that using visual arts can enrich their learning experience (63.3%, n = 38).

### 4.4. VTS experience

The students’ ratings of their VTS experience are presented in Supplementary Fig. 3. The mean scores were greater than 3 for most items, except for the item on whether the VTS format is more familiar and comfortable compared to traditional learning. Regarding the competencies gained through VTS activities, “ability to freely express observed facts,” “ability to analyze the observed facts,” and “acceptance of diverse perspectives” received the highest ratings (Table 2).

The themes and categories describing both positive and challenging experiences with VTS are illustrated by frequency in Fig. 1. In the students’ narratives, being able to learn diverse perspectives, expanding the scope of their thoughts and observations, and sustainable learning were the most commonly mentioned positive experiences.

When I merely listened to lectures, if someone asked me to explain what I learned immediately, it would have been impossible to explain or utilize any of the content. However, after participating in VTS-based learning activities, I was able to recall observations and thought processes I had used during class and explain what I learned to others. For example, I could recall the range of motion assessment procedures for the musculoskeletal system and general appearance assessment procedures quite well.

Regarding challenging experiences, students reported a lack of familiarity and the open-ended nature of observations as the most common challenges faced during VTS activities.

The advantage of this activity is that there is no fixed answer. However, it was also regrettable that there was no predetermined answer. I also want to practice testing the ability to guess the correct answer by observing an artwork with a predetermined diagnosis or problem.

To further explore students’ experiences, we summarized sample quotes from students based on the target competencies of VTS activities in Table 3.

### 4.5. Suggestions from students

Students made several suggestions for improving VTS activities, including: (1) providing more background information, (2) including

**Table 2**  
Students self-rated competences gained from visual thinking strategies.

Items	Mean	SD	Range
The ability to freely express observed facts	4.13	0.72	2–5
Acceptance to diverse perspectives	4.12	0.74	3–5
The ability to analyze observed facts	4.12	0.52	3–5
Observation without bias	3.93	0.84	1–5
Empathy to clients	3.32	0.95	1–5

SD = standard deviation.

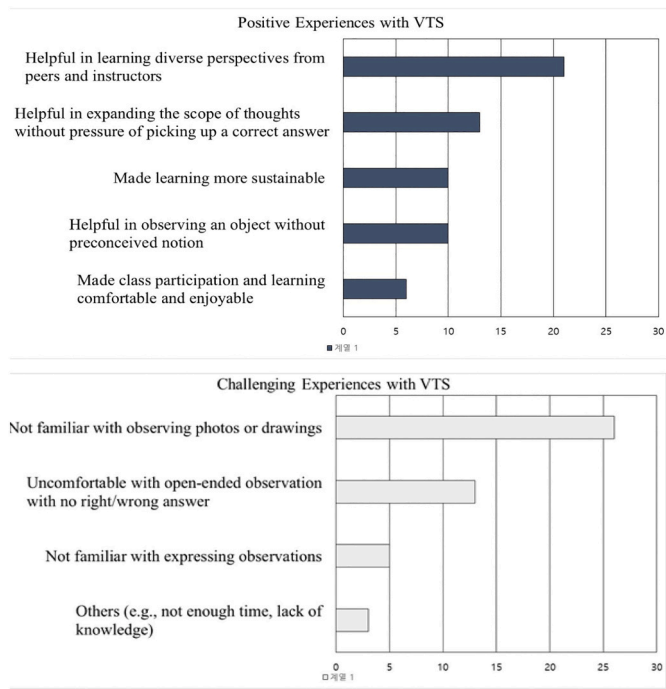


Fig. 1. Frequencies of themes and categories that describes positive and challenging experience with VTS.

diverse artworks, and (3) increasing time allocation and deepening discussion questions. The sample quotes are summarized in Table 4.

5. Discussion

Our quantitative results showed that students positively rated their perception of learner-centeredness of the VTS experience. While VTS was a new and unfamiliar experience for almost all the students, they accepted VTS as an interesting and easy-to-concentrate learning method compared with traditional classes. To further illustrate students' VTS experience, we grouped sample quotes from students according to the target competencies expected to be gained from VTS activities. To the best of our knowledge, this study is one of the first to demonstrate the feasibility and acceptability of incorporating VTS using diverse class meeting formats (i.e., online videoconferencing and offline skills lab sessions) in an existing health assessment course without requiring additional resources. While the study's results need to be interpreted cautiously due to the small sample size, our findings help clarify the strengths of VTS in promoting student-centered active learning, and how VTS promotes observation, communication, and collaboration skills in undergraduate nursing students.

Integrating arts into learning, especially in medical education, has been done for decades to teach various skills, such as communication and observation (Haidet et al., 2016; National Academies of Sciences Engineering and Medicine, 2018). Among the various types of arts-based teaching and learning methods, VTS has been most widely used in healthcare professional education because it requires observation, critical thinking, and collaboration as transferable skills for the entire clinical career (Chisolm et al., 2020). In this study, we introduced VTS in an undergraduate nursing health assessment course for the following reasons. Inspection and communication are important skills for nursing students, but have been disproportionately invested in during the health assessment course compared with the amount of time and effort allocated to other skills, such as palpation and auscultation. Compared with palpation, auscultation, and percussion that require specific techniques and skills to identify whether the condition is normal or abnormal, inspection requires more comprehensive observation and reasoning, and

Table 3 Matching students' comments with target competencies expected from the VTS.

Competencies	Quotes
Empathetic observation	"Through observing various pictures, I became able to observe more carefully. For example, in the past, when I saw a picture of a person sitting on a chair, I thought he/she was resting. Now, I look at the same picture and look at the person's facial expression and think about it." "I remember the class discussion after looking at a photo of a group of older women eating together in a nursing home. My initial focus was just on the older women's appearances within the photo. ... When I revisited the picture afterward, I was now able to notice the surroundings of the older women. I now noticed that there was a wheelchair on the grandmother's chair, which made me realize that she may have difficulty walking. Such activities expanded my perspectives and were very interesting."
Open observation without pre-conceived notion	"I was able to focus more on the assessment through observation without any other information or clues about the subject." "From this experience, I felt that my observation skills, especially my ability to observe contextual information around a person in photos or pictures, continued to grow."
Critical analysis of observed facts	"It was good to be able to infer the subject's health issues by looking in detail at the age, facial expression, eyes, bodily gesture, muscle movement, etc. in various artworks. This activity helped improving breadth and depth of my thinking." "It was impressive that it was possible to observe each body system using a wide perspective gained from the lectures for 15 weeks."
Interactive communication and team building	"I enjoyed sharing my opinion with other students and gaining fresh perspectives because it felt like I was expanding my thinking, and improving my overall communication skills." "I like the atmosphere of discussions where everyone could freely express what they observed and thought, and receive immediate feedback from the instructor without worrying about whether the answer was correct or not."
Acceptance to diversity	"Learning different observations from other classmates was interesting. I was able to learn accepting different opinions naturally and enthusiastically." "I have come to realize that there may be many diverse opinions other than the conditions I assumed from my observation."

VTS = visual thinking strategies.

may benefit from a discussion from multiple viewpoints. Further, because health assessment courses are generally focused on the assessment of specific body system, students are less likely to have opportunities to observe the target patient and surroundings as a whole (Fennessey and Wittmann-Price, 2011). There is a need to adopt a new teaching method that can systematically engage students to fill such gaps in their learning.

While most studies have reported VTS activities offered as a stand-alone session or a separate course (Rana et al., 2020), we used the following strategies to offer VTS activities within the existing curriculum. First, VTS was introduced in a few selected topics by allocating varying lengths of time for each topic (20–40 min). To help students adapt to VTS, we began our first VTS session with a brief overview of its main purposes and philosophy followed by the topic of assessment of older adults. Using images of older adults, students were instructed to observe various body positions, postures, facial expressions, and environments (e.g., furniture, room arrangement, objects a person uses). Second, instead of visiting art museums, we used free resources available online, such as Google Arts and Culture, which contain high-

**Table 4**  
Suggestions for future VTS activities.

Suggestions	Exemplar quotes
Providing more background information	<p>"It would be nice with some background story of the case"</p> <p>"It would be nice with examples showing how to present after observation."</p> <p>"It would be nice with more specific guidelines for observation and analysis."</p>
Including diverse artworks	<p>"It would be nice if artworks were beyond paintings such as sculpture."</p> <p>"How about using video clips?"</p> <p>"We prefer photography. For undergraduate students, it is difficult to practice inspection using pictures with less details."</p>
Increasing time allocation and deepening discussion questions	<p>"I wish more time had been allocated to the activities."</p> <p>"In discussion, adding one or two more discussion questions relevant to lecture contents or a real clinical case will help understand the contents."</p>

VTS = visual thinking strategies.

resolution images from over 1800 art galleries and museums around the world. Thus, the implementation was convenient and affordable. Last, due to the COVID-19 pandemic, which limited in-person class meetings and off-campus activities, VTS activities were offered via offline skills lab sessions and online videoconferencing, and both delivery methods were effective in engaging students. Based on our experience, incorporating VTS into the existing health assessment course is feasible and affordable in situations that limit in-person classes.

In our sample of undergraduate students, VTS was a new approach for almost all of them. Overall, the students enjoyed the activities and collaborated amiably with their peers. Students appreciated listening to others' viewpoints as an opportunity to learn as a team in both on-site and online videoconferencing sessions. In addition, for some students, the VTS activities motivated them to actively apply the knowledge learned in the lectures during observation and discussion. Our students' reactions were consistent with the results of a qualitative study by Moorman (2015), who reported nurses' experience with VTS—that they were able to express their thoughts without worrying about being judged or making mistakes.

Regarding the "open-ended" nature of the VTS activities, the students expressed varying comfort levels. While most students liked being able to observe and talk without the pressure of having to answer correctly, a lack of familiarity and open-ended nature of observations were rated as the most challenging aspects of the VTS. Such reactions were linked with their suggestion of providing more background information, such as a medical diagnosis for people with musculoskeletal problems in the pictures. Considering all, we speculate our students may need further support to improve tolerance to ambiguity or uncertainty, which is an important capacity to learn through the VTS (Klugman et al., 2011).

Based on the findings of this feasibility study, we suggest several directions for future research. First, the evaluation methods need to be further refined. Most studies have performed quantitative evaluations using the number of observations reported by students either with art objects or in clinical settings, or the amount of time students spent looking at art or patient images (Harrison and Chiota-Mccollum, 2019; Naghshineh et al., 2008). In a study with a group of health sciences undergraduate students, Poirier et al. (2020) used deductive content analysis combining two categorization matrices to evaluate both the number of observations and the characteristics of observation. Recently, Ferrara et al. (2020) developed and validated a scoring rubric specific to VTS, which addressed key competencies relevant to VTS, including critical thinking, observation skills, linguistic expression, problem-solving, and inference ability. The evaluation methods employed in these two studies are relatively new and warrant further validation with

diverse student groups and settings. Second, incorporating out-of-class assignments targeting more specific observation skills may be an interesting and valuable approach. For example, in a study by Naghshineh et al. (2008) that targeted pre-clinical medical students, besides VTS activities in the art gallery, there were out-of-class assignments to practice observation skills for certain aspects, such as color, light, shadows, contour, form, texture, and balance. Third, future studies need to include evaluations of VTS experience from the instructor viewpoints to refine its operation and make the VTS become more scalable approach to institutions with varying resources.

This study had several limitations. First, it was a single-group post-test-only pilot study. Therefore, interpretations of the results are limited to the feasibility and acceptability of implementing VTS for selected topics in the health assessment course for second-year undergraduate nursing students in an urban university setting. Second, the study involved a cohort of students from a single institution. We assume that students' motivation and comfort levels for accepting VTS may vary across institutions. Third, pictures or photos were used in this study. When diverse classroom locations become more feasible, using varied artworks, such as sculptures, will further enrich the quality of active learning. Fourth, measures available for this study were limited. Due to the lack of measures specific to perceptions of art-based learning and VTS experience, we used investigator-developed measures which consisted of items based on the VTS literature. Reliability and validity of the questionnaires have not yet been established. For this reason, our results mainly consisted of descriptive reports of each item. The measure of learner-centeredness demonstrated a lower reliability in our sample. Developing reliable and valid measures is necessary to better evaluate students' learning experiences associated with VTS. We did not capture data on students' observation during VTS sessions. If that had been done, analyzing those data in both quantitatively (i.e., time spent in discussion) and qualitatively (i.e., analyzing the contents of students' observation) might have enriched our insight regarding the actual student engagement with VTS activities. Finally, we used free-response questions to collect qualitative data to minimize in-person contact during the COVID-19 pandemic. Conducting a focus group or individual interviews is warranted for future studies to increase the depth of understanding of students' perceptions and experiences of VTS.

## 6. Conclusions

We demonstrated the feasibility of implementing VTS in undergraduate nursing students' health assessment course. Our experience suggests that VTS may be a useful strategy to engage students during online teaching sessions that have grown exponentially during the COVID-19 pandemic. Our findings indicate that VTS as an online teaching and learning method may be a useful approach to promote the active learning of observation, critical thinking, communication, and collaboration skills among students. Based on this study, we suggest diversifying learning materials and developing systematic evaluation and feedback methods for VTS. For future studies, larger randomized controlled trials are warranted to further evaluate the efficacy of acquiring health assessment skills using VTS as a sustainable and transferrable method of active learning in undergraduate nursing students.

## Ethics approval

This study protocol was approved by Yonsei University Health System Institutional Review Board (No. Y2020-0152).

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### CRedit authorship contribution statement

**JiYeon Choi:** Methodology, Formal analysis, Supervision, Writing – original draft, Writing – review & editing, Validation. **Seung Eun:** Writing – original draft, Writing – review & editing, Validation. **Seongmi Choi:** Investigation, Formal analysis, Writing – original draft, Validation. **Bada Kang:** Writing – original draft, Writing – review & editing, Validation. **Soo Hyun Kim:** Writing – original draft, Validation. **Juyeon Bae:** Writing – original draft, Validation. **Judith A. Tate:** Formal analysis, Writing – original draft, Writing – review & editing, Validation. **Youn-Jung Son:** Writing – original draft, Writing – review & editing, Validation.

### Declaration of competing interest

The authors declare no actual or potential conflicts of interests.

### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.nedt.2022.105374>.

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