Exploring the impact of technology enhanced learning (TEL) on observational drawing

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A Meta project submitted to the University of Dublin, Trinity College, in partial fulfilment of the requirements for the degree of Master of Science in Technology and Learning

Declaration

I declare that the work described in this document is, except where otherwise stated, entirely my own work and has not been submitted as an exercise for a degree in any other university

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Abstract

The key challenge of realistic observational drawing is translating the properties of an observed three-dimensional arrangement of objects onto a two-dimensional plane in a precise and realistic manner. It entails a concerted and iterative looking-holding-drawing process that involves the eye, the brain and usually the hand. Observational drawing ability evolves with cognitive maturity and insight. However, many drawers become demotivated once they reach the age and stage when they recognise they cannot draw the complexity of what they know to be there onto the page. There is the old art teaching adage that in order to improve one's ability to draw, one must improve one's ability to see. This seeing entails many visual perceptual skills relating to discrimination, memory, form constancy, tracking, filtering and saccades.

This explorative case study examines the impact of technology enhanced learning (TEL) on drawers' observational drawing aptitudes. It specifically examines its effect in relation to two variables. These are accurate placement (AP) and relative proportionality (RP). It also investigates TEL's impact on participants' *understanding* and *application* of three specific sighting strategies (SS) used by artists to attain AP and RP in their observational drawing. This research adopts a convergent parallel mixed methods design. It triangulates participants' perspectives regarding TEL impact via questionnaire with a comparative assessment of their pre and post TEL still life drawings and with the researcher's observations and evaluations.

This investigation finds that TEL has impacted positively on participants' observational drawing aptitude in relation to AP and RP. It finds that by deconstructing the observational drawing process into looking-holding-drawing through TEL, it has made observational drawing more understandable, manageable and enjoyable for many participants. This study will be of particular interest to art teachers who seek alternative ways of presenting, supporting and motivating their students. This study asserts that TEL can support the studio practice.

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Abbreviations

Observational drawing (OD)

Accurate Placement (AC)

Relative proportionality (RP)

Sighting strategies (SS)

Technology enhance learning (TEL)

Technology enhanced learning experience (TELE)

Technology mediated learning experience (TMLE)

Other emergent abbreviations will explained underneath the relevant figures/ tables

Chapter one: Introduction

1.1 Observational drawing (OD)

Observational drawing (OD) is a complex and demanding looking, processing and responding activity (Bremner & Batten, 1991; Brew, 2011; Eisner, 2002; Efland, 2002; Ford & Rees, 2008; Frith & Law, 1995; Green & Mitchell, 1997; Guerin, Ska & Belleville, 1999; Jolley, & Rose, 2008; Hollingworth, 2005b; Kozbelt, 2011; Morse, Hughes & Andreasen, 2000). The response culminates in the creation of a convincing line drawing that captures the three-dimensional quality of an observed composition onto a two-dimensional plane. One could say that OD is a skilful act of illusion that demands significant cognitive flexibility (Brew, 2011; Ebersbach & Hagedorn, 2011; Eisner, 2002; Efland, 2002; Kozbelt, 2011). The OD process strives for accuracy and precision using the eye, the brain and usually the hand. Chapter two examines OD process in greater detail.

1.2 Accurate placement (AP) and relative proportionality (RP)

Drawing from observation is also an iterative process. It entails repeated looking and continuous measuring of all the observed constituent parts in relation to the whole composition to inform how it can be organised on a page. In a still life observational drawing exercise, one aims to identify, measure and translate all the size relationships or proportions within the observed composition onto the page. While the drawer may choose to magnify or decrease the scale of what can be seen, accurate placement (AP) and relative proportionality (RP) of the arrangement's components are still a necessary requisite of OD. Failure to attain AP or RP results in skewed or disproportionate spatial representation of the observed composition. Many drawers fail to do so and as a result become easily demotivated and frustrated.

1.3 Sighting strategies (SS)

While some gifted drawers have the capacity to draw observed objects free or blind that is without much preliminary measuring, most drawers use sighting strategies (SS) that have been either ‘caught or taught’ (Dougall & Coutts, 2005; Eisner, 2002; Dodson, 1990, Geer, 2011). The former implies that the drawer has acquired them informally from observing others. The latter implies that the drawer has been taught such strategies in some formal

manner. SS includes framing the composition, locating and marking guidelines or measuring composition components using the pencil (Dodson, 1990). SS help attain improved AP and RP. Research indicates that SS are the very aspects of observational drawing that most improve with training and practice (Dodson, 1990, p.70) and yet they can be difficult to teach. This is a key motivation for this research.

1.4 Related research

Despite observational drawing being recognised as being essential to artistic practice (Kozbelt, 2001; Seeley & Kozbelt, 2005), Chamberlain, Riley & McManus, (2011) assert that perceptual and memorial processes underlying it still remain poorly described. There are studies that have investigated drawing development in relation to spatial awareness and perspective (Lange-Knutter, Kermmann & Heckhausen, 2002; Luquet, 2001; McCloskey, 1995; Morra, 2002; Morra 2005; Nicholls & Kennedy; 1992; Picard & Durand, 2005; Picard & Vinter, 1999; Taguchi; 2004; Toomela, 2003). Other studies have explored challenges or impediments to observational drawing (Ebersbach & Hagedorn, 2011; Frish, 2006; Luquet, 2001). Other research explores different ways and means of integration drawing and technologies in innovative ways (Browning, 2006; Gregory, 2009; Lu, 2005; Taylor, 2009). However, there is still space for this kind of explorative research regarding how might TEL help learners understand and apply practice discrete skills to improve aspects of their observational drawing.

1.5 Research purpose

The purpose of this study examines the impact of technology enhanced learning (TEL) using *Scratch* software on participants' *understanding* of AP and RP. It also investigates their' *application* of three key SS to attain better AP and RP in their subsequent observational drawing. It determines whether any improvement in AP and RP in their subsequent post TEL drawings can be attributed to TEL. It examines what TEL component, if any at all, was most successful. It explores what features of each TEL component was most effective with respect to users' AP/ RP progress. It also examines TEL's impact on users' understandings and dispositions towards the OD processes.

1.6 Methodology overview

This exploratory case study (Creswell, 2014; Cohen et al, 2007; Yin, 2002) adopts a mixed methods approach using visual methodologies (Creswell, 2014; Cohen et al, 2007; Dawson,

2009), written questionnaire and observation (see figure 1.1) Participants' pre and post TEL observational drawings are assessed in a methodical and systematic and objective manner to ascertain AP/ RP success and development. These AP/RP scores are triangulated with participants' perspectives regarding any perceived improvement in AP/ RP understanding and their TEL engagement via a twenty-minute written questionnaire. A small number of screen prints of participants' completed TEL tasks are also studied in relation AC and RP. These are triangulated with researcher's overt observations and reflections (Creswell, 2014; Cohen et al, 2007).

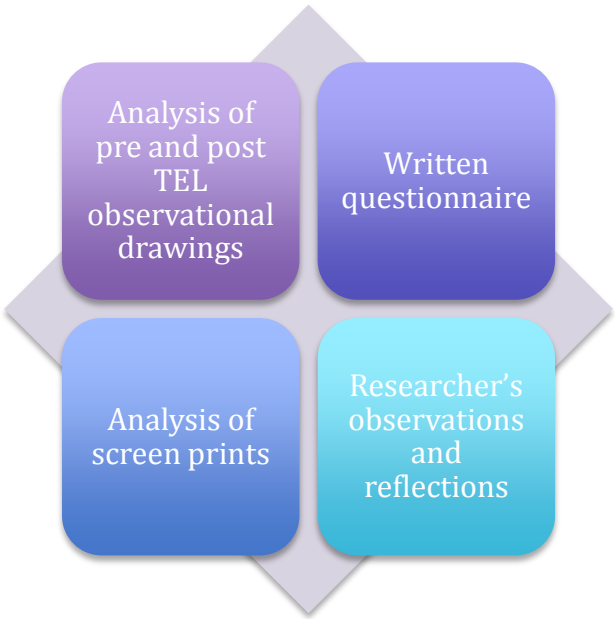


Figure 1.1 Mixed methods employed

1.7 Findings

This explorative study finds that TEL does impact positively on participants' subsequent drawing abilities in relation to AP/RP understanding and attainment. It finds that the majority of participants think that their drawing aptitude had improved post TEL and as a consequence of TEL. This research asserts that TEL has changed participants' dispositions towards OD in a positive manner. It discovers that a pedagogically informed and considered TEL entailing *understanding, applying, drawing* and *evaluating* can progress learners' OD development in relation to understanding, looking and measuring. It recommends further research into TEL as a scaffold for students' OD and visual perceptual skills development.

1.8 Roadmap to chapters

Chapter two presents a literature review of relevant readings and research concerning OD with respect to skills, process, and drawing development theories. It outlines problems encountered by drawers and limitations of traditional teaching approaches in relation to AP and RP. Chapter three describes the TEL design in relation to AP and RP skills and concepts development. Chapter four describes and explains why a convergent parallel mixed methods approach was adopted (Creswell, 2014, Cohen et al, 2008) for this study. It describes procedures undertaken in relation to the TEL implementation and data collection. Chapter five describes and discusses the systematic processes used for quantitative and qualitative data analysis and triangulation. It discusses the key findings. Finally, in chapter six, the researcher posits explanations based on evidence gathered, draws certain conclusions about the impact of TEL on drawers' OD development while acknowledging the limitations of the study.

Chapter two: Literature review

2.1 Introduction

This chapter describes the different motivations for observational drawing (OD). It examines visual perceptual skills and looking. It presents Dodson's (1990) iterative stages concerning *looking-holding-drawin*g. It examines the challenges novice drawers encounter in translating observed three-dimensional forms onto a two-dimensional plane. It presents staged-theories in relation to drawing development. It outlines the range and limitations of current teaching approaches practised to develop OD abilities in relation to AP and RP.

2.2 Drawing as tool for understanding and research

According to Vygotsky's sociocultural learning theory, the use of tools and signs is a unique feature of human development. From a neo-Vygotskyan perspective, drawing is understood to be one example of mediated action, whereby an artefact such as a drawing tool is used to enable drawers interact with, and understand their physical and social environment (Cole, 1995). Drawings are one tangible outcome of such interaction. Therefore, drawing is perceived to be a powerful, visual and visceral tool that can be used in many ways to represent and articulate how we observe our world (Driscoll, Lambirth & Roden, 2012). It entails complex modes of thinking and reasoning within a specific socio-cultural context (Herne, Cox & Watts, 2009). Drawing is regarded as a powerful and insightful tool that enables the artist make sense of, represent or respond to the world. It is means of constructing and communicating meaning.

Scientific or visual curiosities are the two key motivators for any OD (Dodson, 1990). The former seeks to understand the subject or composition of the drawing more. The latter seeks to understand the interplay of the visual elements observed in the arrangement more. These could entail the relationships between line, shape, form, colour and tone, pattern and rhythm, texture and spatial organisation. Both types of OD entail the challenge of looking at the composition, taking note of a contour or shape, holding that contour or shape in one's mind and recreating it on paper. Both are reliant on visual perception. From a research perspective, drawings are perceived to be a very rich source for analysing and understanding human cognitive, emotional, visual and motor processes and development (Frisch, 2006). OD is both the subject and a research tool in this study.

2.3 Visual perceptual skills

Visual perceptual skills are the vision skills that are required to understand, analyse, and interpret what is seen. Visual discrimination skills help in identifying differences between objects that are similar such as proportions in similar shaped objects. These are both crucially important in OD. Visual memory helps one recall what has been seen. Dodson (1990) refers to this ability as 'holding'. Brew (2011) refers to it as 'pausing'. Figure Ground is the perceptual skill that pinpoints details without getting confused by the background or surrounding imagery (Kozbelt, 2001; McManus, 2011; Seeley & Kozbelt, 2008). This skill is especially helpful when one is presented with a lot of visual information at one given time. This capacity to take note of possible background guide-markers and yet ignore or discard unnecessary background detail is a necessary sighting strategy for measuring AP and RP. Eye teaming skills ensure that both eyes function as a single functioning pair that allows the brain to fuse two separate pictures coming in from each eye into one image. This skill is called binocularity. Using both eyes simultaneously as a single functioning pair is one of the most important visual perceptual skill. Interestingly, monocularity is deliberate action used to ascertain measurements in OD.

The focusing system (Kozbelt, 2001; McManus, 2011; Seeley & Kozbelt, 2008) helps one see clearly at different distances over extended periods of time. It also allows one quickly shift focus when required. OD is usually done from one fixed vantage point. Visual Closure is the ability to visualise a complete whole when given incomplete information or a partial picture. This skill enables one to comprehend things quickly so that the visual system does not have to process every detail to recognise what one is seeing. Visual form constancy is the ability to cognitively manoeuvre forms in our minds and picture what they would look like. This particular skill helps one distinguish differences in size, shape, and orientation and is very relevant to accurate placement (AP) and relative proportionality (AP). Tracking skills allows one to follow a line of detail such as print. The oculomotor system accurately directs eye movements (Kozbelt, 2001; McManus, 2011; Seeley & Kozbelt, 2008). Fixation is the ability to maintain steady visual attention on a target. Saccadic visual skills is the ability to make eye jumps from one target to another quickly and accurately. These abilities are often used in OD. However, learner drawers frequently fail to 'hold' (Dodson, 1990) the same sustained viewpoint or scan all composition components often to draw them in relation to one another. This research explores whether TEL can harness our focussing for OD tasks.

2.4 Looking-holding-drawing drawing process

Still life drawing is a challenging task. It entails drawing a real and tangible arrangement of objects as opposed to objects depicted in a secondary source such as a photograph or poster. It involves a *looking-holding-drawing* process (Dodson, 1990). *Holding* refers to the processes entailed in registering, recording and retaining visual spatial information for translation to the page. While Dodson (1990) very deliberately omits thinking from the looking, holding and drawing sequence, he like many others appreciate that there are many simple and largely independent cognitive processes underlying drawing skills (Efland, 2002; Frith & Law, 1995). This *looking-holding-drawing* aligns well with the cognitivist 'input-process-output' learning model (Jordan, Carlile & Stack, 2008). This study examines OD through the lens of this looking, holding, drawing process. It examines how TEL might help drawers in relation to one or more of these three actions. Henderson & Holingworth (1999) assert that OD from can be explained as three phases, but there is debate regarding the sequence. One phase entails the extraction of basic physical properties such as colour and texture. Another phase entails encoding the shapes, proportions and spatial properties within the scene. The other stage concerns semantic encoding and identification of the objects. This research focuses on the second phase, as it is a priority focus in OD. While one might still recognise a badly drawn object due to other identification cues or context, the aim of OD is visual realism.

2.5 Looking, Holding and Cognition

According to cognitive learning theories, thinking entails five basic processes concerning *sensation, perception, attention, encoding* and *memory*. *Sensation* is the initial stage whereby stimuli from the external environment are held briefly in the relevant sensory registers before being transferred for further processing. Visual information is held for less than second and less than ten bits of visual information are held at any given time (Massaro, 1993*). Perception* is the interpreting entailing both a bottom-up and top-bottom intellectual processes. Studies have found that we tend to perceive closed figures, smooth continuous lines, similar objects and groups of objects more than their opposites. We perceive depth by triangulating information concerning inter-positioning, texture gradients, linear perspective, relative retinal size, motion cues and optical flow patterns (Jordan et al, 2008).

Attention is a cognitive process that enables the drawer to focus on one thing at a time. The attentive cognitive process is selective and determines what reaches conscious awareness

through controlled and automatic processes and focus. While a learner drawer may exercise controlled processes to sight measure AP and RP, a more experienced drawer may do so in a more automatic fashion. *Encoding* is the organising cognitive process that results in schemata construction generated by bottom-top and top-bottom intellectual processes. The bottom-up component is fuelled by perception while previous understanding shapes the top-bottom component. The fifth cognitive process concerning *memory* is managed by different kinds of interrelated systems concerning the sensory, short-term (STM) and long-term (LTM) memory. Drawing demands both. The sensory and short term are required to look, hold and recreate the observed still life properties line by line and long-term memory is required to recall and apply knowledge about drawing procedures (procedural memory) concepts and principles (semantic memory).

2.6 Attaining accurate placement (AP) and relative proportionality (RP)

In OD, the drawer needs to decipher what size each still life component appears from his or vantage point in relation to the other compositional elements and where each observed object is positioned in relation to each other from that same fixed view point. The drawer needs to recall or hold that fixed vantage point each time he or she looks to obtain more information about what can be seen. The drawer needs to be able to revisit that same viewpoint for every look. Any adjustment of the head, body posture or extension of the elbow angle when measuring the still life will result gaps and overlaps on the page. It is important that drawers be able to mentally hold that specific viewpoint each time for repeated looking and secondly hold the length, direction, angle, thickness or shape of each line observed.

Often the characteristics of a newly analysed line are remembered by linking it in someway with a previously drawn contour line of to the composition. Every line can be scaffold for another line. Drawings are developed in an interrelated as opposed to a disjointed manner. Often, still life arrangements have a deliberate arrangement entailing interrelationships through the overlap of contrasting objects to provide aesthetic interest for the viewer, but also to challenge and simultaneously aid the artist. This latter point might seem confusing, but juxtaposing contrasting objects in still life drawing can be both challenging in terms of complexity yet helpful in determining guide lines and measurements.

2.8 Drawing: Stage and phase theories of developement

Lowenfeld and Brittain identified four key stages in children's drawing development (1987). When children enter the so named *Gang Stage* of dawning realism between nine and fourteen years of age, they wish to draw the world around them in all of its complexity. During this stage, there is emergence of a dawning visual realism and an increased awareness of their environment. There is increased understanding and application of learned spatial drawing conventions to re-present 3D objects on a 2D plane and the disappearance of the basic base line in their work. Their work now perceives and documents overlapping and oclusion of objects and there is far less distortion and exaggeration. Morgan (1993, p. 21) proposes five emergent modes of working that aligns with Lowenfeld and Britton's age and stage theory (see appendix A & B for detailed descriptors). She notes that from seven years of age into adulthood, there is a predominantly analytical drawing approach explored. Visual realism is paramount, but symbolist overtones can still pervade their work. A more analytical approach is developed based on visual realism. Consequently, older drawers more self-conscious about their drawings and they become easily de-motivated if the art teacher faila to provide structured guidance and support (Barnes, 2002; Eisner2002; Green & Mitchell, 1997). This research examines whether TEL can help novice drawers look-hold-draw what they see (visual realism) as opposed to what they know to be there (Ebersbach & Hagedorn, 2011).

2.9 Limitations of traditional teaching aproaches

The key teaching methods of teaching OD includes discussion, explanation, clarification, demonstration, teacher-directed learning tasks, negotiated drawing and portfolio evaluation. A good art teacher will discuss a still life composition in advance of drawing in terms of the its visual and textual properties and will elicit their observations through focussed visual questioning. By doing so, the teacher draws his of her students' attention to composition components in a more concerted and concentrated manner. However, as learners are seated in different positions and are themselves of different heights, this means that everyone's viewpoint is unique. Therefore it is very difficult for the teacher to see exactly what each student sees. One key advantage of using the technology embraced by this research is that it provides everyone with the same viewpoint irrespective of height or seating position so that everyone can compare and share more easily and empathetically.

Portfolio assemblage and critique is another key tool for teaching and learning. Consecutive drawings can highlight mistakes made by the learner. However, portfolio does not really inform the teacher regarding at what stage in the *looking-holding-drawing* process does the learner have the difficulty. Often the learner drawer doe not know either. Inconsistencies or miscalculations especially if noted by the learner may indicate a difficulty with holding or drawing as opposed to looking. AP and RP miscalculations may indicate difficulties relating to drawing as opposed to looking or holding. As the TEL design outlined in chapter three is divided into five discrete phases with specific *looking-holding-drawing* tasks that exercise specific visual perceptual skills, this enables the teacher and learner ascertain with greater specificity and certainty where and why any mistakes are being made in relation to AP and RP.

Art teachers teach so named 'sighting' strategies (SS) as outlined earlier through demonstration, teacher tasks and examining preliminary drawings by other professional artists (Dodson, 2009; Hurwitz & Day, 2007; Willenbrink, 2006). Teacher demonstration has limitations in that it is usually a once off performance that cannot be revisited. There is a plethora of readily available *YouTube* video clips that demonstrate specific sighting strategies. However, these are often recorded from the side as opposed to through the eyes of the artist. To truly understand, learners need to apply them from their viewpoint in a first hand and experimental manner. Digital 'sighting' in phases two and three of the TEL design described in chapter three enables learners to move, remove, mark, unmark and remark more easily and speedily. As everyone has an identical viewpoint, learners can pair, share and compare their decision making with their peers. They can also screen print and email their decision making at any stage of the TELE for teacher appraisal.

Chapter three: Design of TELE

3.1 Introduction: Technology and visual arts

Many artists and art educators have incorporated emerging digital technologies into their studio or classroom practice (Black & Browning, 2011; Flood and Bramford, 2007; Gude, 2007; Leornard & Leonard, 2006; Lu, 2005; Mayo, 2007). Art teachers mainly employ technology as a presentation tool rather than 'facilitating students' creative production and thinking, collaborative learning problem solving and higher order learning' (Gregory, 2009, p. 48). However Duncan (2004), Flood & Bamford (2007) and Stankiewicz (2004) warn that avoiding the inclusion or integration of digital technologies in arts education practices will result in gulfs between visual arts education and the world of art itself.

3.2 Haptics technologies and visual arts

Haptic technologies (pronounced hap-tiks) are ever exploring the interaction of touch sensation and control with computer applications for a more visceral visual experience. Designers and sculptors can create with devices that provide touch feedback regarding the form, texture or pattern they are sculpting or creating. Some artists employ haptic devices to virtually shape maquettes or preliminary virtual 3D designs. (Butler & Neave, 2008). They appeal to visual artists who wish their audiences to interact with or contribute their artwork. Many museums are already embracing haptic technology (Frisoli 2007; Tecchia et al. 2007) that permits interaction with virtual artwork. It does so by the use of haptics combined with stereoscopic 3D projections. While haptics technologies enables users to create and thus further understand the properties of three-dimensional spatial arrangements, this research explores more accessible and readily available software called *Scratch* to enable novice drawers *understand* how to translate those properties onto a two-dimensional plane.

3.3 Description of technology enhanced learning experience (TELE)

This technology enhanced learning experience (TELE) is designed to enable participants' understand AP and RP, exercise visual perceptual skills relating to AP and RP and apply three key sighting strategies (SS) to attain AP and RP in their drawings. It is comprised of five key phases concerning *drawing, understanding, applying, drawing* and *evaluating* (see Table 3.1). The first and the fourth phase entails drawing a similar still life composition in the art room for a similar duration of twenty minutes with special attention paid to AP and RP.

Table 3.1: outlines learning components of TELE

TELE phase	Learning component	Concepts and skills
Phase one: Drawing	Draw from observation: A still life drawing Class discussion	Looking, holding and drawing
Phase two: Understanding	TEL 1: Replicate 'Sugar, salt and pepper' by Wayne Thiebaud Pair, share and compare Class discussion	Looking, holding and reconstructing painting by repositioning and resizing
	TEL 2: Replicate 'Roast beef dinner' by Wayne Thiebaud. Pair, share and compare Class discussion	Looking, holding and reconstructing painting by repositioning and resizing
Phase three: Applying	TEL 3: Examine a digital still life arrangement in relation to placement and proportionality Class discussion	Looking and measuring (sighting-strategies)
Phase four: Drawing	Draw from observation: A similar still life drawing to phase one Class discussion	Looking, holding and drawing using sighting strategies
Phase five: Evaluating	Self appraise their two drawings in relation to AP and RP Class discussion	Assessing their work in relation to AP and RP progress

Table 3.2 Time and location of each TELE phase

TELE phase	Duration	Location
Phase one: Drawing	5 minute introduction 20 minute drawing still life 10 minute discussion	Art Room
Phase two: Understanding	5 minute explanation 20 minute TEL engagement	Computer Lab
	5 minute 20 minute TEL engagement 10 minute discussion	Computer Lab
Phase three: Applying	5 minute explanation 20 minute drawing still life 10 minute discussion	Computer Lab
Phase four: Drawing	5 minute introduction 20 minute drawing still life 10 minute discussion	Art Room
Phase five: Evaluating	20 minute self assessment 10 minute discussion	Art Room

and RP. Phases two and three takes place in the computer lab and entails the completion of three *Scratch*-based exercises available online at http: //www.scratch.mit.edu/users/ visartsmie that concern AP, RP and SS to attain both the former.

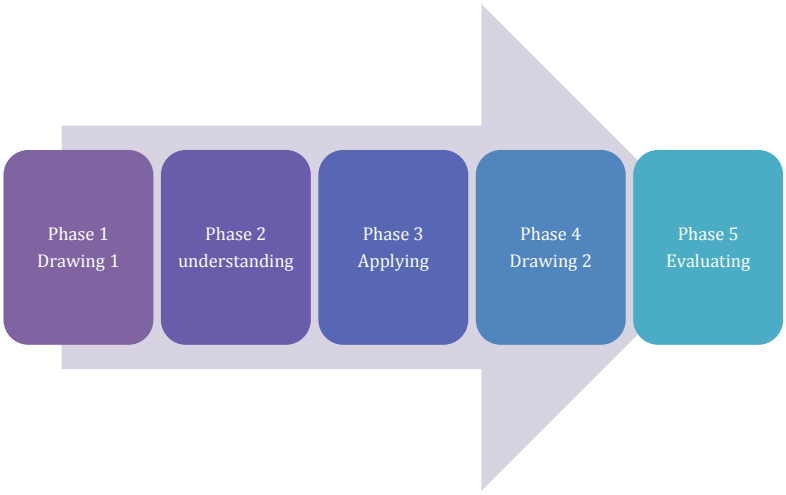


Figure 3.1: The five phases of the AP/ RP orientated TELE

Stage five entails self assessing their two observational drawings with their matching digital photographs in relation to AP and RP. This TELE design is designed around the research question and sub questions but wis also informed by social constructivist principles; kolb's learning cycle and blended learning design principles (Driscoll, 1998; Jordan et al, 2008). The design process also follows Passerini and Granger's (2000) Hybrid model of instructional design as well as Gagne's learning theory applied to instructional design (Russell, 2005).

3.4 Phases one and four: *Looking, holding and drawing*

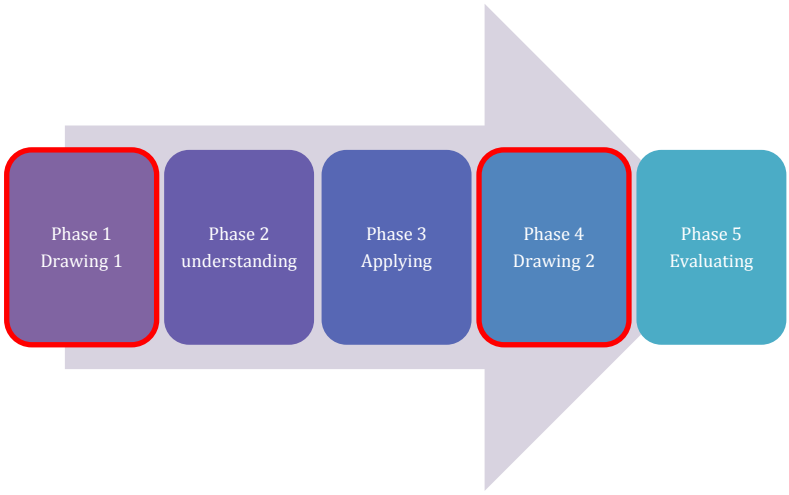


Figure 3.2: Phase 1 and Phase 4 of TELE

Participants complete an observational drawing of a still life composition in stages one and four (see figure 3.2). The still life composition is a simple arrangement of rectangular or spherical familiar forms such as a vase, perfume bottle, candle holder or lantern. Every seating position is of a similar distance. On each occasion, a digital photograph is taken from

every seat's viewpoint so that comparisons can be drawn between the completed drawing and the digital photograph (see figure 3.3). On both occasions, participants are encouraged to focus on AP and RP.

The second observational drawing follows two learning phases that addressed AP, RP and SS in a direct manner. As a result, it is anticipated that participants' will have an increased understanding and attainment of AP and RP in their post TEL observational drawing and be better equipped to apply three specific sighting strategies (SS) to aid such accuracy.

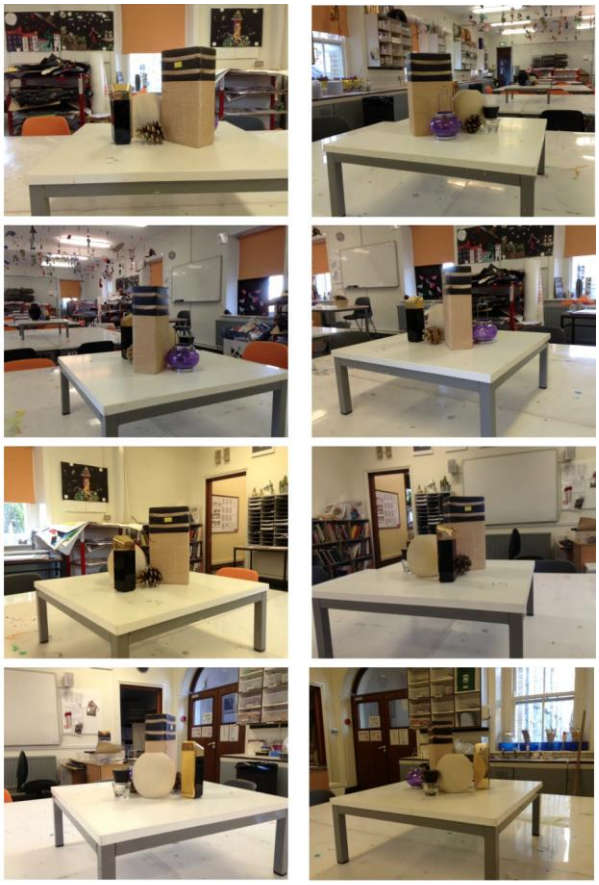


Figure 3.3: Sample of digital photographs taken of still life A from every seating position

3.5 Stage two: *Understanding AP and RP*

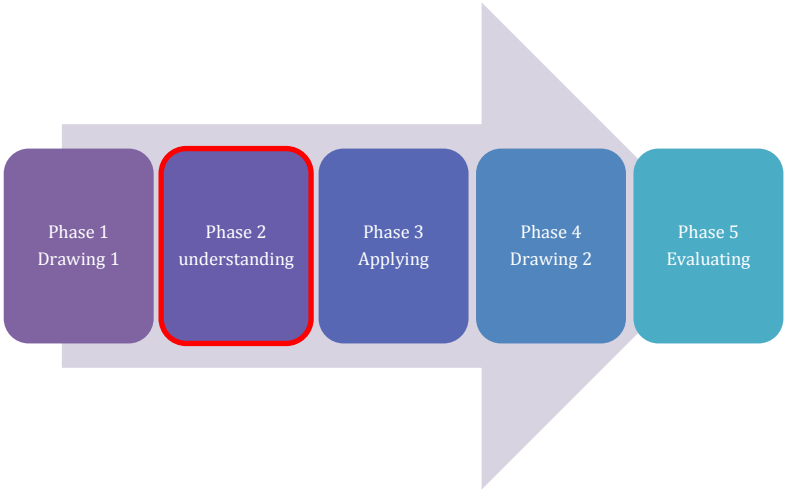


Figure 3.4: Phase two of TELE

In TELE type one (see figure 3.4) participants are asked to look at two canonical paintings entitled *Sugar, Salt and Pepper* and *Roast Beef Dinner* by the American artist Wayne Thiebaud in relation to AP and RP (see figures 3.5 and 3.6) and replicate them using a specially designed programme using *Scratch* software. The first painting depicts three familiar objects on a kitchen table that rests against a wall. It is simple arrangement 'sliced' by three very definite horizontal lines. These horizontal three lines are very helpful visual cues from an OD perspective as they connect all three objects and inform us about the placement and relative proportions of the sugar, salt and pepper sellers.

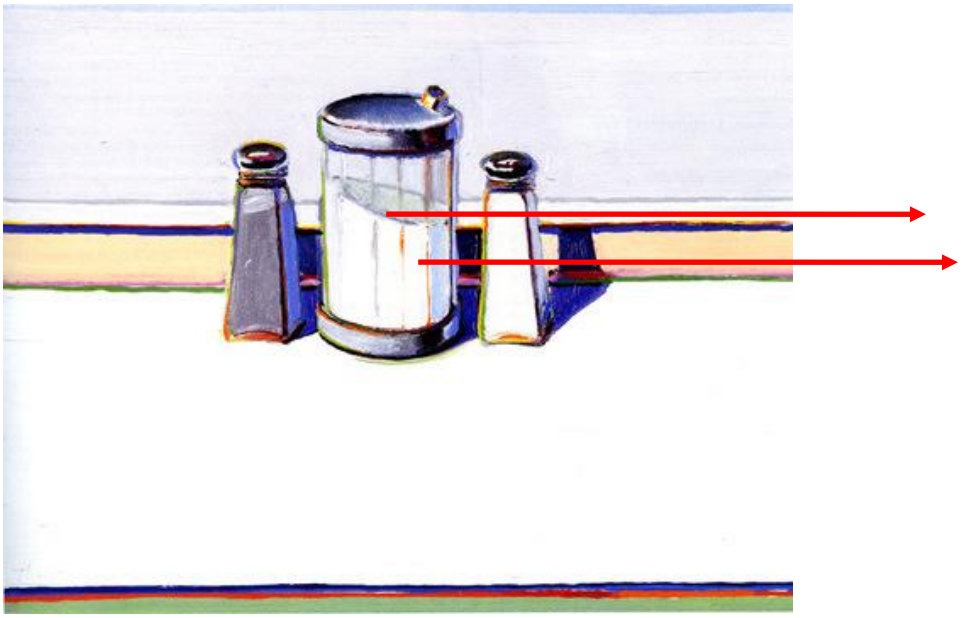


Figure 3.5 *Sugar, salt and pepper* by American artist Wayne Thiebaud

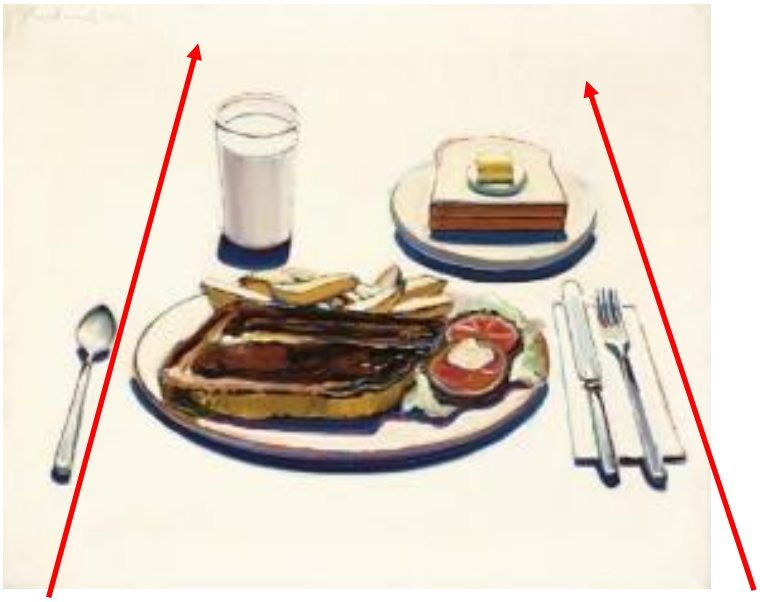


Figure 3.6 *Roast beef dinner* by American artist Wayne Thiebaud

The second painting depicts a roast beef dinner meal with accompanying cutlery, glass of milk and side plate with bread and butter. There are no vertical or horizontal lines that slice the composition. The painting has a monochrome background. One must compare each object in relation to one another to ascertain information regarding their placement and RP. This painting has no background guidelines to aid looking and measuring. Hence this painting is more difficult to replicate with respect to AP and RP.

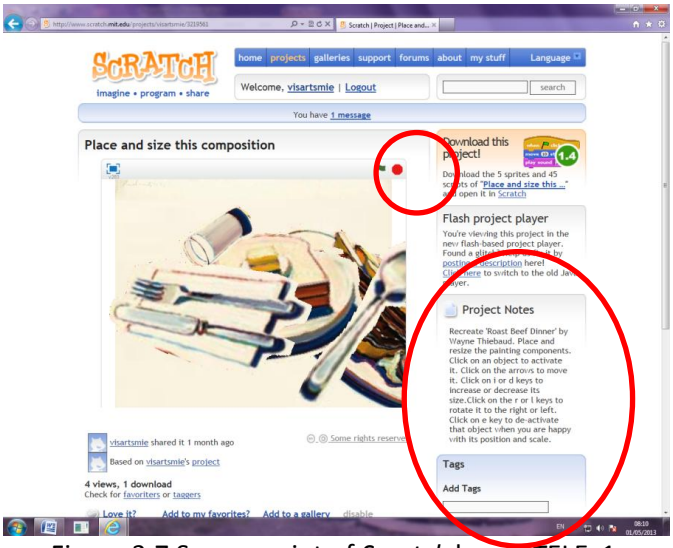


Figure 3.7 Screen-print of *Scratch* based TELE 1

Once they examine each painting, they are challenged to reconstruct the painting on the computer screen by resizing and repositioning each composition component (see figure 3.7).

Participants can work simultaneously on their own computer. The are presented with three key tools to help them achieve AP and RP. These include **a rotation, motion and resizing tool**. Users have to exercise visual discrimination, visual memory, visual form constancy, visual tracking, fixation and saccadic visual skills as addressed in chapter two to attain an exact replication of each paintng. Users can use any of the tools at any stage of the replicating process. There is no precribed sequence.

The rotation tool permits users to rotate each compositional component using the letters R or L motherboard keys. It rotates by one degree per click, but also moves smoothly and continuously until the users stops pressing the key. This tool enables the user to look, hold and rotate each component compositional component the right way up (see figure 3.8).

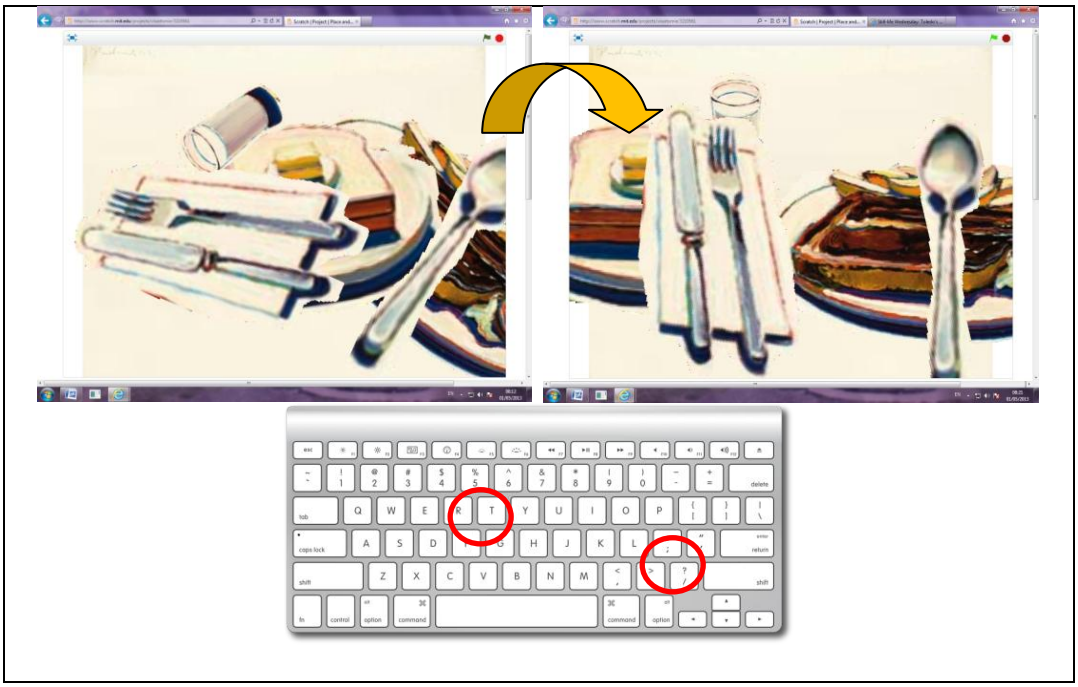


Figure 3.8 L and R keys are ued to rotate composition components the correct way up

The motion tool permits the user to look, hold and moves each compositional component to their correct location (AP). Users can direct each compositional component using the motherboard arrow keys. The arrows signal the direction of the motion (see figure 3.9). The resizing tools allow users to look, hold and resize each compositional component in relation to each other (RP). The letter d key decreases the size of the selected object while the letter i key increases its size while the key is being pressed.

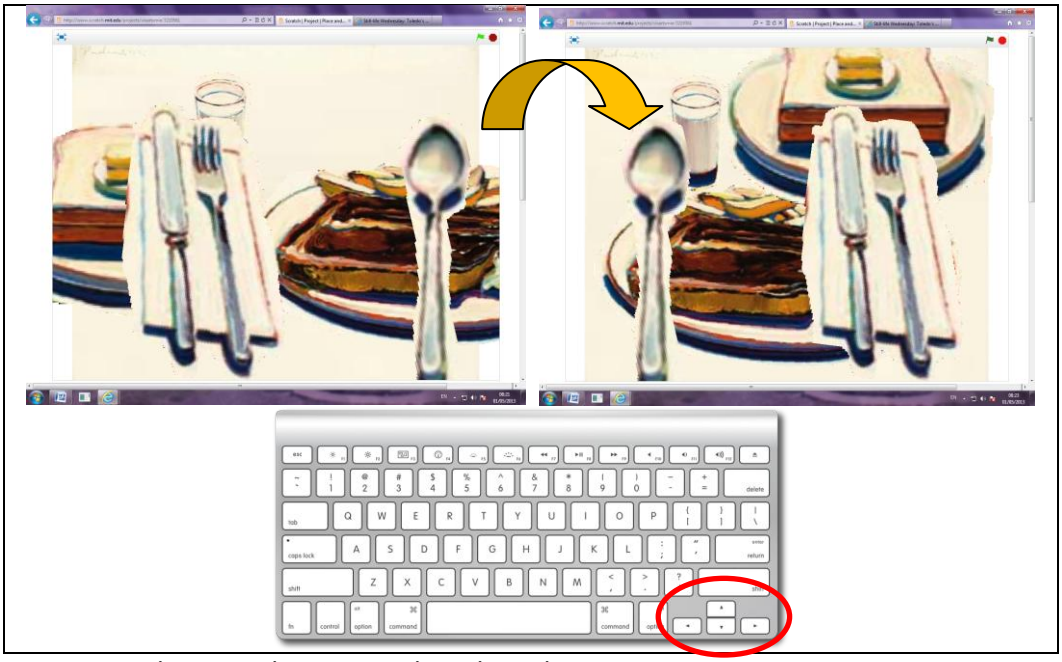


Figure 3.9 The arrow keys move the selected composition component

This TELE phase requires particpants to engage in constant looking and holding to replicate both paintings using the various tools. Once they are satisfied with their copy, they are invited to screen print and email their copy to the teacher for his or appriasal.

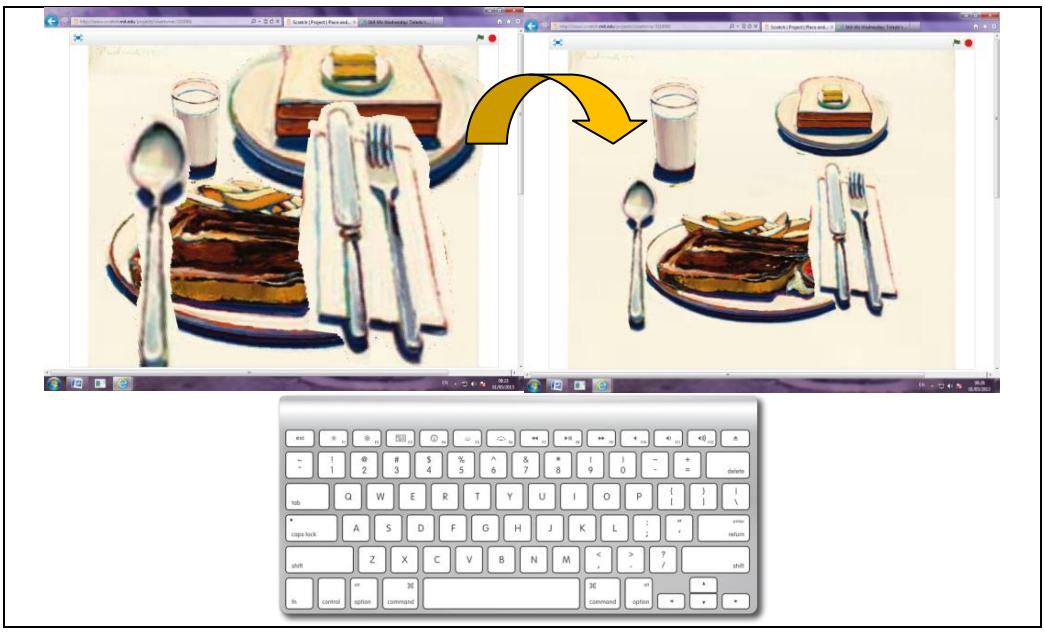


Figure 3.10 Iterative resising and repositioning of objects

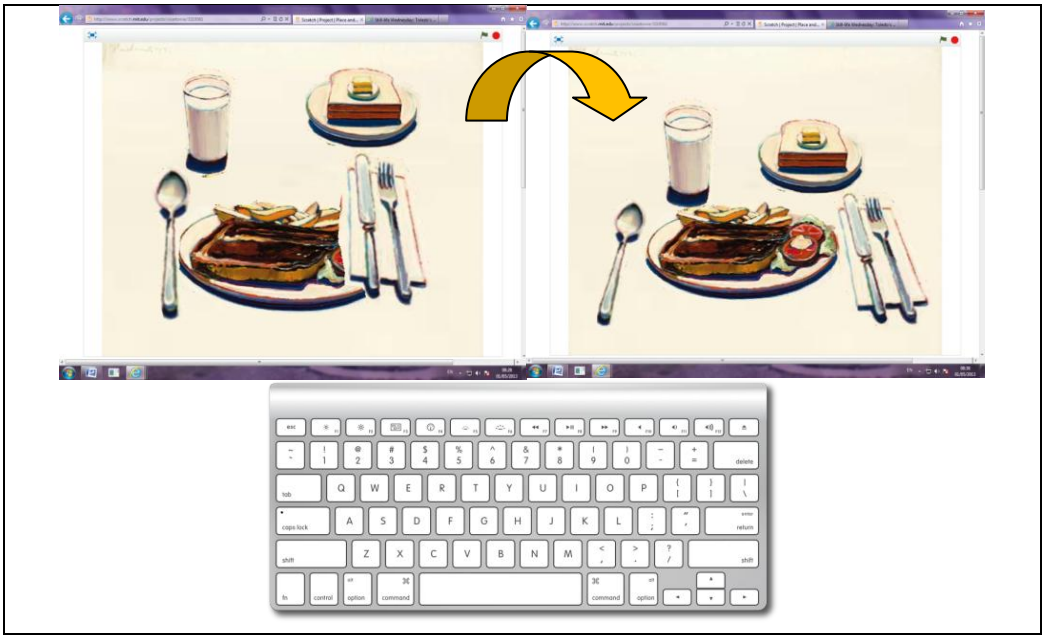


Figure 3.11 Directionality of objects fine tuned to evidence the foreshortening effect

3.6 Phase three: *Applying sighting strategies to attain* AP and RP

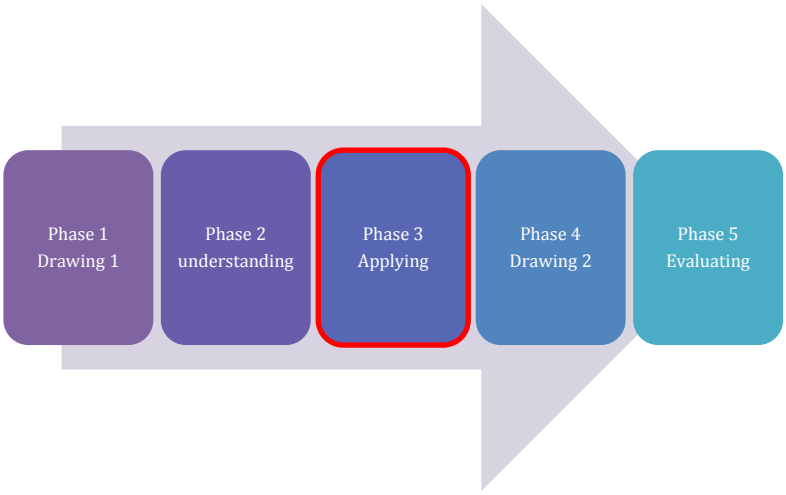


Figure 3.12: Phase three of TELE concerning application

In phase three, the participants examine a digital photograph of a still life composition not unlike the one they drew in stage one (see figure 3.13). This TELE type two teaches users to

1. Frame the composition by resizing, rotating or moving a digital viewfinder . This exercises their figure ground perceptual skills as outlined in chapter two as well as cognitive decision making regarding how much of the background to include in the frame and why.
2. Measure composition components using the pencil, thumb and index icon. This exercises visual form constancy skills and tracking skills and is a much practised SS to attain AP and RP.

3. Record and compare those measurements with their neighbour. This demonstrates to participants that having the same vantage point, measuring reference and still life should result in identical sighting measurements
4. Locate and mark significant guidelines such as the midpoint or lines of alignment or intersection. This entails users' exercising their visual discrimination, visual form constancy and visual tracking skills.

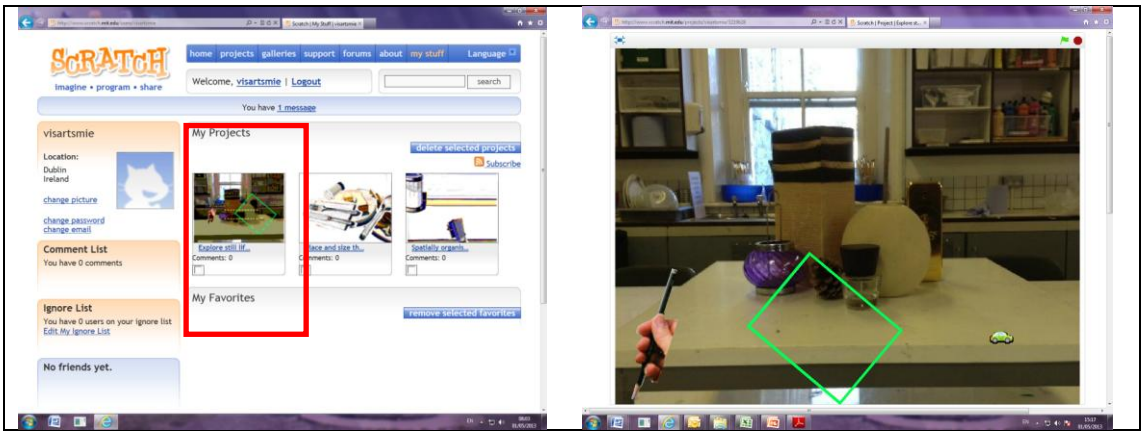


Figure 3.13 TELE 3 as seen on website and as viewed by user

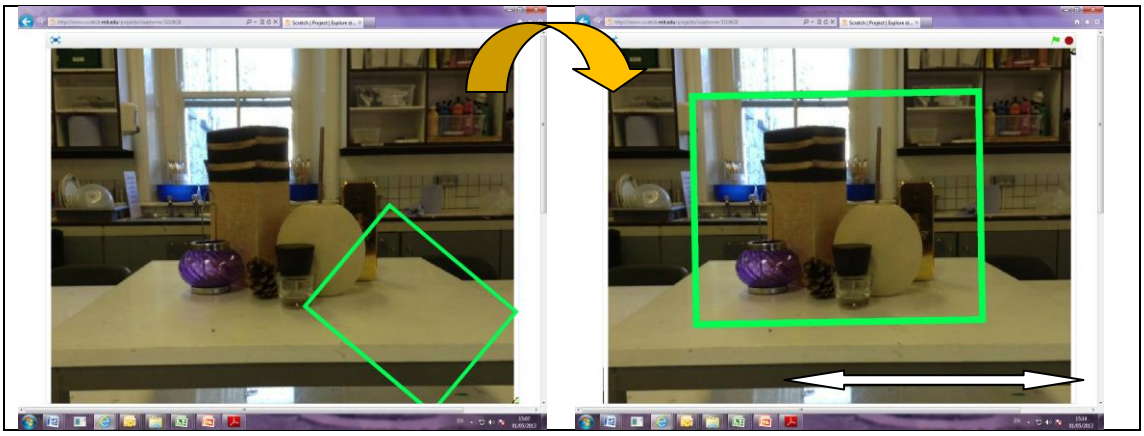


Figure 3.14 Screen-prints of viewfinder feature

In this *Scratch*-based TELE, there are three features or tools to undertake the three SS tasks. These include a pencil sprite, a viewfinder sprite and a green car guide marker sprite. Sprite is the term used for the active characters on the stage (see figure 3.13). **The viewfinder** is a tangible cardboard frame that many artists used to decipher what to include in the drawing. In this case, users have access to a digital and modifiable viewfinder (see figure 3.14). There is no fixed correct answer in relation to framing, but generally one includes enough background to aid AC and RP and not too much so that it becomes too distracting. The decision as to whether to go portrait or landscape depends on the dimensions of the observed still life. In this case, the arrangement is wider than taller and so it lends itself to a landscape arrangement. The user can modify the shape, size and location of the viewfinder

by the same keys as in the previous TELE type 1. [I and d for size alteration, arrow keys for motion and direction and R and l keys for rotation.

Guideline marking is a very important sighting strategy (SS) to enable drawers attain AP and RP. Noticing and marking vertical and horizontal background lines can provide a scaffold for the drawing. Figure 3.15 depicts an axis created by looking, holding and marking two significant lines. *In this exmaple, the horizontal line was selected as it aligns with the bottom strip of the vase, the top of the gold bar aftershave and the top of the tiles in the background. The vertical 'plumb' line was selected as it aligns with the edge of the vase facing the viewer. Participants manoeuvred the car using the same motion and rotation keys [the arrow and letter r and l keys] but pressed the letter m key to mark the guidelines as in* (figure 3.15).

The pencil is frequently used to measure the lengths and widths of the composition components in relation to one another (RP). The artist ususlly selects one object as the non standard unit of meaurement for the whole composition. *In this case, the height of the purple glass candle holder is used as the reference for that measurement. Using the same computer letter keys for motion (arrow keys) and rotation (L and R), users are challenged to look, hold and in record measurements of the still life components (see figure 3.17). Users are then invited to share their pair, share and compare their measurements which should be the same as the measurement reference is agreed beforehand and the pencil distance and viewing position are fixed.*

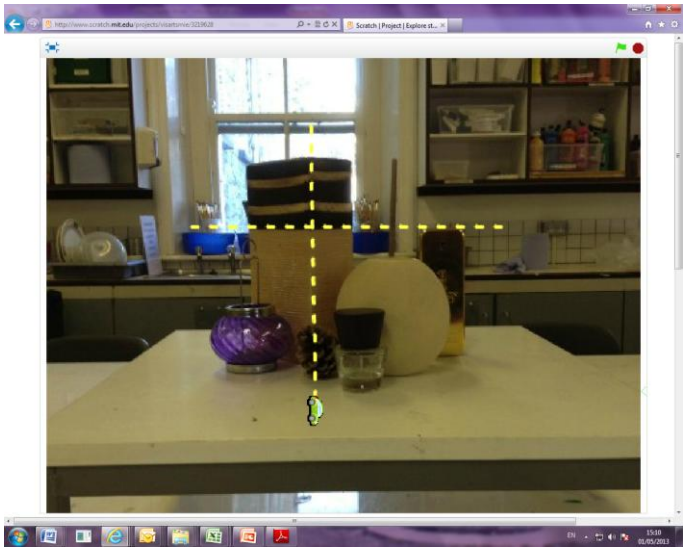


Figure 3.15 Axis drawn by the guide marking sprite

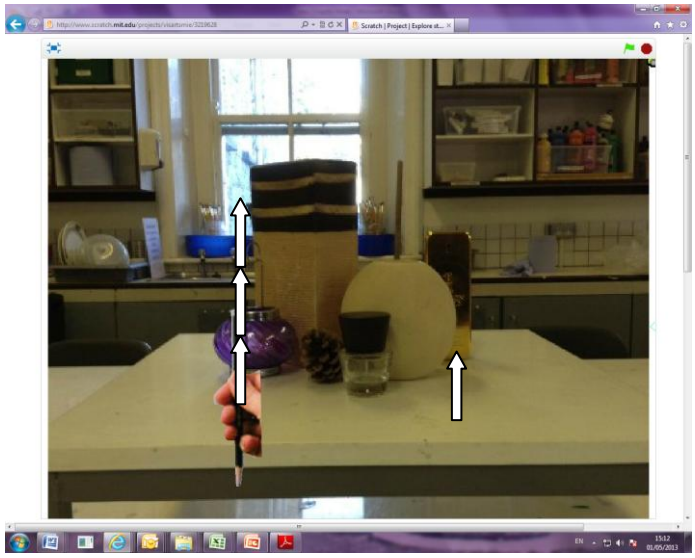


Figure 3.16 Screen-print of pencil measuring tool

When participants are finished applying those sighting strategies, they are invited to screen print and email their measurements to the teacher for appraisal. This TELE type two finishes with a short whole group discussion about the relationship between SS and AP or RP. For research purposes only, the participants were asked to reflect on the affordances or frustrations of this TELE and consider how it compares with learning about sighting strategies in the art room straight away.

3.7 Phase five: *Evaluating their perceived progress*

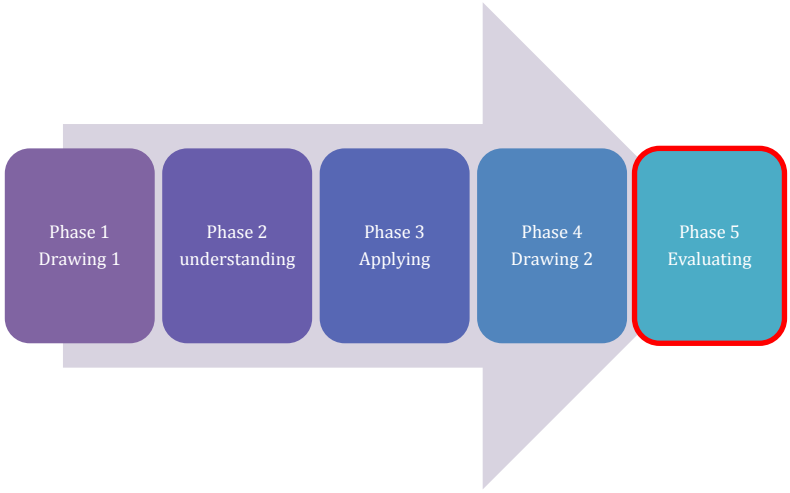


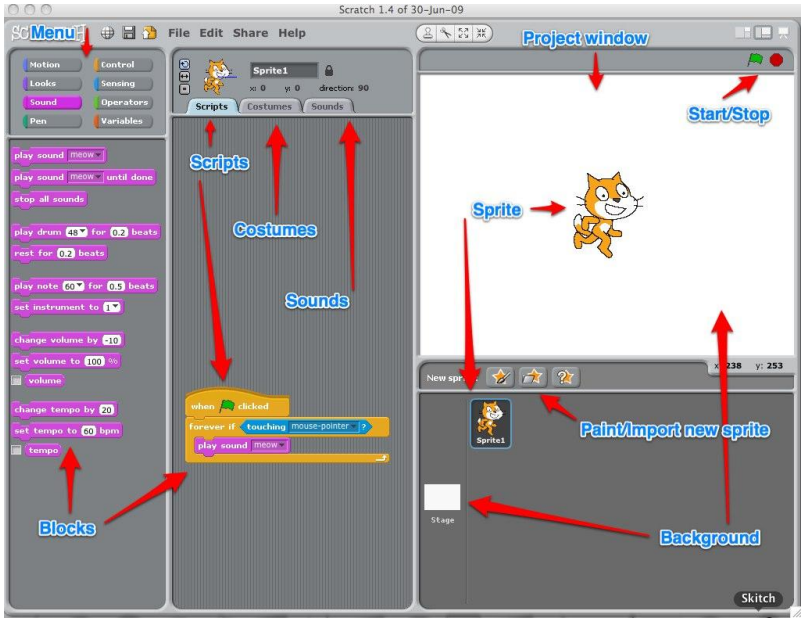
Figure 3.17 Phase five of TELE concerning evaluation

The final phase entails self and peer evaluation (see figure 3.17). In this case, the evaluation served a very specific research purpose also. Participants are handed back their previous observational drawing with its matching digital photograph and a score out of ten. This mark

reflects the amount of pre-selected coordinates they 'hit' or 'missed' in their drawing. It provides an indication of how successful the drawing is in relation to AP and RP from that viewpoint and distance. They are afforded time to pair, share and compare their results and self appraise their second drawing in relation to their first one. This non executive but cognitive exercise (Brew, 2011) as explained in chapter two entails visual tracking, saccadic and form constancy skills. For this research, participants were asked about their self development in relation to AP and RP in a follow up written questionniare.

3.8 A note about *Scratch* software and script coding

Developed at the MIT Media Lab, 'Scratch allows learners to experiment by snapping together visual coding blocks to control pictures, sounds, and other elements. It is freely distributed for Windows, Mac OSX, and Linux. In the computer software, scratching refers to reusable pieces of code that can easily be combined, shared, and adapted. Students can create stories, games, art, music, animations, and much more' (Lamb & Johnston, 2001). *Scratch* is not difficult to use as it is aimed at children from primary school upwards. After installing the software from the *Scratch* web site, scratch.mit.edu, users can drag chunks of code from these blocks into the script area (see figure 3.18). These pieces of code are combined to create actions for objects called sprites. The results can be seen on a 'stage'. When activated, other users can play the performance or operate or create with the sprites.



3.18 Figure: Screen print of Scratch interface
http://bevenson.files.wordpress.com/2011/12/scratch-1-4-of-30-jun-092.jpg
[Accessed April 19th]

Chapter four: Methodology

4.1 Impact evaluation case study

This chapter describes and explains the merits the research methods adopted and the procedures of the study. This study is orientated around TEL impact evaluation on two aspects of observational drawing (Higgins, 2012). It explores the impact of specially designed *Scratch*-based TELEs on participants' to attain accurate placement (AP) and relative proportionality (RP) as explained in previous chapters. This is a small-scale case study involving thirty participants. A case study was selected for this particular research project as case studies can answer why and how rather than simply what questions (Yin, 2009). They have the potential to explain or evaluate why a particular programme did or did not work (Ashley, 2012).

4.2 Mixed methods approach

A Mixed methods approach was considered to be the most appropriate approach in that it affords a certain degree of eclecticism regarding investigative methods and tools and triangulation of findings to either confirm or contradict hypotheses (Bassey, 1999). The quantitative and qualitative potential can generate more accurate understanding (Biesta, 2012). The methods adopted for this study comprise of questionnaire, visual methodologies and researcher's observation. Visual methodologies are a critical method of this study as their pre and post TEL still life drawings are pivotal in ascertaining any signs of tangible AP/ RP improvement. The use of drawings to study cognitive and emotional development is a long established method (Mitchell, 2012). It is also considered to be a very pragmatic and economical tool as all is required is paper and a drawing media. In this study, drawings are examined in a very systematic analytical fashion whereby each drawing is measured and marked in relation to ten pre selected spatial coordinates. The other visual data includes screen prints of completed TELE type one and two exercises concerning replication and still life guideline marking as emailed by a small number of participants. Each participant completed a twenty-minute post-TEL questionnaire that ascertained his or her perspectives regarding TEL impact on their subsequent observational drawing. All this data is triangulated with researcher's observations and reflections (Creswell, 2014).

4.3 Participants in study

The participants in question are a group of thirty novice drawers. This opportunistic group comprises of twenty-six females and four males. Twenty-five out of a possible thirty or eight-three per cent of respondents recorded that they do not engage in drawing as a hobby (see appendix H). Seventeen participants or fifty-seven per cent recorded that they do frequent galleries or exhibitions in their spare time. Fifty per cent (n15) perceived their drawing ability to be 'average' as opposed to 'very good', 'good' or 'weak'. Thirty per cent (n9) described his or her drawing ability as 'good' (see appendix I) Five participants or less than seventeen per cent perceived their drawing ability to be weak. Twenty-five or just over eighty per cent of the grouping wrote that they had no previous experience of *Scratch* programming before (see appendix H).

4.4 Procedures

Participants completed a pre and post TEL observational drawing in an art room. There were four tables on each occasion with similar still life compositions with respect to content, from and complexity. A digital photograph was taken from every seat in advance of the drawing exercises and each seat was given a code so that the drawings could be marked anonymously. All participants read, signed and were provided a copy of the participant information/ participation sheet (appednix D). Each observational drawing took approximately twenty minutes. It was explained to them that the focus of the study concerned AP and RP only, and that they were to focus on those apsects of their drawing as opposed to tonal or textural variation.

Participants completed two specially designed *Scratch*-based TELEs in weeks two and three in a computer laboratory. Each participant had their own computer. They were provided with oral and written explanations about learning outcomes and instructions (see apendices E & F). There were instructions also available on the *Scratch* website itself at (http://www.scratch.mit.edu/users/visartsmie). Each TELE has timetabled to allow for explanation, participation, discussion and informal peer appriasal and TELE evaluation (see table 4.1).

Table 4.1 Outine of TELE timetable

TELE phase	Duration	Location
Phase one: Drawing	5 minute introduction 20 minute drawing still life 10 minute discussion	Art Room
Phase two: Understanding	5 minute explanation 20 minute TEL engagement	Computer Lab
	5 minute 20 minute TEL engagement 10 minute discussion	Computer Lab
Phase three: Applying	5 minute explanation 20 minute drawing still life 10 minute discussion	Computer Lab
Phase four: Drawing	5 minute introduction 20 minute drawing still life 10 minute discussion	Art Room
Phase five: Evaluating	20 minute self assessment 10 minute discussion	Art Room

4.5 Researcher's observations during TELE implementation

The atmosphere was positive and participants were enthusiastic. The *Scratch* induction or orientation period took a little longer than anticipated. Some participants had certain initial difficulties such as accessing the website, locating the TELEs themselves on the website, or manoeuvring the 'sprites' in each TELE. Other participants worked very autonomously and speedily with no difficulties. While the researcher refrained from completing the tasks for any user, he demonstrated how to control some of the sprites for a few participants. Some had difficulty in recalling which keys controlled what actions. One might surmise that those who were more familiar with computer gaming might have grasped the instructions more readily than those who do not play.

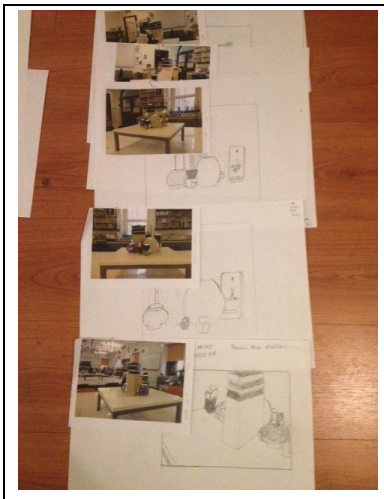
Participants automatically expressed reactions and exchanged progress with each other during TEL engagement. They looked and peer appraised each other's work routinely and instinctively. Some screen-printed their completed digital replications or still life guideline markings while others did not know how to screen print or had no email access in the computer lab to so. Some participants were very surprised by some of the sighting measurements they obtained. They did not expect certain objects in the foreground to be the same height as objects occluded in the background. The vast majority opted for a landscape arrangement in TEL type 2 while a smaller number opted for a portrait arrangement of the same digital sill life composition.

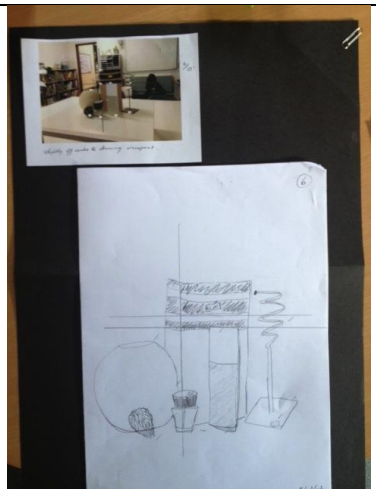
4.6 Data collection via questionnaire

The participants completed a twenty-minute anonymous written questionniare (see appendix G) comprised of twenty questions. The design was influenced by guidance provided in Cohen, Manion & Morrision (2007), Arthur, Waring, Coe & Hedges (2012) and Cresswell (2002). The questionnaire was comprised of both open, closed and Likert question types (Arthur et al, 2012). It sought information about their drawing interests and perceived abilities. It explored their perspectives reagrding any perceived improvement regarding AP or RP. It sought their opinions regarding the experienced TELE in relation to progressing their observational drawing undertanding, aptitude or disposition in any way. It asked them to appraise each TEL component, and each feature of each TELE type one and two in relation to their perceived usefulness. Participants completed the questionaire annonymously. However, they were coded in such a manner the author could be triangulated with their pre and post TELE observational drawings. This was important in order to compare perceived levels versus actual signs of AP or RP improvement.

4.7 Analysing process used on pre and post TELE observational drawings

Ten significant drawing guideline coordinates were marked on their co-requisite digital photographs (see figure 4.1). They were deemed significant in that each selected point was located at either a point of significant intersection, overlap or located along a selected axis. Each axis and set of coordinates was unique to each viewpoint. Once these were selected and marked, they were used as a means of measuring the participant's AP and RP success. Any drawing that attained all ten coordinates obtained a score of ten. The marking and scoring process was manual. Identical axes were drawn on the photo and drawing. Ten coordinates were marked on the photograph using a marker and the each coordinate was then ticked on the drawing itself. For example, participant six in figure 4.4 attained a score of six out of ten. The following two chapters will discuss the analysed data, posit some conclusions and their implications regarding TEL impact, highlight the limitations of the research and make recommendations regarding future avenues of related research.





Each digital photograph was analysed and ten significant points were marked using marker. These coordinates were used to assess participants' drawings in relation to AP/RP

Figure 4.1 Students drawings and matching digital photographs

Chapter five: Data analysis and findings

5.1 Comparing actual AP/ RP improvement scores

The accurate placement and relative proportionality (AP/RP) scores for the first still drawing ranged from four to nine points out of a possible ten. As a collective, they scored 192 points out of a possible 300 points. In order words, as group they scored 65.8% of the total preselected AC/ RP coordinates as explained in chapter four. The mean or average score for pre TMLE drawing or still life 1 was 6.5. The median was also 6.5. The mode has seven, which was higher than anticipated by the researcher as fifty percept signalled that their drawing ability was average, but that response would factor other drawing considerations such as tonal and textural variation. The AC/ RP scores for the second still life drawing range from six to ten points. As a collective, they scored 247 or 82.3% of the preselected coordinates. This is an increase of 16.5% or 49 points. The mean of the post TMLE drawings scores was 8.2, which is an increase of 1.7. The median for the post drawing scores was 8, which is an increase of 2.5. Overall, all but two participants improved their AC/RP score by an average 1.6 points or 16%. The highest score increase was five points or 50%. Three participants decreased their AC/ RP score by one point or 10% in the post TMLE drawing. Appendix J details each drawer's progress.

Table 5.1 Participants results in pre and post still life drawings

	Pre TELE drawing	Post TELE drawing
Total score	192/ 300	247/ 300
Mean	6.5	8.2
Median	6.5	8

Apart from the systematic assessing of each participant's pre and post TELE observational drawings, the researcher analysed them in relation to his observations on each day and the sighting strategies presented and practised in TELE type two. The researcher observed a most definite increased use of the pencil as a measuring tool in the post TELE observational drawing exercise. However, he also noted that participants appeared more frustrated completing the second still life drawing. Some explained that they were more conscious of measuring and use of SS the second time around and that this awareness was impeding them to some extend. However, the results indicate that the majority improved slightly with respect to AP and RP due perhaps to this raised awareness and thus mindfulness.

5.2 Participants' perceived AP/ RP progression

Thirty participants completed questions concerning their perceived improvement if any at all in relation to their observational drawing ability. They reflected upon these questions having had the opportunity to self evaluate their drawings with their matching digital photographs and their first set of AP/ RP scores. They provided were with five options. These included 'very much so, a little improvement, not sure, not really or not at all'. Twenty-one or just over two thirds thought there was 'a little improvement', but only one recorded 'very much so'. In contrast, three marked 'not really' and the remainder were unsure.

Table 5.2 Participants' perceptions regarding any improvement in their drawing ability

Perceived improvement in observational drawing?	Number of respondents
Very much so	1
A little improvement	21
Not sure	5
Not really	3
Not at all	0

Table 5.3 Participants' perceptions regarding any improvement regarding AP

Perceived improvement in Accurate placement?	Number of respondents
Very much so	2
A little improvement	20
Not sure	8
Not really	0
Not at all	0

When asked specifically about their perceptions regarding any improvement with respect to their observational drawing aptitude with respect to accurate placement, exactly two thirds (n20) thought the improved a little, while just two recorded 'very much so' (see appendix K). The remaining eight participants were unsure. When asked specifically about any perceived improvement regarding their observational drawing aptitude regarding RP, just over half (n16) the sample group recorded 'a little improvement', while two more recorded thought

very much so. Four felt there was not really any discernable improvement while eight respondents communicated they were unsure.

Table 5.4 Participants' perceptions regarding any improvement regarding RP

Perceived improvement in Accurate placement?	Number of respondents
Very much so	2
A little improvement	16
Not sure	8
Not really	4
Not at all	0

The findings indicate an alignment between actual and perceived improvement as obtained through systematic scoring, participant's questionnaire and researchers' observations. The TELE impacted in positive manner overall. However, as there was no control group, it is very difficult to ascertain whether a traditional discussion, demonstration and negotiated drawing approached would have yielded the same or better results.

5.3 Respondents evaluations of the Scratch-based TMLE's

Table 5.5 Participants' perceptions regarding TEL 1

	Replicating *Sugar, Salt and Pepper* painting	Replicating *Roast beef Dinner* painting
Very helpful ☼☼☼☼☼	7	9
Helpful ☼☼☼☼,	18	16
Neutral ☼☼	4	4
Not really helpful ☼	1	1

Participants were surveyed as to whether they thought either or both the *Scratch* based TELEs positively impacted their AP/ RP and attainment (see appendix L). They were afforded four options of 'Very helpful ☼☼☼☼☼, Helpful ☼☼☼☼, Neutral ☼☼ or Not really helpful ☼'. In both cases, only one respondent recorded that this TMLE was 'not helpful' or remained neutral. Nine respondents recorded *Roast beef dinner* as being 'very helpful', where as

seven recorded *Sugar, salt and pepper* as 'very helpful'. The slight increase for *Roast Beef Dinner* might be explained by the fact that they were more familiar with how to direct the sprites the second time round. Overall, the majority of participants attributed some of their perceived improvement to TELE type one engagement.

Table 5.6 Participants' perceptions regarding TEL 2

	Applying sighting strategies
Very helpful ☼☼☼☼☼	11
Helpful ☼☼☼☼,	18
Neutral ☼☼	1
Not really helpful ☼	0

When asked to evaluate TMLE type two which entailed practising sighting exercises before drawing their second still life drawing, just over one third indicated that it was very helpful. Just under two thirds (n18) considered it to be helpful. Only one respondent remained neutral. No participant/ respondent recorded anything negative about either TELE type. Nearly all the sample group felt that both TELEs helped them in some conceptual or skills based manner with respect to AC or RP understanding and attainment.

Some of the participants further explained how the TELEs helped them in relation to their drawing. Respondent six commented that TELE type one enabled him or her to focus on from as opposed to the content. Respondent nine explained that it helped him or her to understand [sight] measuring and [relative] positioning better. Respondent sixteen remarked that it was good exercise that made him or her think about size and that she or he enjoyed looking at the angles, size and space. Respondent twelve explained that it made him or her more aware of the importance of proportions. Respondent nine commented that TELE type two was brilliant and it began to become clear to him or her how to measure a still life. Respondent ten noted that TELE type two enabled him or her to notice lines in the background that she or he would not have noticed before to aid his or her drawing. Respondent twelve explained that it made him or her aware of guidelines and how useful they can be. Respondent twenty-one explained that it enabled him or her see that some objects were the same height despite not appearing so initially. Respondent twenty-six commented that looking at lines of axis was very helpful. Respondent twenty-nine remarked

that it broke down the picture easier so that she could identify a midpoint and improve positioning of compositional components.

5.4 Respondents evaluations of TELE two's specific features or tools

As the second TMLE had three specific sighting tools, the questionnaire asked respondents to evaluate the *perceived usefulness* of each sighting strategy sprite or tool in relation to aiding their observational drawing (see appendix M). The green car guideline-marking sprite was considered to be the most useful tool with twenty-one 'very useful' responses. The other two sighting strategies were considered very useful also by half of the respondents (n16 each). The pencil measuring tool was received more 'not really useful' votes (n7). This latter sighting strategy is the more complex one to teach and learn as it entails a lot of iterative measuring so the researcher is not surprised by that response.

Table 5.7 perceived usefulness of each TELE 2 feature

	Guideline marking	Digital viewfinder	Pencil measure
Very useful ☼☼☼☼☼	21	16	16
Useful ☼☼☼,	6	13	6
Neutral ☼☼	1 blank	0	1 blank
Not really useful ☼	2	1	7

Unfortunately, the vast majority of respondents did not disclose further explanation regarding the perceived usefulness of each tool. Perhaps respondent fatigue set in at this stage. They were completing the questionnaire during their break time and they were quite time poor.

5.5 Analysis of TELE screen prints

Only seven participants managed to email screen prints from their *Scratch* engagement. These proved interesting in terms of analysing author's understanding and application progress. However, there is not enough of them to ascertain patterns or findings. In figure 5.1 for example, the left screen print from TELE type one evidences that the user found the replication task difficult to complete within the time period afforded. While both AP and RP are very good, he or she has not managed to resize or reposition the salt seller correctly. The other participant below has resized and repositioned all the still life components within the given time period. However, the angle of the spoon is incorrect and the placement of

the knife, fork and knapkin are positioned slightly lower than in orginal painting on the left. Luckily, from a drawing perspective both these errors do not really affect AP or RP of the other compositon components as unusally they are disconnected from one another. However, usually an error in attaining correct AP or directionality with respect to one compositional component can affect the rest of an observational drawing. However, the upright position of the spoon on the left combats any feeling of depth within the painting.

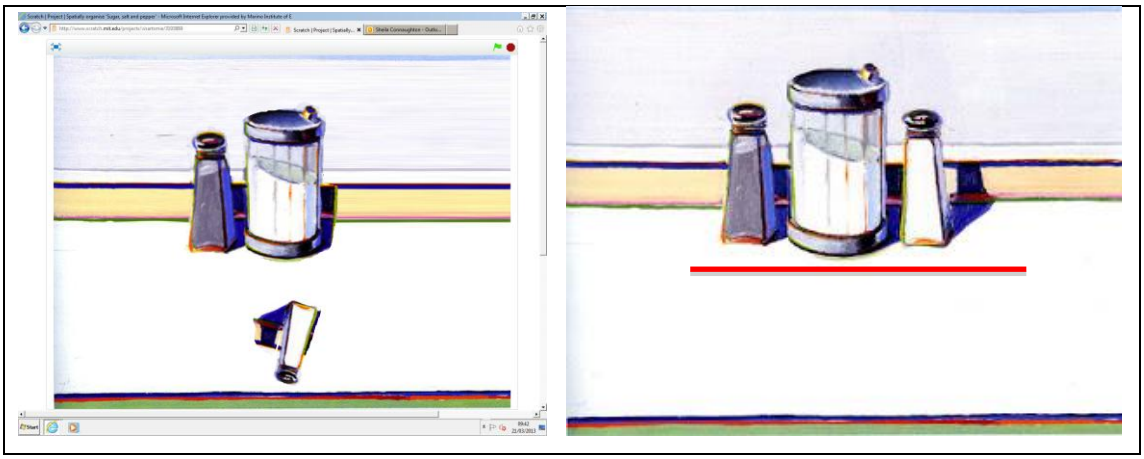


Figure 5.1 Screen print of participant's screen print and *Sugar, salt and pepper* painting

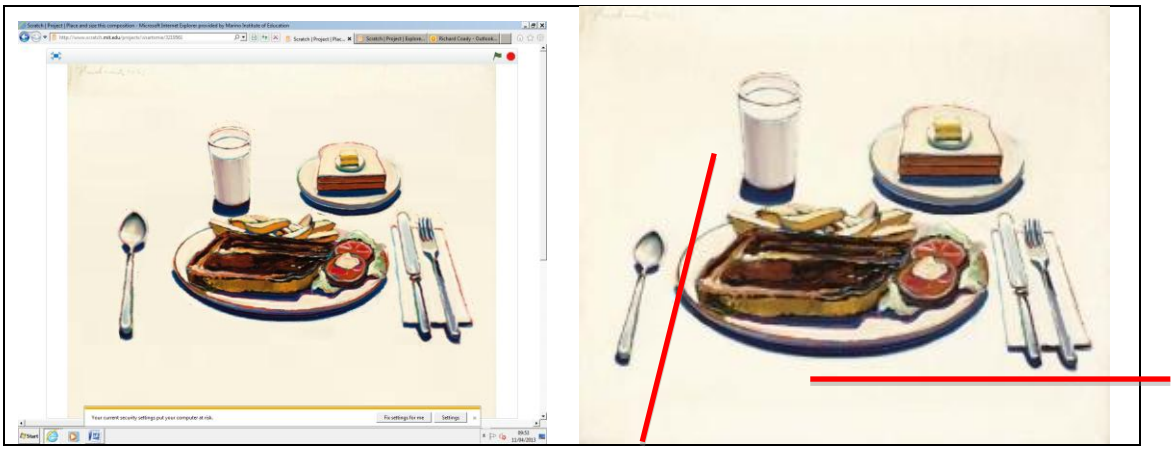


Figure 5.2 Screen print of participant's screen print and *Roast beef dinner* painting

By comparing screenprints of completed guideline marking from two respondents from TELE type two (see figure 5.3), we can see that both have selected the very same arrangement with respect to the viewfinder. They have both resized and located the viewfinder in very identical positions. However, they have guidemarked the composition differently. In the left screen print, the participant has marked RP and AP in relation to steps. The other participant has denoted two anchor horizontal lines in the background that cut the composition. He or she has also noted that the base of two composiiton components share the same base line.

While all guide markers are helpful, the participant who completed this screen print evidences greater understanding and application of the principles of guideline marking more so than other participant.

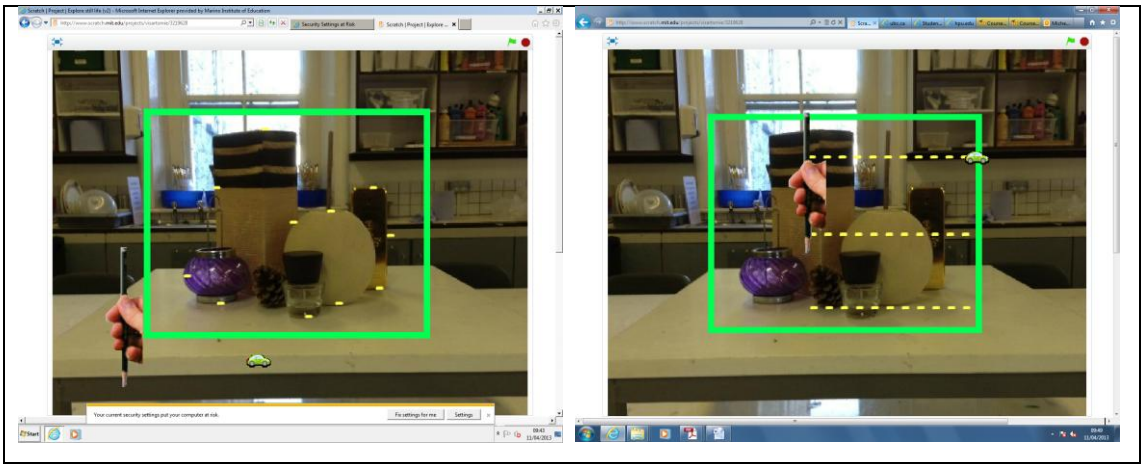


Figure 5.3 Screen print of two participant' screen prints

5.6 participants' perspectives regarding TELE impact

Participants were asked whether the TELE had any impact on their understanding of the OD process. Everyone recorded something positive (see appendix N). No one recorded anything negative. Following content analysis, there emerged three key categories or themes with respect to new understandings following TELE engagement. Eight respondents recorded that it helped them in terms of **measuring**. For example, respondent two commented that he or she is more aware and able to position objects when drawing still life' (see table 5. 8). They make reference to sighting, sizing, aligning and guide lining.

Nine respondents recorded that it improved their **looking**. For example, respondent nine remarked that it makes him or her more aware of size and objects size/ position in the photo (see table 5.6). Five explained that TEL helped to understand observational drawing more. For example, respondent twenty-nine wrote that [It has] given him or her an easier breakdown to do a drawing and that he or she has a better understanding of how to do a drawing (see table 5.8). While not specifically mentioning the specific visual perceptual skills, their comments allude to visual fixation, tracking, fixation and form constancy as outlined in chapter two. Six respondents commented that it developed their understanding of the observational drawing process as it broke down it down into more comprehensible steps (see table 5.9).

These comments indicate that participants think the TEL enabled them to look and measure in a more competent manner than before. Referring back to the literature search chapter whereby observational drawing was presented through the lens of looking-holding-drawing, it appears that TEL has helped many participants in relation to the looking and holding aspect of the drawing process which was the focus of the *Scratch*-based TELE type one and two learning experiences. The final chapter draws conclusions from these findings and makes recommendations within the limitations of the study.

Chapter six: Conclusions, limitations and recommendations

6.1 Conclusions drawn from study

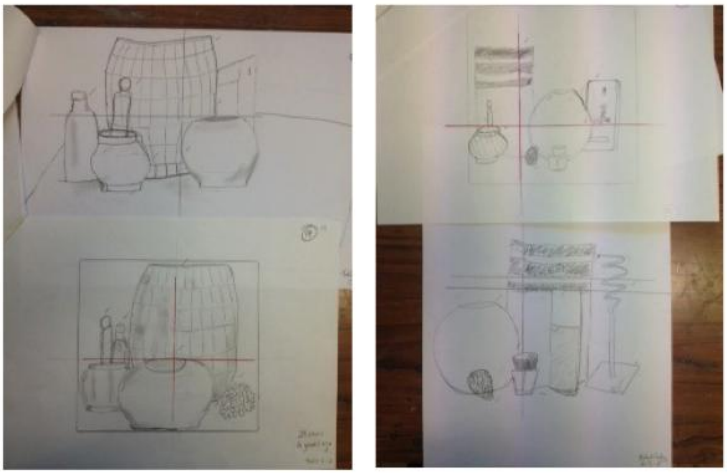


Figure 6.1 sample pre and post TEL drawings

This small-scale explorative case study concludes that TEL has positively impacted on participants' AP and RP *understanding, looking* and *measuring*. All but three of the opportunistic sample group scored higher in their second and post-TELE drawing. This correlates with the researcher's impressions and appraisals. He felt that the post TEL drawings were more confident with improved, or more definite line and shape (see figure 6.1). His qualitative comments (see appendix P) correlate well with the each participant's actual AP/ RP improvement. Post TEL, many participants depicted a better composition, incorporated axes to aid their drawing or drew better defined lines and shapes on the page. Post TEL drawings tended to be a little larger in scale also.

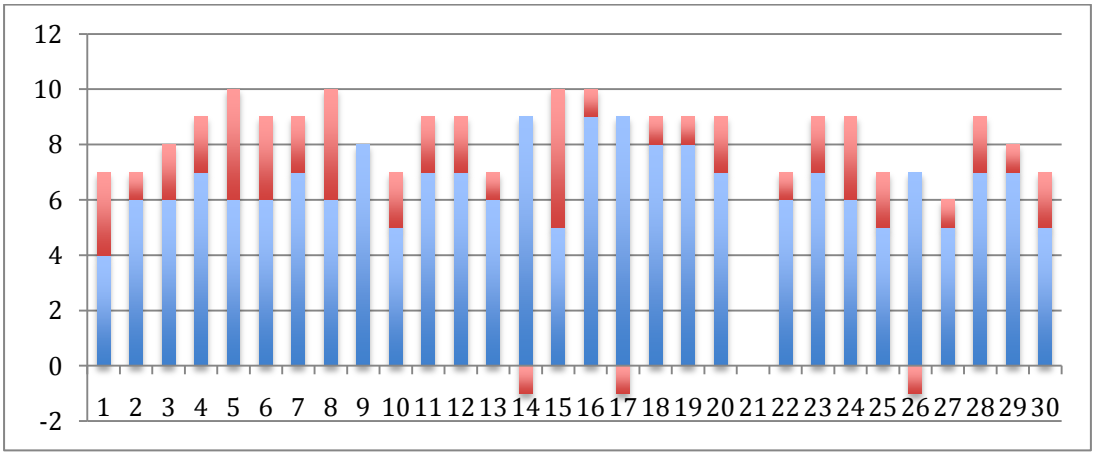


Figure 6.2 AP/RP scores of each participant (blue is the pre TEL AP/RP score and the red indicates the increase of decrease in post TEL score)

This study finds that the *actual* improvements in participants' AP/ RP attainment post TEL parallels participants' perceived AP/ RP drawing development as a consequence of the five phased TELE. Slightly fewer than three-quarters of the sample group thought that their drawing aptitude had improved a little having been presented with their pre and post-TELE drawings, the matching digital photographs and their pre TEL AP/ RP scores, (see figure 6.2). By this stage, they had experienced all five phases of the TELE concerning *drawing, understanding, applying, drawing* and *evaluating.* While self-appraisal of one's drawings is not new in teaching drawing, inviting novice drawers to analyse their work in a more systematic and specific manner enabled them to self assess their work and progress in a very particular way. In this case, the focus was on AP and RP attainment.

The questionnaire revealed that the majority of them think that the *Scratch*-based *understanding* and *application* TELE components aided their OD development (figures 6.3 & 6.4). TELE type one which entailed replicating a painting through resizing and repositioning was considered helpful by eighty per cent of the group (see figure 6.4). TELE type two which entailed practising sighting strategies on a digital still life photograph received even more positive feedback (see figure 6.5). Nearly everyone commented that it was helpful or very helpful. Of the three sighting strategies presented to, and practised by the participants, the **guide marker tool** received the most favourable responses. Interestingly, the researcher noticed that guide marking is a little more prominent in some of the post TEL still life drawings.

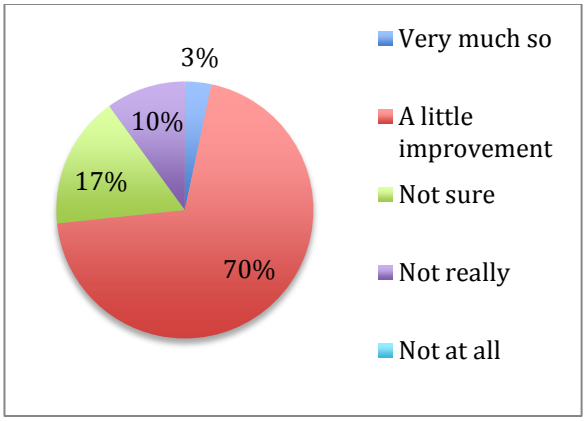


Figure 6.3 Participants' perceived level of improvement in OD

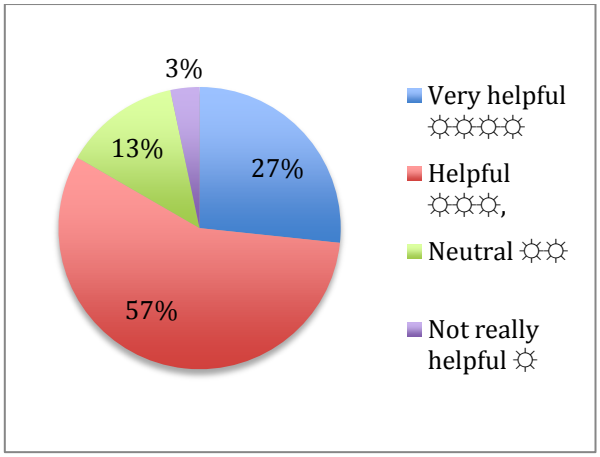


Figure 6.4 Participants' perceptions of TELE 1 impact on AP/RP

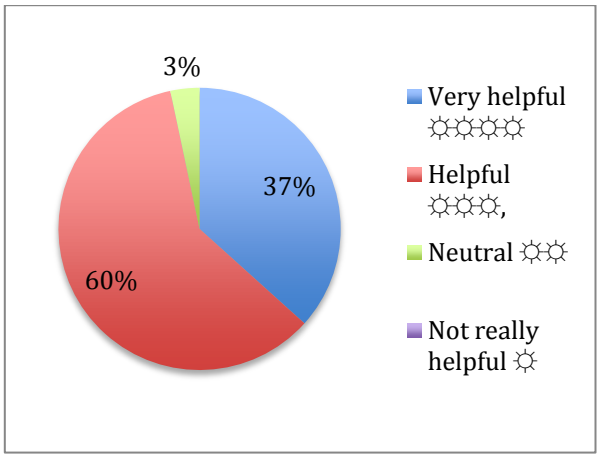


Figure 6.5 Participants' perceptions of TELE 2 impact on AP/ RP

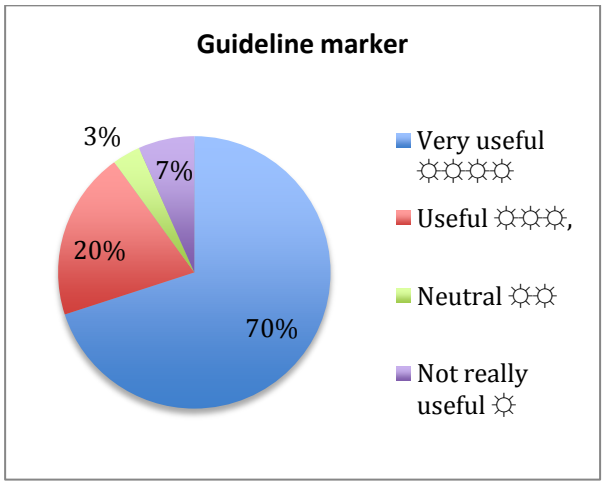


Figure 6.6 Participants' favourite sighting strategy tool

This research discovers that in addition to understanding, looking and measuring, TEL impacted positively on participants' dispositions towards OD (n24). Six participants specifically commented that TEL has increased their confidence in relation to OD while others (n4) wrote that they enjoyed OD more than before (see appendix O).

6.2 TELE effectiveness

This research finds that the TELE design deconstructed the complexity of observational drawing for the learners and thus enabled them to *understand* and *apply* sighting strategies to attain better AP and RP. The fact that everyone had the exact viewpoint in TELE type one and two meant that learners could pair, share and compare more readily and empathetically with one another or the teacher. This shared identical viewpoint appears to be one of the key affordances that technology could provide learners and that cannot be replicated in traditional teaching. Column five of table 6.1 summarises that TEL enhanced and progressed their learning about accurate placement and relative proportionality.

Table 6.1 TEL detailing the phase, learning component, related visual perceptual skills and impact on participants' AP/ RP understanding and application

TELE phase	Learning component	Concepts and skills	Visual-Percpetual skills	Impact
Phase one: Drawing	Draw from observation: A still life drawing Class discussion	Looking, holding and drawing	Fixation Discrimination Memory Form constancy Tracking Saccadic	
Phase two: Understanding	TEL 1: Replicate 'Sugar, salt and pepper' by Wayne Thiebaud Pair, share and compare Class discussion	Looking, holding and reconstructing painting by repositioning and resizing	Fixation Discrimination Memory Form constancy Saccadic	
	TEL 2: Replicate 'Roast beef dinner' by Wayne Thiebaud. Pair, share and compare Class discussion	Looking, holding and reconstructing painting by repositioning and resizing	Fixation Discrimination Memory Form constancy Saccadic	'Helpful' (n17) 'Very helpful' (n8)
Phase three: Applying	TEL 3: Examine a digital still life arrangement in relation to placement and proportionality Class discussion	Looking and measuring (sighting-strategies)	Fixation Form constancy Tracking Saccadic	'Helpful' (n11) 'Very helpful' (n 18)
Phase four: Drawing	Draw from observation: A similar still life drawing to phase one Class discussion	Looking, holding and drawing using sighting strategies	Fixation Discrimination Memory Form constancy Tracking Saccadic	Average score improved by 16.5%
Phase five: Evaluating	Self appraise their two drawings in relation to AP and RP Class discussion	Assessing their work in relation to AP and RP progress	Assessing their work in relation to AP and RP progress	'A little improvement' (n 21)

This research asserts that deconstructing the complex and demanding nature of observational drawing into more manageable learning components through TEL enabled learners to understand and apply that understanding more easily and effectively. Once the learners have acquired increased competence and confidence in relation to AP and RP, the art teacher could move onto another aspect of OD relating to tonal and textural variation for example.

Limitations of research

In order to obtain an in-depth analysis of a programme component, one needs to collect 'detailed information using a variety of data collection procedures over a sustained period of time' (Creswell, 2014, p. 14). OD is a practice that takes practise and so not having the time to evaluate the gradual and more subtle signs of AP/ RP improvement across a wider and longitudinal spread of portfolio pieces somewhat limits the significance of the study's findings. The findings relate to one particular context. Making generalisations or presumptions of similar outcomes from other contexts would be unwise.

This study had no control group and so one cannot conclude for certain that TELE components alone accounts for the *actual* or *perceived* AP/RP improvement. Perhaps the face-to-face drawing and evaluating components progress understanding and application also. There was a missed opportunity not to have obtained far greater numbers of screen prints of participants' completed TEL tasks so that the researcher could analyse their progress. The researcher presumed that they had installed and could access their email in the computer lab. While he researcher created all the scripting coding himself, his technological knowledge of the breath and range of other possible software that could have been used instead of *Scratch* was quite limited. Therefore, there could be other more appropriate software or applications that might have yielded even more positive results.

6.3 Recommendations from investigation

This study discovers that TEL can positively impact on AP and RP aptitudes in relation to understanding and application of sighting strategies. It cannot assert what specific visual perceptual skills have improved as a consequence of such engagement. Table 6.1 outlines the range of visual-perceptual skills most likely exercised at each stage. It recommends that should be further, deeper and longer research undertaken. If one believes that learning to see better enables one to draw better, then this concerted looking which exercises many

visual perceptual skills relating to discrimination, memory, tracking, form constancy, fixation and saccadic visual skills will benefit other *looking-holding-responding* actions and undertakings also. Perhaps the value of this small piece of research is not so much related to it findings concerning AP and RP development, but rather it signals the potential of TEL in enabling us to see.

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Appendix A: Stages of drawing development

The scribbling stage (age two to four years of age)

- Random marking
- Not looking while drawing
- Whole arm action
- Marks representing events or passages of movement through time and space
- Action representations such as stabbing, banging and slapping

The pre-schematic stage (four to seven years of age)

- Naming drawn objects
- Modfifying, editing or refining shapes
- Psychological perspective (size and placement is based on importance)
- Rotation of page while drawing resulting in multiple perspectives
- Random placement of objects
- More detail of certain body parts more than others
- Exaggerated proportions

The Schematic stage (seven to nine years)

- Repetition of specific learnt shapes
- Attention paid to detail and pattern
- Exaggeratiion and disproportion still evident
- The use of base lines to structure drawing
- Evidence of x-ray drawing
- Simulataneous representation of plan and elevation

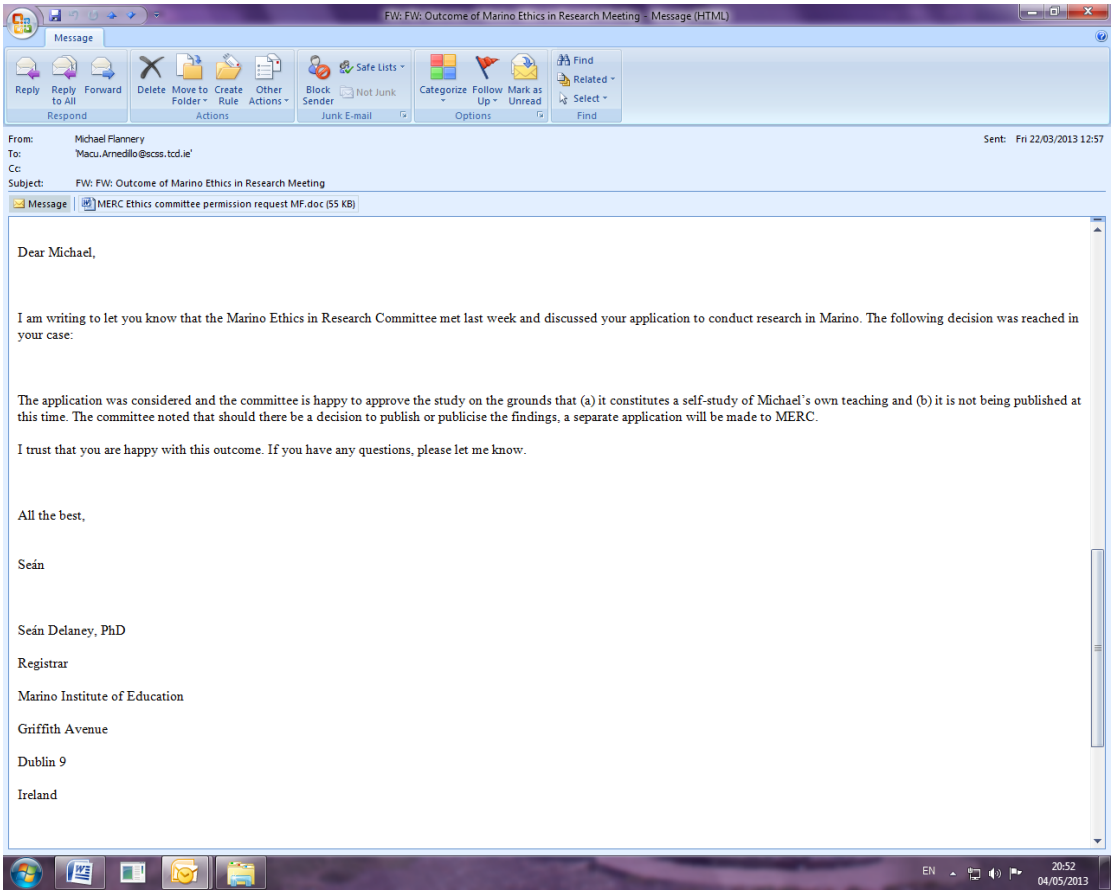
The Gang stage (Nine to twelve years)

- Emergence of dawning visual realism
- Increased awareness of their environment
- Understanding and application of learned spatial drawing conventions to re-present 3D objects on a 2D plane
- Disappearance of the base line
- Overlapping and oclusion of objects
- Less distortion and exaggeration

Appendix B: Stages of drawing development

1. Experimentation and experience of materials and tools (from eighteen months upwards into adulthood)
2. Symbolic interpretation (from three years to eight years of age but can continue into adulthood as a valid option for communication and expression)
3. Predominantly symbolist approach but with some visual analytical approaches adopted in parts of the work (mainly from five to twelve years of age)
4. Predominantly analytical approach (from seven years of age into adulthood) in this mode, the need for visual realism is paramount, but symbolist overtones can still pervade
5. Analytical approach (from seven years of age onwards) This mode is characterised by visual realism based on personal experiences

Appendix C: Screen-print of ethical approval from MERC and SCSS



FW: FW: Outcome of Marino Ethics in Research Meeting - Message (HTML)

Message

Reply | Reply to All | Forward | Delete | Move to Folder | Create Rule | Other Actions | Block Sender | Safe Lists | Not Junk | Categorize | Follow Up | Mark as Unread | Find | Related | Select

Respond | Actions | Junk E-mail | Options | Find

From: Michael Flannery
To: 'Macu.Arnedillo@scss.tcd.ie'
Cc:
Subject: FW: FW: Outcome of Marino Ethics in Research Meeting
Sent: Fri 22/03/2013 12:57

Message | MERC Ethics committee permission request MF.doc (55 KB)

Dear Michael,

I am writing to let you know that the Marino Ethics in Research Committee met last week and discussed your application to conduct research in Marino. The following decision was reached in your case:

The application was considered and the committee is happy to approve the study on the grounds that (a) it constitutes a self-study of Michael's own teaching and (b) it is not being published at this time. The committee noted that should there be a decision to publish or publicise the findings, a separate application will be made to MERC.

I trust that you are happy with this outcome. If you have any questions, please let me know.

All the best,

Seán

Seán Delaney, PhD

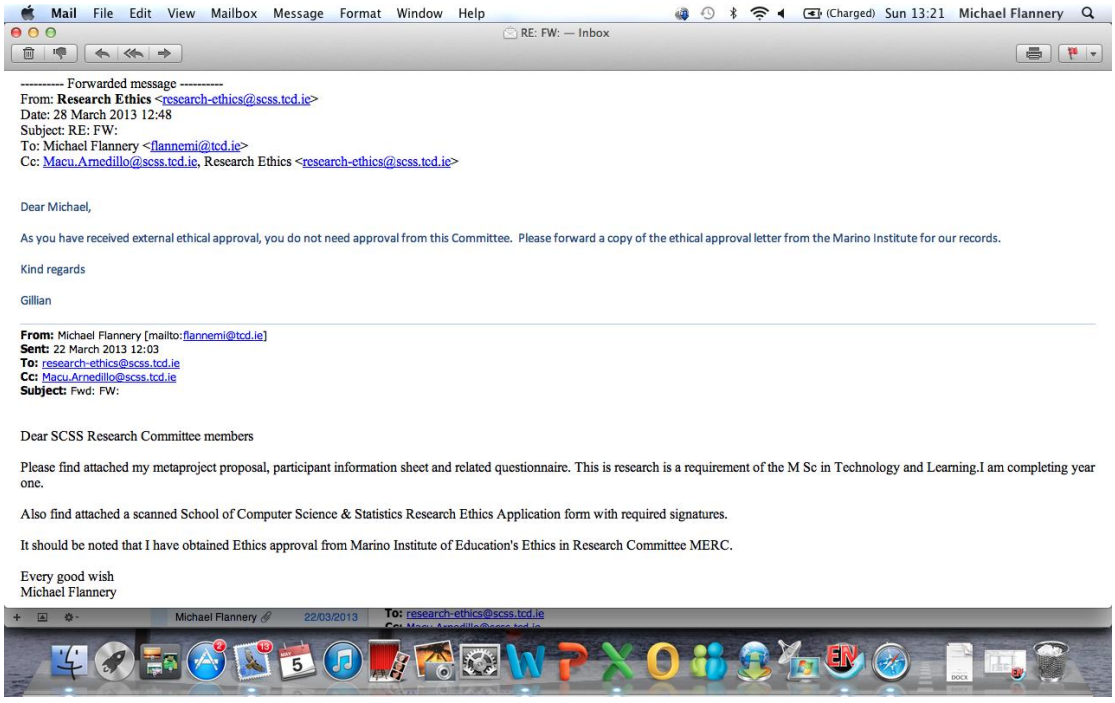
Registrar

Marino Institute of Education

Griffith Avenue

Dublin 9

Ireland



Mail File Edit View Mailbox Message Format Window Help (Charged) Sun 13:21 Michael Flannery

RE: FW: — Inbox

---------- Forwarded message ----------
From: **Research Ethics** <research-ethics@scss.tcd.ie>
Date: 28 March 2013 12:48
Subject: RE: FW:
To: Michael Flannery <flannemi@tcd.ie>
Cc: Macu.Arnedillo@scss.tcd.ie, Research Ethics <research-ethics@scss.tcd.ie>

Dear Michael,

As you have received external ethical approval, you do not need approval from this Committee. Please forward a copy of the ethical approval letter from the Marino Institute for our records.

Kind regards

Gillian

From: Michael Flannery [mailto:flannemi@tcd.ie]
Sent: 22 March 2013 12:03
To: research-ethics@scss.tcd.ie
Cc: Macu.Arnedillo@scss.tcd.ie
Subject: Fwd: FW:

Dear SCSS Research Committee members

Please find attached my metaproject proposal, participant information sheet and related questionnaire. This is research is a requirement of the M Sc in Technology and Learning.I am completing year one.

Also find attached a scanned School of Computer Science & Statistics Research Ethics Application form with required signatures.

It should be noted that I have obtained Ethics approval from Marino Institute of Education's Ethics in Research Committee MERC.

Every good wish
Michael Flannery

Michael Flannery 22/03/2013 To: research-ethics@scss.tcd.ie

Appendix D: Copy of participant information/ participation sheet

Title: Exploring Technology-mediated learning experiences to teach and assess learners' observational drawing skills in relation to relative positioning and proportionality

Participant Information sheet

Researcher: Michael Flannery PhD
Supervisor: Prof. Inmaculada Arnedillo-Sánchez

Background of research:

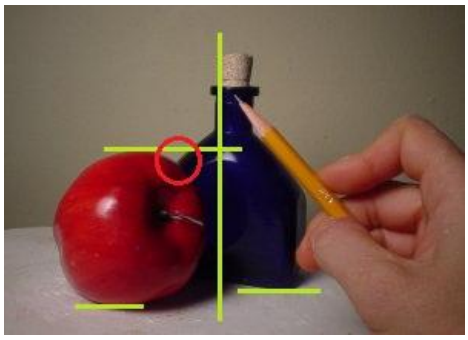


Figure 1: Seeing, processing and depicting accurate placement and relative proportionality

Drawing represents far more than a technical skill than merely putting marks on to paper. Two fundamental skills and related concepts concern seeing, processing and depicting accurate proportions and relative placement of objects onto the page (see figure 1). This research explores whether technology mediated learning experiences (TMLE) can improve this ability. It explores whether TMLE can improve your ability to identify, measure and replicate proportions and placement of objects with greater accuracy.

Procedures of this study:

Participants/ respondents will

1. Complete an intervention comprising of technology mediated learning experiences (TMLEs) that are part of Visual Arts Education module content
    a. Drawing two still life drawings (one before and one after TMLE intervention)
    b. Completing two *Scratch* based TMLEs
        i. Placing and resizing still life components from the paintings *Sugar, Salt and Pepper* and *Roast Beef Dinner* by Wayne Thiebaud
        ii. Completing sighting measurements of a still life composition
2. Optional anonymous written survey: Volunteer participants will complete a twenty minute survey
3. Optional Focus group interview: Volunteer participants will share further perspectives regarding any emerging findings ascertained from the questionnaire or to elicit more perspectives regarding the research.

While completion of part one is part of the module design for visual arts education, participation in the survey, group interview and giving consent to analyse their digital artwork is completely voluntary. Participants can withdraw from the research at any time before May 1st 2013. There will be no penalties or repercussions as a consequence for either

non-participation or withdrawal at any stage before May 1st 2013. If you decide to withdraw, all related information would be removed. Simply email me at michael@mie.ie with your pseudonym and we will take the necessary steps to remove all related data.

Publication:

The results of this research will be part of an assessment component for a Masters in Technology and Learning at the Department of Computer Science and Statistics at Trinity College Dublin. All participants will be contacted should findings be presented or published elsewhere.

Possible conflict of interest:
While the assessment will be marked anonymously, it should be noted that the researcher will not be marking the assessments. Other lecturers of this module will mark them. Non-participation in the research will not affect quality of module engagement.

Declaration:

1. I am 18 years or older and am competent to provide consent.
2. I have read, or had read to me, a document providing information about this research and this consent form. I have had the opportunity to ask questions and all my questions have been answered to my satisfaction and understand the description of the research that is being provided to me.
3. I agree that my data is used for scientific purposes and I have no objection that my data is published in scientific publications in a way that does not reveal my identity.
4. I understand that if I make illicit activities known, these will be reported to appropriate authorities.
5. I freely and voluntarily agree to be part of this research study, though without prejudice to my legal and ethical rights.
6. I understand that I may refuse to answer any question and that I may withdraw at any time without penalty.
7. I understand that my participation is fully anonymous and that no personal details about me will be recorded.

Participant's name: _____

Participant's signature: _____

Date: _____

Statement of investigator's responsibility: I have explained the nature and purpose of this research study, the procedures to be undertaken and any risks that may be involved. I have offered to answer any questions and fully answered such questions. I believe that the participant understands my explanation and has freely given informed consent.

Researchers' contact details:
Michael Flannery
Phone 01-8057727
Email michael@mie.ie

Investigator's signature: _____ Date _____

Appendix E: Copy of instructions to replicate paintings

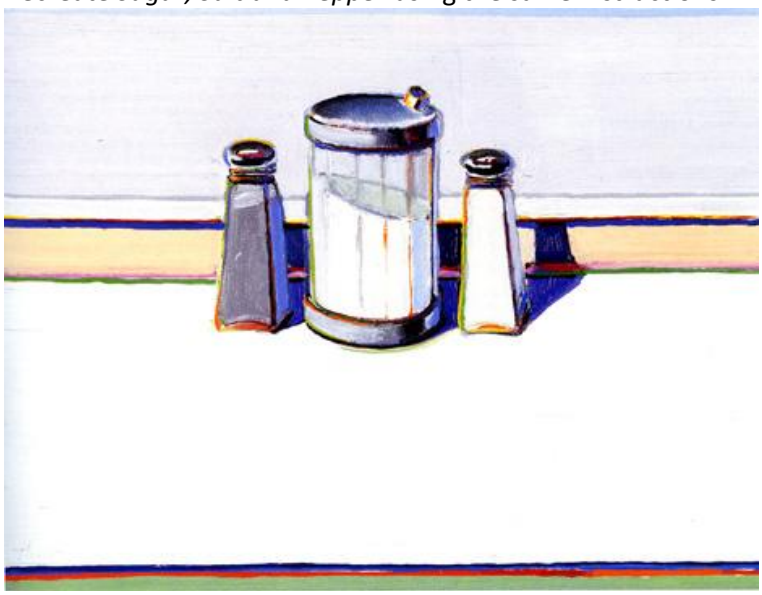
TMLE 1: Resizing and placing

Recreate *Roast Beef Dinner* using the instructions provided

- Click on object to activate it
- Click on arrow buttons to move object
- Click on l or r keys to rotate left or right
- Click on i or d keys to increase or decrease size of object
- Click on e key to deactivate object before moving onto another

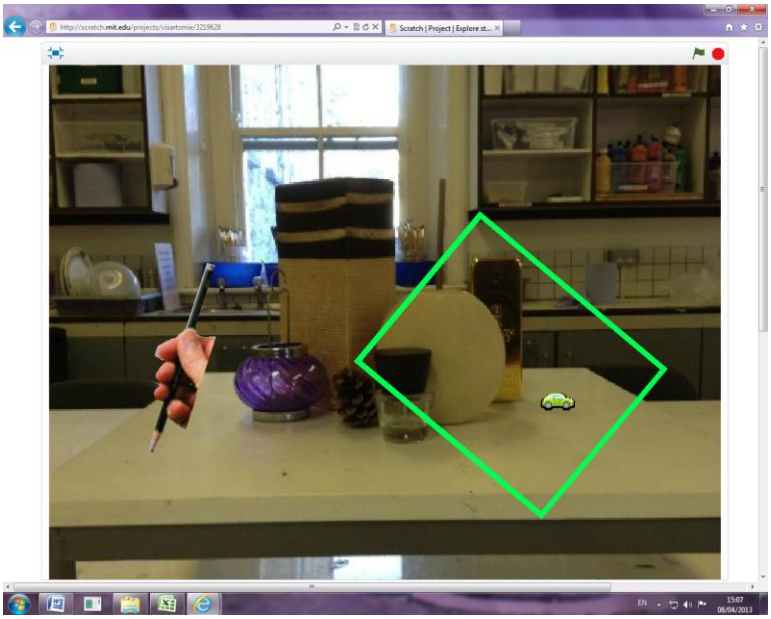
If possible screen print with ctrl and PrtScn keys to copy and paste in an email to michael@mie.ie

Recreate *Sugar, Salt and Pepper* using the same instructions



TMLE 2: Sighting exercises

Appendix F: Copy of instructions to apply sighting strategies



Move and resize the viewfinder to capture an appropriate view of still life

- Arrow keys to move viewfinder
- l and r keys to rotate viewfinder
- i and d keys to increase r decrease viewfinder
- e to exit and fix viewfinder

Move car and mark the midpoint, high low or side points of importance using the car

- Arrow keys to move car
- l and r keys to rotate car
- m key to mark
- c key to clear all guidelines
- e to exit and deactivate car

Sight measure and record the still life using the top of pencil to thumb

- Height of still life
- Width of still life
- Height of glass lantern
- Width of glass lantern
- Height of rectangular vase
- Width of rectangular vase
- Height of spherical candle holder
- Height of front aftershave bottle
- Height of metallic aftershave container
- Height from front of table to back of table
- Height of back window pane
- Height of observable sweeping brush stick
- Height of your viewfinder
- Width of your viewfinder

Appendix G: Copy of questionnaire *(layout adjusted for thesis)*

Dear participant, over the past number of weeks, you completed some technology mediated learning experiences (TMLEs) that were designed to ascertain, improve and self assess your ability to see, measure and depict accurate placement and relative proportionality of observed still components in relation to the whole composition. I would like to ascertain your perspectives regarding these TMLEs as part of my studies in Technology and Learning.

If you have further queries regarding this study, please feel free to email me (Dr. Michael Flannery) at michael@mie.ie or phone me at 01 8057727. This questionnaire should take no more than twenty minutes.

Please tick that you have read, understood, signed and received a signed copy of the participant consent form.

Advanced thanks for giving of your time to share your perspectives in relation to this study.

Please create and write a pseudonym below for questionnaire retrieval purposes only: This is so we can retrieve your data should you wish to withdraw at any time before May 1st

It should be noted that I have obtained ethics approval from Marino's Ethics in Research Committee and subsequent to that ethical approval from the School of Computer Science and Statistics at the University of Dublin, Trinity College. This research is a partial requisite of a Masters degree n Technology and Learning.

General background:

1. Class group
2. Gender
3. Drawing: Do you draw or paint as a hobby? If yes, please explain further.
4. Scratch: Have you encountered 'Scratch' before? If yes, please explain further.
5. Critical Studies: Do you visit gallery exhibitions? If yes, please explain further.
6. How do you rate your ability to draw from observation? Please circle one of the following and explain further. Excellent, very good, good, adequate, weak

7. Drawing has been described as a looking, holding (those observations) and drawing (those observations) process. In light of that description, which area do you find most challenging if at all? Please elaborate.

Appraising your observational drawing prior to and following TMLEs

8. Please take a look at your two observational still life drawings. You completed one before the TMLE programme and one afterwards. Do you think that your drawing ability has improved in anyway? Please circle one of the following and explain further.

Very much so, a little improvement , not sure, not really, not at all

9. Please compare your two observational drawings in relation to their digital photographs. Do you think that your drawing has improved in relation to accurate placement of still life components? Please circle one of the following and explain further.

Very much so, a little improvement , not sure, not really, not at all

10. Please compare your two observational drawings in relation to their digital photographs. Do you think that your drawing has improved in relation to relative proportionality of still life components? Please circle one of the following and explain further.

Very much so, a little improvement , not sure, not really, not at all

Recalling and critiquing each TMLE: Kindly recall and rate how beneficial each TMLE listed below by circling the most relevant descriptor in terms of how you think they developed your drawing skills in relation to accurate positioning and relative proportionality. Please detail further in the adjacent column.

11. Drawing from observation an inverted and black and white version of *Three machines* by American artist Wayne Thiebaud.	Very helpful ☼☼☼☼☼ Helpful ☼☼☼ Neutral ☼☼ Not really helpful ☼	
12. Completing the *Scratch* based TMLE entailing positioning and resizing the compositional components of Wayne Thiebaud's Sugar, Salt and Pepper as accurately as in the original painting.	Very helpful ☼☼☼☼☼ Helpful ☼☼☼ Neutral ☼☼ Not really helpful ☼	
13. Completing the Scratch based TMLE entailing positioning and resizing the compositional components of Wayne Thiebaud's Roast Beef Dinner as accurately as in the original painting.	Very helpful ☼☼☼☼☼ Helpful ☼☼☼ Neutral ☼☼ Not really helpful ☼	

Recalling and critiquing each TMLE: Kindly recall and rate how beneficial each TMLE listed below by circling the most relevant descriptor in terms of how you think they developed your drawing skills in relation to accurate positioning and relative proportionality. Please detail further in the adjacent column.

14. Completing the *Scratch* based TMLE entailing establishing an appropriate viewpoint, locating the midpoint, marking guidelines and taking comparative measurements before drawing it from observation.	Very helpful ☼☼☼☼☼ Helpful ☼☼☼☼ Neutral ☼☼ Not really helpful ☼	

Following on from question 14, please rate each tool and explain that rating.

15. How useful was the digital viewfinder?
Very useful, Kind of useful, Not really useful, Not useful at all

16 How useful was the marking tool?
Very useful, Kind of useful, Not really useful, Not useful at all

17. How useful was the measuring tool?
Very useful, Kind of useful, Not really useful, Not useful at all

Your opinion is valued and appreciated.

18. What other ways do you think technology could develop drawers' observational drawing ability? Please elaborate.

19. Has the TMLE changed your understanding of drawing process in any way? Please explain.

20. Has the intervention changed your disposition towards drawing in anyway? Please elaborate.

Thank you for taking the time out to complete the questionnaire

Appendix H: General information about participants

Respondent	Gender	Drawing	Scratch	Gallery
1	F	No	No	No
2	F	No	No	No
3	F	No	No	No
4	F	No	No	Yes
5	M	No	In class	No
6	M	No	No	No
7	F	No	No	No
8	F	No	No	No
9	F	No	No	Not really
10	F	No	No	No
11	F	No	N/A	Holidays
12	F			
13	F	No	No	No
14	F	Yes	In class	When away
15	F	No	Yes	No
16	F	No	No	No
17	M	No	No	Yes
18	F	No	No	Yes
19	F	No	No	No
20	F	Occasionally	No	Yes
21	F	Yes	No	Yes
22	F	No	No	No
23	F	No	No	Yes
24	F	No	No	No
25	M	No	Yes	No
26	F	No	No	Yes
27	F	No	No	No
28	F	Yes	No	Yes
29	F	No	No	No
30	F	No	No	Rarely

Appendix I: Participants' perceptions regarding their OD ability

Respondent	Level	Looking	Holding	Drawing
1	Adequate		Holding	
2	Adequate		Holding	
3	Adequate		Holding	
4	Adequate			Drawing
5	Good			
6	Adequate			Drawing
7	Adequate		Holding	
8	Adequate	Measuring		
9	Adequate		Holding	
10	Weak	Looking		
11	Adequate			Drawing
12	Adequate		Holding	
13	Adequate			Drawing
14	Good		Holding	
15	Adequate			Drawing
16	Good			Drawing
17	Good		Holding	
18	Good		Holding	
19	Very good		Holding	
20	Good	Looking	Holding	Drawing
21	Good			
22	Weak		Holding	Drawing
23	Good		Holding	
24	Weak			Drawing
25	Adequate		Holding	
26	Weak			Drawing
27	Weak			Drawing
28	Adequate		Holding	
29	Good	Looking		
30	Adequate		Holding	

Appendix J: Participants' AP/RP scores

Participant	Still life 1 score	Still Life 2 score	Perceived drawing Level	Perceived difficulty with Drawing	Score Difference Between still life drawings
1	4	7	Adequate	Holding	3
10	5	7	Adequate	Holding	1
15	5	10	Adequate	Holding	2
25	5	7	Adequate	Drawing	2
27	5	6	Good		4
30	5	7	Adequate	Drawing	3
2	6	7	Adequate	Holding	2
3	6	8	Adequate		4
5	6	10	Adequate	Holding	0
6	6	9	Weak	Looking	2
8	6	10	Adequate	Drawing	2
13	6	7	Adequate	Holding	2
22	6	7	Adequate	Drawing	1
24	6	9	Good	Holding	-1
4	7	9	Adequate	Drawing	5
7	7	9	Good	Drawing	1
11	7	9	Good	Holding	-1
12	7	9	Good	Holding	1
20	7	9	Very good	Holding	1
23	7	9	Good	Hold/Draw	2
26	7	6	Good		0
28	7	9	Weak	Hold/Draw	1
29	7	8	Good	Holding	2
9	8	8	Weak	Drawing	3
18	8	9	Adequate	Holding	2
19	8	9	Weak	Drawing	-1
14	9	8	Weak	Drawing	1
16	9	10	Adequate	Holding	2
17	9	8	Good	Looking	1
21	Absent	7	Adequate	Holding	2

Appendix K: Participants' perspectives regarding TELE 1 and TELE 2

Participant	Any perceived difference in drawing aptitude?	Any perceived improvement in accurate placement?	Any perceived improvement in relative proportionality?
1	A little improvement	A little improvement	A little improvement
2	A little improvement	A little improvement	A little improvement
3	A little improvement	A little improvement	A little improvement
4	A little improvement	A little improvement	Very much so
5	Not sure	Note sure	A little improvement
6	A little improvement	Note sure	A little improvement
7	A little improvement	A little improvement	Not really
8	Not sure	Note sure	Not sure
9	A little improvement	Note sure	Not sure
10	A little improvement	A little improvement	Not sure
11	Not sure	A little improvement	A little improvement
12	A little improvement	A little improvement	Not sure
13	Not really	A little improvement	Not really
14	A little improvement	Note sure	A little improvement
15	A little improvement	A little improvement	Not really
16	A little improvement	A little improvement	A little improvement
17	Not sure	A little improvement	A little improvement
18	A little improvement	Note sure	A little improvement
19	Very much so	Very much so	A little improvement
20	Not sure	Note sure	Not really
21	Not really	Note sure	Not sure
22	A little improvement	Very much so	Very much so
23	A little improvement	A little improvement	Not sure
24	Not really	A little improvement	Not sure
25	A little improvement	A little improvement	A little improvement
26	A little improvement	A little improvement	A little improvement
27	A little improvement	A little improvement	Not sure
28	A little improvement	A little improvement	A little improvement
29	A little improvement	A little improvement	A little improvement
30	A little improvement	A little improvement	A little improvement

Appendix L: Perceptions regarding helpfulness of TELEs regarding OD

Participant	TMLE 1 Sugar, salt and Pepper	TELE 1 Roast Beef Dinner	TELE 2 Still life sighting
1	Very helpful	Very helpful	Very helpful
2	Helpful	Neutral	Very helpful
3	Neutral	Helpful	Helpful
4	Helpful	Very helpful	Helpful
5	Helpful	Helpful	Very helpful
6	Very helpful	Very helpful	Helpful
7	Neutral	Helpful	Very helpful
8	Helpful	Very helpful	Helpful
9	Helpful	Helpful	Neutral
10	Helpful	Very helpful	Very helpful
11	Very helpful	Very helpful	Very helpful
12	Helpful	Helpful	Helpful
13	Helpful	Helpful	Helpful
14	Helpful	Helpful	Very helpful
15	Very helpful	Very helpful	Very helpful
16	Helpful	Helpful	Helpful
17	Helpful	Helpful	Helpful
18	Helpful	Helpful	Helpful
19	Helpful	Not very helpful	Very helpful
20	Neutral	Helpful	Helpful
21	Helpful	Helpful	Helpful
22	Helpful	Helpful	Helpful
23	Very helpful	Very helpful	Very helpful
24	Not really helpful	Neutral	Helpful
25	Very helpful	Helpful	Helpful
26	Helpful	Neutral	Helpful/ V helpful
27	Helpful	Neutral	Helpful
28	Very helpful	Very helpful	Very helpful
29	Helpful	Helpful	Helpful
30	Helpful	Helpful	Neutral

Appendix M: Participants' perceptions regarding TELE 2 marking tools

Respondent	Viewfinder	Marking tool	Measuring tool
1	Kind of useful	Very useful	Very useful
2	Kind of useful	Very useful	Very useful
3	Kind of useful	Kind of useful	Very useful
4	Kind of useful	Kind of useful	Kind of useful
5	Kind of useful	Kind of useful	Not ticked
6	Not really useful	Very useful	Very useful
7	Very Useful	Very useful	Very useful
8	Kind of useful	Not useful at all	Very useful
9	Kind of useful	Very useful	Kind of useful
10	Kind of useful	Very useful	Very useful
11	Very Useful	Very useful	Very useful
12	Kind of useful	Very useful	Very useful
13	Very Useful	Kind of useful	Not useful at all
14	Very Useful	Very useful	Very useful
15	Very Useful	Kind of useful	Kind of useful
16	Very Useful	Very useful	Not useful at all
17	Kind of useful	Very useful	Kind of useful
18	Very Useful	Very useful	Very useful
19	Very Useful	Very useful	Not useful at all
20	Very Useful	Very useful	Not useful at all
21	Kind of useful	Very useful	Very useful
22	Kind of useful	Not useful at all	Kind of useful
23	Kind of useful	Very useful	Very useful
24	Kind of useful	Very useful	Not really useful
25	Kind of useful	Very useful	Very useful
26	Kind of useful	Very useful	Not really useful
27	Very Useful	Very useful	Not really useful
28	Very Useful	Very useful	Very useful
29	Very Useful	Blank	Very useful
30	Very Useful	Kind of useful	Kind of useful

Appendix N: TEL impact on participants' understanding of OD

Respondent	Comments relating to **measuring**
1	More aware of helpful [sighting] mechanisms
2	I am more aware and able to position objects when drawing still life
3	It has taught me to measure objects and proportion them on my page
17	Taught me to work with lines more
19	The strategies are very useful and has given me more direction when approaching drawing
24	The straight lines have helped a bit I think
25	Helped [with] positioning techniques and to size up painting efficiently (help from Michael)
30	It has helped me with sizing objects and [ensuring] each object was in some sort of proportion with each other

Respondent	Comments relating to **improved looking**
23	It has helped me to look at still life in a different way…to look at the relationship between objects
6	Made me focus more on line and comparison.
9	It makes you more aware of size and objects size/ position in the photo
10	I now notice things I would not have noticed before
13	It has made me see…what I see in front of me…angles become more important…objects in relation to each other
18	I think it will help with looking at lines in drawing
20	It has allowed me to see different objects are different sizes and appreciate that more in my still life [drawing]
21	It has helped me to think about positioning a little more and to look for repeat pattern in lines
27	Makes me think about proportion, finding [guide] lines in the background very helpful

Respondent	Comment relating to **improved understanding**
5	Think and understand proportion and components of art and observation
7	I understand that there is a process you can use to help drawing
14	Made me realise how important proportion is in depicting the accuracy of a picture
16	It has broken it down and made drawing easier for me
22	It broke down the steps to drawing process
29	Given me an easier breakdown to do a drawing. Better understanding of how to do a drawing

Appendix O: TEL impact on participants' disposition towards OD

Respondent	Question 20: Has the intervention changed your disposition towards drawing in any way?	Code
1	Opened my eyes to spatial awareness and different [guide] lines of support	A
2	I am more confident in my ability to draw	C
3	I feel [still life drawing] is more approachable now and I wouldn't be as inclined to avoid it now	C
4	Blank	
5	Have definitely become more interested in art	I
6	I feel more confident drawing and representing still life	C
7	I don't feel as bewildered…and now believe I could achieve a good, well measured still life picture	C
8	I feel I am getting a better understanding of depth, space and height	U
9	Blank	
10	Drawing has become a little more enjoyable	E
11	I feel more confident and understand what to do and why. It…helps explain the process	C &U
12	It is more enjoyable knowing that there are different skills to use	E
13	I am more aware, therefore I am worse	A
14	To take more time to look closely	U
15	More enjoyable	E
16	It has improved my view of drawing [disposition]	E
17	I guess I am leaning towards embracing technology in art more	IT
18	It helped me to look at base lines/ proportional lines and how to use these to place objects and become more accurate	S
19	I have a more positive approach to drawing and more confident in positioning and resizing	C
20	I have seen [I am noting] sizing in different ways	U
21	I don't know if it has hindered me or not…I don't know if I am [now] paying too much attention to positioning than the detail I like to pay attention to is suffering	
22	I am better prepared to draw- breaking it down and spatial awareness	S
23	It has made me focus on breaking up drawing into a number of smaller tasks before drawing	S
24	Blank	
25	More interest and understanding (group conversations very helpful)	I & U
26	I have probably subconsciously drawn from the IT classes [TMLEs]	
27	Made me more critical of my own drawing but gives me direction	S
28	Blank	
29	Yes it [has]	
30	I prefer drawing but it has helped me with sizing	S

C = Increased confidence, E = Greater enjoyment, I = Greater interest, S = Skills development,
U = greater understanding

Appendix P: Researcher's observation of post TEL drawing

participant	Researcher's observation of post TEL drawing
1	*Maintained one fixed viewpoint*
2	*Better form and composition*
3	*Much better axis*
4	*Awareness of background*
5	*More complete drawing*
6	*Better framing of composition*
7	*Better defined shape and form*
8	*Better defined shape and form*
9	*Better defined shape and form*
10	*Better composition*
11	*Better defined shape and form*
12	*Better framing of composition*
13	*Attained one fixed viewpoint*
14	*Base line too high on page*
15	*More complete drawing*
16	*Cleaner lines*
17	*Less complete*
18	*Better form and composition*
19	*More complete drawing*
20	*Managed more complex viewpoint*
21	*Only one drawing completed*
22	*Less complete but better shape and form*
23	*Less complete but better shape and form*
24	*Better framing of composition*
25	*Better form and composition*
26	*Less complete but better shape*
27	*Managed more complex viewpoint*
28	*Better form and composition*
29	*Better composition*
30	*Better defined shape and form*