

Posters That Teach – Blended Learning and Total Engagement

Adina Stan, UNSW Global Foundation Studies, Australia

Mahnaz Armat, UNSW Global Foundation Studies, Australia

Elysabeth Leigh, Aalto University, Finland & University of Technology
Sydney, Australia

Elizabeth Rosser, UNSW Global Foundation Studies, Australia

Nikki Hayes UNSW Global Foundation Studies, Australia

Abstract

Electronically mediated technologies are prohibited from use in a major assessment component of a blended learning subject. This subject employs a multidisciplinary problem-based approach to explore international issues and perspectives using a rich blend of face-to-face, electronically mediated, individual and team-based activities. The assessment is a role-play which occurs during the second half of a year-long pathway to university program. Belief in the importance of helping students integrate knowledge with an understanding of learning strategies informs the design of this particular assessment task. To complete the task, small teams develop and display a hand-drawn poster summarising their understanding of a real life 'wicked problem' explored in depth during the semester. Composing and preparing their poster ensures that students create visual evidence of their learning about the context of a complex contemporary international issue, which varies from year to year. It also introduces students to higher order thinking and develops critical and creative thinking skills.

This paper aims to introduce and describe the learning principles informing the design of the assessment strategy. The task compels students to question information, seeking deeper engagement with data and generating first-hand engagement with the issue. The learning design also facilitates students' crucial skills of knowledge generation and learning management, and helps them apply this knowledge to other aspects of their future learning. This task bridges the gap between the technical and non-technical skills essential for success in the 21st century.

Keywords: role-play; visual literacy; blended learning; wicked problem.

Introduction

What Are These Posters That Teach?

They are hand-drawn by teams of 4 to 5 students, who work collaboratively to investigate and solve wicked problems in International Issues and Perspectives, an interdisciplinary, problem-based subject at UNSW Foundation Studies, which is a university pathway program. The posters represent one element of a more complex learning assessment, which takes the form of an extended role-play. Teams have one week to prepare their poster. The most prominent feature of these posters is that they are hand-drawn, and no electronically mediated technology is allowed for the production of the posters. This is especially challenging as all the activities that contribute to the development of the learners' knowledge leading up to and following this task are underpinned by a blended learning approach (Torrise & Drew, 2013).

This paper builds on a previous analysis of the same activity presented at the Asian Conference on Technology in the Classroom 2017, Kobe, Japan by the same authors (papers.iafor.org/papers/actc2017/ACTC2017_34873.pdf). We have reviewed our ideas taking into account a broader range of literature as well as our own discussions and reflections following the conference. This paper aims to argue that the role-play contextualization of the poster stimulates active learning by framing collaboration, divergent thinking and convergence of meanings. At the same time, the collaborative hand drawing of the poster in the absence of electronically mediated technology has a deeper impact on the quality and complexity of student engagement, knowledge construction and originality of expression.

Why a *Role-Play* Instructional Design? A Literature Review

According to Kariel (1977), experiential learning can generate tensions which can only be resolved by “becoming alive to new ways of seeing the world” (p. 61).

Over the years, the terms role-plays, simulations and games have been used interchangeably in the education literature to refer to “active learning exercises that seek to deepen students' conceptual understanding of a particular phenomenon, set of instructions, or sociopolitical process by using student interaction to bring abstract concepts to life” (Krain & Shadle, 2006, p. 4). According to Sutcliffe (2002), these exercises provide learners with an imaginary or real world within which to act out a given situation. Sutcliffe (2002) goes on to explain that “remote theoretical concepts can be given life by placing them in a situation with which students are familiar” (p. 3).

Active learning is an approach that shifts pedagogy from a teacher-centred instruction to a student-centred (even teacherless) learning paradigm whose aim is to create experiential learning environments that bring learners to discover, construct knowledge and problem solve for themselves (Barr & Tag, 1995). Gardner (1991) has called this ‘education for understanding’ because it facilitates “a sufficient grasp of concepts, principles, or skills so that one can bring them to bear on new problems and situations, deciding in which ways one's present competencies can suffice and in which ways one may require new skills or knowledge” (p.18). Fox and Ronkowski (1997) show that active learning enhances learner involvement with and comprehension of abstract concepts while simultaneously facilitating skill development. Furthermore, Jensen (1998) suggests that an active learning approach makes learning more engaging and memorable while Krain and Nurse (2004) show that active learning can make issues more real, more ‘human’ to the learners.

Given the variety of uses of the terms role-plays, simulations and games in education literature, some scholars attempt to draw distinctions between them. According to Krain and Shadle (2006), simulations place learners “within a reasonable representation of a real environment within which political or social interactions occur” (p. 52). They involve mainly structured interactions revolving around negotiations, policy-making or decision-making processes as can be seen in the negotiations of treaties or debates on various issues from the perspective of certain individuals, organisations or countries (Boyer, 2000; Krain & Shadle, 2006). As such, “simulations have the power to recreate complex, dynamic political processes in the classroom, allowing students to examine the motivations, behavioural constraints, resources and interactions among institutional actors” (Smith & Boyer, 1996, p. 690).

As early as 1959, Bloomfield & Padelford commented that simulations could “produce tangible results over and above what [could] be taught and learnt about politics by more usual methods of instruction” (p. 1112). This has been confirmed by more recent research, which shows that learners remember 10% of what they read, 20% of what they hear, 30% of what they see, 50% of what they see *and* hear, 70% of what they say, and 90% of what they do *and* say together (Stice, as cited in Smith & Boyer, 1996).

Conversely, games engender a sense of competition and have clearly defined rules, endpoints and ultimately, winners and losers (van Ments, 1989). For example, in a business context, learners may engage in a competition buying and selling shares on the stock market with the aim of achieving the highest profit in a given context and time frame (Sutcliffe, 2002). Games do not require the players to take on the persona of a real-world actor (Krain & Shadle, 2006). Christopher and Smith (1988) distinguish between closed and open games. Unlike closed games, which are puzzles with pre-determined answers, open games are fluid and changeable by nature; players with conflicting interests navigate complex and nuanced relationships to reach collaborative solutions to real-life problems. These features make open games very similar to role-plays.

Role-plays place learners in a structured environment and ask them to take on a role. Unlike simulations, which can be more prescribed and have clearly defined preferences and goals, role-plays, in large part, allow learners to create their own interpretation of their roles because they are less goal-oriented (Krain & Shadle, 2006). In fact, interactions within the role-plays are more interpersonal than goal-oriented (Shaw, 2010). The main aim of a role-play is to dramatize the phenomena of interest, the relationships between players and the challenges confronting them (Sutcliffe, 2002). According to Andrianoff and Levine (2002), this dramatization “provides the essence of learning” (p. 121) because it allows learners to personalize their learning and engage in role-playing. In this way, learners “inhabit the issue (making it more “real” and immediate) and think beyond their own perspectives” (Scott, 2001, p. 347). This point of view is further strengthened by Heathcote’s and Bolton’s (1995) ‘mantle of the expert’ approach.

Acting in the role of representatives of real-life organisations, the learners are entrusted with a ‘mantle of the expert’ which authorises them to investigate and address the issues *as if* they were the experts (Heathcote & Bolton, 1995). This ‘mantle’ of expertise changes thinking and learning *about* the issues, to that of thinking *from within* the issues. Acting within this ‘mantle’, learners investigate and respond to the issues from the perspective of contributors to, victims of or activists against the issues rather than neutral passive observers. In this way, learners experience an active, urgent and purposeful view of learning, in which knowledge is to be acted upon, not merely taken in (Heathcote & Bolton, 1995). In addition to empowering the learners

to drive their own learning, the ‘mantle of the expert’ gives legitimacy to trial and error, and learning from errors. This stimulates critical review and self- and peer-correction as the learners engage with the task and co-construct their knowledge.

This is especially so in our role-play, as different stakeholder teams liaise with each other in search for relevant collaborations and partnerships that can help them solve the issues. The gradual realization that there are a variety of stakeholders with opposing or even conflicting interests reveals the tension and reinforces the life-like ‘wickedness’ of the issues. Therefore, role-plays can be particularly effective in bridging the gap between academic knowledge and everyday life (Maddrell, as cited in Krain & Shadle, 2006). This is confirmed by Kuzma and Haney (2001), who suggest that “one way to ground abstract concepts is to provide references so that students can ‘see’ what the instructors are trying to explain” (p. 34).

In this context, the role of the teacher/instructor is to facilitate a learning environment that develops in the learners qualities of leadership, competency and responsibility for their own learning (Aitken, 2013). Cognitive conflict or puzzlement becomes the stimulus for learning and knowledge evolves through social negotiation and individual understanding (Kirkley & Kirkley, 2005).

The Role-Play Overview

“When an individual plays a part, he implicitly requests his observers to take seriously the impression that is fostered before them” (Goffman, as cited in Freie, 1997, p. 732).

The role-play assessment is an active learning instructional design based on a framework first developed at UNSW Foundation Studies by Elizabeth Rosser over ten years ago. Known as *The Big Paper b-Sim*, the original design was modelled on the highly successful *Mekong e-Sim* created by R. McLauchlan, D. Kirkpatrick, H. Maier and P. Hirsch (Baron & Maier, 2004). In its current format, the role-play maintains the core structure and methodologies from these exemplars with changes to allow for upgrades in the technological tools used.

The role-play fosters an environment of open inquiry, debate and reflection within an atmosphere of urgency that reflects contemporary international events (van Ments, 1989). Participants attempt to solve contemporary international issues, known as ‘wicked problems’. These are ill-defined social problems that are by their nature confronting, and as such have no known definitive or objective solutions (Rittel & Webber, 1973; Khaira & Yambo, 2005). Learners take on the role of real-life stakeholders, develop empathy and experience real-life complex issues from multiple perspectives. To reinforce authenticity, the wicked problems are introduced via scenarios based on current investigative documentaries capable to reveal the complexity of the issues and provide visual evidence of their severity. Some of the scenarios have covered topics such as fuel for the future, fracking, water security, plastic pollution or gender inequality.

More concretely, the role-play is staged over a period of six weeks. The activities of each week build on the achievements of the previous week(s) as can be seen in Figure 1, below. The first stage (weeks 1–2) includes the briefing, when the lecturer introduces the topic, and learners form teams (of 4–5 students) and select their stakeholder from a given pool. A typical role-play is likely to consist of approximately 20 stakeholders. This stage stretches over to the second week, when teams interpret and research their stakeholder role using both face-to-face and web-based strategies.

In the second stage (weeks 3–4), a scenario is released to provide a clearer topic focus. Teams investigate the issues arising out of this scenario from their stakeholder perspectives using a variety of pre-taught analytical tools (later described in more details in the context of visual literacy), and develop their stakeholder profile on UNSW Wikispaces. This profile is then reviewed, refined and represented visually by hand in the mind map poster. The poster is an assessable task worth 10%.

The third stage (week 5) includes a public forum that reunites all the stakeholder teams in a three-hour emergency summit, where teams use their expertise to negotiate solutions to a serious, unexpected and high-risk issue development that requires immediate action. Each team prepares an assessable action plan poster worth 10%.

The fourth and final stage (week 6) is debriefing. This involves “talking about the experiences, analyzing them, evaluating them, and integrating them into one's cognitive and conscious data base” (Lederman 1984, p. 417). To consolidate this, learners prepare individual Debriefing Reports in which they record their reflections on their learning experience throughout the role-play. This is the final assessable component of the role-play, also worth 10%.

The role-play integrates all four stages of Kolb's (1984) experiential learning model to accommodate a variety of learning preferences. Kolb's model consists of four stages: abstract conceptualization, concrete experience, reflexive observation, and active experimentation (Kolb 1976, 1984, 1988). Players learn abstract concepts from lectures, scenarios, readings, videos and discussions (abstract conceptualization). Second, learners research their roles and develop goals to achieve (concrete experience). Third, learners develop strategies to achieve their goals and experiment with their strategies – this includes the preparation of the mind map poster in stage two, and action plan in stage three (active experimentation and concrete experience). Finally, they reflect on their actions, choices, and the learning outcomes (reflexive observation).

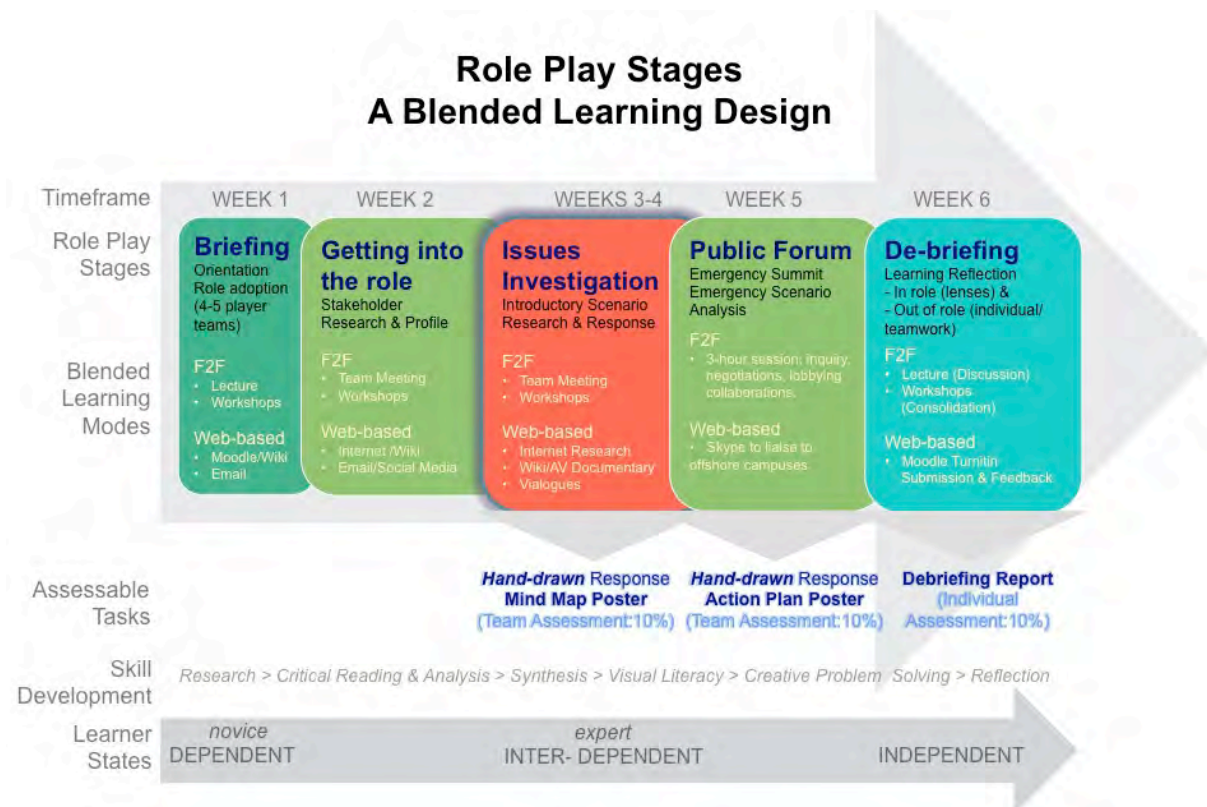


Figure 1: Role play stages – A blended learning design.

The transformative nature of the role-play encourages learners to progressively gain expertise in their stakeholder role and insight into the complexity of related issues. The real-life approach to the role-play also has potential to create a deliberate sense of ambiguity, which is integral to the ‘wickedness’ of the problem they are addressing (Rittel & Webber, 1973). Hence, players find themselves constantly thoughtful and questioning as they are prompted to react to the unfolding situation. Thus, the emphasis of learner performance and assessment is on behaviour/performance rather than outcome. The authentic possibility of multiple decisions and outcomes ensures a safe environment for bold critical thinking, direct emotional engagement, originality and creative problem solving.

Preliminary activities involving team and stakeholder selection as well as the introduction of the ‘wicked problem’ are aimed at revealing the heterogeneity of group members. Productive differences of opinions are valued as fuel for creative team-based learning, critical thinking and original expression. Progression from one stage to the next is driven by the release of new tasks, questions or news flashes (trigger events) intended to stimulate more focused lines of inquiry. Nevertheless, different stakeholder teams pursue their own directions and interests within the bounds of the wicked problem and their stakeholder role. Learners are, therefore, more likely to be process-minded than goal-oriented. In this context, the role of the teacher is to monitor proceedings and intervene as little as possible, preferably not at all while helping teams stay aware of their learning goals, time frames and required outcomes.

Why *Visual Expression*? A Literature Perspective

The Greek poet Simonides observed that “Words are the images of things”, and Aristotle claimed that “without image, thinking is impossible” (as cited in Benson, 1997, p. 141).

Researchers who study problem solving are convinced that visualisation, namely imagery or picture-like representations, is a powerful cognitive tool (Finke, 1990; Rieber, 1995). In fact, the meaning of the Greek term ‘to prove’ (*deiknumi*) is *to make visible or show*; pointing to “the close link between demonstrating understanding and having the capacity to show or draw a proof” (McLoughlin & Krakowski, 2001, p. 1).

Research confirms that there is a strong correlation between visual and verbal information, memory and learning. In 1969, John Debes first used the term, ‘visual literacy’ in education to describe the capacity of a learner to “discriminate and interpret the visible actions, objects, and/or symbols, natural or man-made, that he encounters in his environment. Through the creative use of these competencies, he is able to communicate with others. Through the appreciative use of these competencies, he is able to comprehend and enjoy the masterworks of visual communication” (as cited in Avgerinou & Ericson, 1997, p. 281). In support of Debes’ definition, Brill et al. (2007) propose that visual literacy is “the ability to both accurately interpret and create messages that are transmitted through the sense of sight, with emphasis on using communication systems that do not rely primarily on traditional text based alphabetic or numeric codes” (pp. 49–50).

Horton (1983) sees a correlation between visual literacy and visual thinking, hence he defines visual literacy as “the ability to understand and use images, including the ability to think, learn, and express oneself in terms of images” (p. 99).

While we agree with the above definitions, we tend to associate visual literacy with both visual thinking and creative expression in line with Baca & Braden’s (1990) view: “Visual literacy refers to the use of visuals for the purposes of communication, thinking, learning, constructing meaning, creative expression, [and] aesthetic enjoyment” (p. 48). In addition, as reinforced by Felton (2008), we believe that “the capacity to manipulate and make meaning with images is a core component of visual literacy” (p. 61). This is further substantiated by Wileman (1993), who sees visual literacy as “the ability to turn information of all types into pictures, graphics, or forms that help communicate the information” (p. 114). Hence, visual literacy is “an organizing force in promoting understanding, retention, and recall of so many academic concepts with which students must contend” (Robinson, quoted in Stokes, 2002, p. 12); and as such, a core 21st century skill (White, Breslow & Hastings, 2015).

The mind map poster is a hand-drawn visual expression of the learners’ insights into and stakeholder response to the role-play ‘wicked problem’. As such, the learners manipulate imagery to encode complex messages that demonstrate their ability to construct and express nuanced meanings visually. According to Zeyab (2017), learners “can better visualize their ideas using visual information, thereby offering students a better understanding of the concept and transferring this abstract idea to a more concrete image” (p. 31). In this way, learners use their critical and creative thinking as they conceive, develop and integrate their visuals into the mind map poster.

Interestingly, White, Breslow & Hastings (2015) see visual literacy as global *communication* competency. The mind map poster is prepared in teams; therefore, visual literacy is achieved through interactive thinking, extensive discussions and negotiations which enable learners to derive meaning through what is being communicated. In this way, the negotiating of visual expression of complex, abstract ideas is motivational, and stimulates genuine interest in and engagement with the topic (Rasul et al., 2011; Yunus et al., 2013). From a cognitive load theory perspective, visual literacy can also enhance learning effectiveness by facilitating faster storage

of knowledge in the long-term memory (Mayer, 2009). According to Sweller & Chandler (1994), the capacity of the working memory to assimilate multiple elements of information simultaneously is limited. Nevertheless, since the working memory processes visual and auditory separately, the capacity of working memory can be extended if information is presented through two channels – one processes auditory and verbal information while the other manages visual information, imagery (Mayer & Moreno, 2003). According to this dual encoding theory, the working memory processes the information from these channels at the same time by integrating words and images to create long-term memory knowledge. Hence, audio-visual information is processed more effectively than either audio or visual alone (Clark & Pavio, 1991). Therefore, a multimedia approach is more likely to foster more meaningful and deeper learning on condition that there is not too much information, or ideas are not too complex, in which case there is the possibility of cognitive overload (Sweller & Chandler, 1994).

The drawing of concrete visual symbols allows learners to interpret and transfer to paper abstract concepts, in other words the formation, inspection, transformation, and maintenance of images in the ‘mind’s eye’, which Mathewson (1999) calls ‘visual-spatial thinking’. This crystallizes and consolidates understandings and maximizes the capacity of the working memory to process complex information. In fact, Mathewson (1999) sees this construction of learning as a “self-activating response to challenges, dissonance, or discrepancy rather than a purely passive encoding of experience” (p. 36), where the role of visual-spatial thinking is to “preserve relationships among a complex set of ideas as a single chunk in working memory, increasing the amount of information that can be maintained in consciousness at a given moment” (p. 33). Spatial images are, therefore, very important to the cognitive process because they have the capacity to expedite the movement of information to the long-term memory. Ainsworth et al. (2011) confirms that drawing helps learners remember the information more effectively and can make learning more enjoyable.

Embedded in the International Issues and Perspective course are visual frameworks that promote thinking and learning based on visual discourse analysis. This is defined as “a theory and method of studying the structures and conventions within visual texts, and identifying how certain social activities and social identities get played out in their production” (Albers, 2007, p. 87). Consequently, learners are pre-taught a range of visual/analytical tools capable to serve as organizational frameworks that can communicate the logical structure underpinning their visual message (Tarquin & Walter, 1997; Trowbridge & Wandersee, 1998). The use of such visual organisers can reduce the cognitive demands on learners because they assist them to process information in a non-linear format and, thus, free up working memory space that can be employed for creative thinking and problem solving (Myer & Moreno, 2003). This is especially useful given the fact the participating learners are international students whose first language is not English.

In preparation for the role-play, learners also explore relevant visual literacy techniques as well as corresponding skills of visual exploration, critique and reflection. Some of the techniques include analysis of visuals in terms of colour, size and symbolism of different image elements, positioning on the page, overall context of the image, possible direct and underlying messages, intended audience reaction, impact, etc. In addition, a series of relevant visual organisers/analytical tools are explored for the purposes of both illustrating and deciphering complex visual messages. Some of these are:

- **Critical Lenses** such as socio-economic, financial, cultural, political, environmental, etc. Different stakeholders may highlight different aspects of the issues depending on their unique lenses. For example, in *The Plastic Age?* Role-play, a stakeholder such as the 5 Gyres Institute may be inclined to view the plastic pollution ‘wicked problem’ through environmental, education, scientific lenses while a plastic manufacturing company (e.g. MBA Polymer) is likely to use economic and financial lenses.
- **Issues**, namely, important problems or challenges that are difficult to address in isolation because of their strong connections with and implications for other problems or challenges. These *must* be consistent with the relevant stakeholder lenses.
- **Scale** of the issues and/or stakeholder impact (individual, group/family, local, regional, national, international, bilateral, multilateral, global).
- **SWOT Analysis** (Stakeholder Strengths, Weaknesses, Opportunities and Threats)
- **Stakeholder Disposition Map** to position the role-play stakeholders with regards to the main issues on a scale ranging from a position of power (in favour and influencing the situation) to one of a victim (against and unable to influence the situation). This also allows the disposition of stakeholders against each other depending on their similar or antagonistic interests.
- **Fishbone Diagram (Ishikawa Diagram)** to identify and illustrate cause and effect relationships.
- **Forces and Impacts** of relevant issues.
- **Known Knowns/Unknowns – Unknown Knowns/Unknowns** to drive in-depth, meaningful research of the issues.

Observation of our learners using this range of visual organisers/analytical tools shows them move through a “continuum of visual thinking” (McLoughlin & Krakowski, 2001, p. 8). At first teams engage in visual thinking by interpreting visually abstract concepts; this is done at the stage when learners research and analyse their stakeholder role. Then, they move on to visual learning by constructing knowledge through interaction with the visuals; this is the stage of producing the mind map poster. Finally, they progress to visual communication where a range of creative imagery and graphic frameworks are brought together to stimulate transaction and dialogue; this is achieved at the stage of the emergency summit, when teams negotiate partnerships with a view to producing action plans capable to solve the problems raised in the emergency scenario.

The Role of Technology

In the International Issues and Perspectives course, technology is not merely a tool for instruction delivery, but it is thoughtfully integrated into the curriculum to optimise learning and empower students to become independent learners (Mills & Tincher, 2003, Garrison & Kanuka, 2004). Thus, we believe we have achieved an effective blend of **instructional modalities** (facilitator-driven, learner-driven, flexible learning) and **delivery media** (multimedia, UNSW Moodle (moodle.telt.unsw.edu.au), lectures, workshops, PowerPoint Presentations, Prezi (prezi.com), Vialogues (vialogues.com), workbooks); **instructional methods** (face-to-face and technology-based), **web-based technologies** (e.g. UNSW Wikispaces (www.unsw.wikispaces.net), Prezi (https://prezi.com), PowToons (www.powtoon.com), Vialogues (vialogues.com), Wordle (www.wordle.net/create), online discussion forums and blogs) and **learning states** (dependent, inter-dependent, independent).

The combination of these depends on learning goals, course content, teaching and learning styles, and learner characteristics (Dziuban, Hartman & Moskal, 2005 in Kosar, 2016). Hence,

the role-play also combines a rich blend of instructional modalities and methods that facilitate the learners' transformation from novices to experts (in terms of content knowledge) and from interdependent to independent learners (in terms of study skills and competencies). Lectures are used to introduce the role-play wicked problem, stages and weekly tasks while workshops are allocated to learner-driven learning. The role-play is hosted on UNSW Wikispaces (Figure 2), where teams develop and publish their stakeholder profile, investigations and response to the documentary scenario. They also use the wiki discussion board to liaise and seek collaborations with other participating stakeholders. An example can be viewed at: <http://ufsb2016.unsw.wikispaces.net>.

Figure 2: A snapshot of the 2016 Role Play Assessment WIKI: The Plastic Age? (<http://ufsb2016.unsw.wikispaces.net>).

The documentary scenario, which offers an overview of the wicked problem, is a multimedia program which teams analyse via Vialogues (Figure 3). This online software facilitates private and autonomous team discussions about the video, creating opportunities for both synchronous and asynchronous interactions.

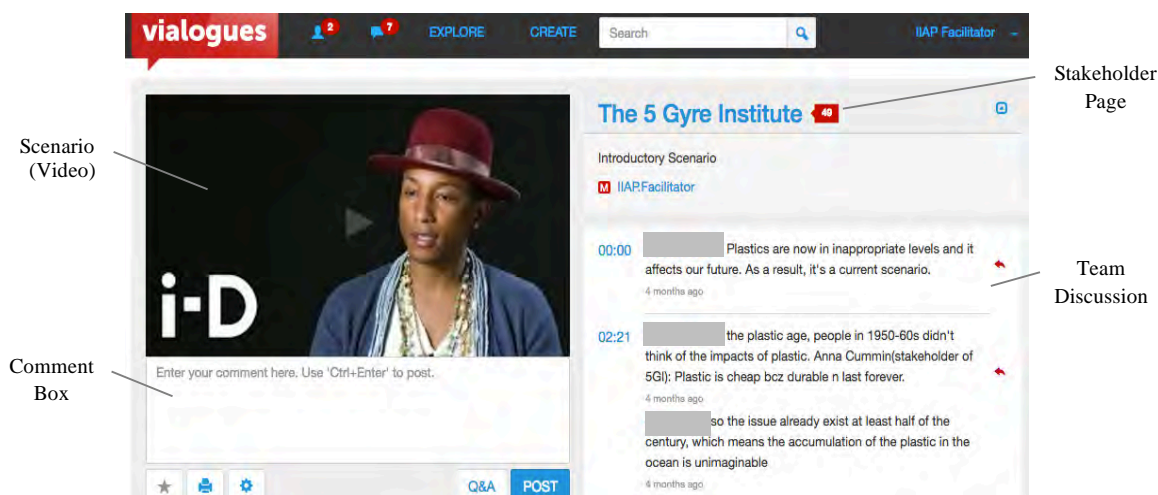


Figure 3: A snapshot of an online discussion about the Introductory Scenario 2016 Role Play Assessment WIKI: The Plastic Age? For privacy reasons, the names of the learners participating in this discussion have been covered.

Why *Hand-Drawn* Posters in a Blended Learning Course?

While the stakeholder analysis and wicked problem investigation in the early stages of the role-play are mediated by information and communications technology, the ensuing stakeholder response to the issues raised in the documentary scenario is presented visually in the form of a hand-drawn mind map poster. In fact, the use of *any* electronically mediated technology is prohibited in the *performance* of this task. This is because we believe that “computers have the potential to support cognition” and “extend intelligence” (McLoughlin & Krakowski, 2001, p. 5) but, at the same time, have the potential to overpower creative expression if the users do not have the optimum skill level to operate them with confidence. Zeyab (2017) agrees that, “sometimes, the best strategy does not include digital tools” (p. 13). We have, therefore, opted for hand-drawn techniques that involve only basic technologies, such as coloured pens, highlighters, markers, watercolours, paper and occasionally, as per learners’ original choice, sand to represent sandstorms in the Sahara desert, or makeup powder for various effects. Admittedly, learners are allowed and even encouraged to draw inspiration from online research, which may also include imagery.

The rationale for this is to stimulate in the learners “the active reconstruction of past visual experience with incoming visual messages to obtain meaning” (Sinatra, 1986, p. 5). In other words, we aim to place an emphasis learners’ ability to actively develop original visual interpretations of known information and team understandings as opposed to simply copying and pasting existing visuals. In this way, learners are stimulated to analyse, evaluate and manipulate images to develop their own specific language in a sense that the visual messages presented need to be decoded to have meaning (Branton, as cited in Stokes, 2002). Ainsworth et al. (2011) suggests that expressing abstract concepts as hand drawings can be “transformative by generating new inferences” (p. 1). Moreover, Clark and Pavio (1991) observe that generating images produces better recall than traditional semantic exercises, such as repetitions, translations into another language or brainstorming synonyms. This is especially meaningful in our context, where the language of instruction is our students’ second language. Visual literacy, thus, compels our students to avoid acceptance of knowledge/authority without questioning it and engage in deeper thinking by effectively recognizing, interpreting, and

employing the distinct syntax and semantics of different visual forms (Felten, 2008). This prompts stakeholder teams to filter semantics and expression and adopt a constructivist approach to their learning, namely “acquire knowledge by building it from innate capabilities interacting with the environment” (Houston, 1995, p. 64). Through iterative appraisal and re-evaluation of their drawings, teams revisit and refine their shared understanding of the issues, as well as potentially transform their own initial perceptions and re-assess their thinking gaining more depth of insight (Gardner, 1994). This leads to a more genuine engagement with the issues and a higher level of creative thinking and originality.

Another reason for limiting learners to the hand drawing of complex abstract ideas as opposed to verbal or written expression is that we understand that not everyone can perceive, filter or express information the same way. The mind map poster accommodates ‘multiple intelligences’ (Gardner, 1994) and various learning styles, visual, auditory and kinaesthetic (Brown, 2014). According to Gardner (1994), visual-spatial and linguistic intelligences provide the main sources of information storage and problem solving. Furthermore, hand drawing involves three senses, *seeing*: visualising abstract concepts; *hearing*: listening to team members’ perspectives; and *touching*: learners draw visual symbols on paper using their hands and coloured pencils. In this manner, the hand drawing of the poster engages various learning styles at the same time, which maximizes interaction and creativity, heightens awareness, provides for surprise and reinforces sentiments (Bredemeir & Greenblat, 1981; Wilson, 2011).

According to Dallow (2008), the visual is “like an interface or cultural zone of social exchange ... a social sphere or arena where contemporary views of reality are displayed;” he goes on to add that “a notion of visual literacy could be the capacity to negotiate or ‘navigate’ this visual cultural zone” (p. 98). Hailey et al. (2015) also agree suggesting that experiences that engage visual literacy are ‘essentially social exchanges’. The requirement to hand draw the mind map poster on one piece of paper with a certain set of pens and without any computer technology generates a need for all the members of a stakeholder team to inhabit the same space at the same time. This is conducive to insightful and passionate discussions during which team members listen with the same attention and intensity with which they talk. They reflect on their own and others’ thinking, they shift perspectives and develop the ability to hold multiple perspectives simultaneously. They gain confidence dealing with ambiguity and gradually learn to appreciate the impact of providing visual evidence. They overcome challenges through perseverance and realize that there can be more than just one possible answer (Hailey et al., 2015). Such face-to-face conversational interactions provide a means for the teams to converge, influence each other’s thinking and construct meaning together through their own interpretations and refinements of ambiguous, abstract and possibly fragmentary information (Roschelle, 1992).

By prohibiting technology, we ensure that teams engage in genuine ‘collaboration’ as defined by Lai et al. (2001), namely, “participants work together on the same task, rather than in parallel on separate portions of the task” (p. 6). Research shows that social interaction stimulates the elaboration of conceptual knowledge, which enhances comprehension of abstract concepts (Roschelle & Teasley, 1995; Lai, 2000). By collaboratively representing their own stakeholder position on paper in a visual form, teams gain deeper insights into their own stakeholder role and develop expertise in solving the role-play wicked problem. As such, the preparation of the mind map poster is like a rite of passage, or in the words of Bredemeir and Greenblat (1981), more like an “initiation ceremony experience” (p. 309).

We have been questioned about the decision to refrain from using design software such a

Photoshop or InDesign. The pros and cons of using such technology have been extensively discussed among our colleagues, nevertheless, the consensus has been that such software is technically complex and requires detailed understanding to be used flexibly and effectively; and neither learners nor facilitators can be assumed to master such technology. Hence, limited software-handling skills are likely to act as a barrier not only to expression but also to critical and creative thinking. At the same time, there is the possibility for one or two team members, who may be more confident using computer-mediated technology to take over the creative process and dominate the teamwork. This would only stimulate ‘cooperative learning’, “typically accomplished through the division of labor, with each person responsible for some portion of the problem solving” (Lai, 2001, p. 6). Admittedly, this would limit learning for all team members involved.

A Mind Map Poster Example

The poster in Figure 4 was submitted by the stakeholder group representing 5 Gyres Institute (www.5gyres.org) in response to plastic pollution in *The Plastic Age? Role Play* in September 2016. It represents visually the team’s analysis and response to ocean plasticization through their stakeholder lenses (environmental, scientific) and in consideration of other stakeholders in play.



Figure 4: Mind Map Poster illustrating the response of the 5 Gyres Institute Stakeholder to the plastic pollution ‘wicked problem’ raised in *The Plastic Age? Role Play* in September 2016. Student permission has been given for using these materials.

After the completion of the mind map poster, stakeholder teams are given the option to write a brief summary of the illustrated message. This allows them to critically reflect on their work and their mastery of visual literacy and derive further confidence in their own learning.

In the words of the *5 Gyres Institute* Stakeholder Team:

The Mind Map Poster aims to illustrate, from the top left corner: plastic is massively produced (**industrialisation**) and consumed globally (**consumerism**) however, there is a failure to manage it thoroughly during recycling. Plastic waste, which is not biodegradable, is dumped into landfills that pollute the soil. This leads to **land degradation** that contaminates drinking water systems and food production (**water and food security**). In addition, toxic microbeads directly flow into lakes and rivers through the drainage systems. Fish accidentally eat micro-plastics and, thus, toxins penetrate the **food chain** all the way up to humans (**health crisis**). Plastic waste that does not get recycled ends up in the oceans and tends to accumulate in the centre of **ocean gyres** or float to seashores of many islands (**global environmental system**). The toxic plastic damages the **marine ecosystem** causing the **Arctic ecosystem** to become the victim of plastic pollution due to the chain of effects. **Responses** from our organization include: promoting activism through social media, conducting research expedition, corporation with government in legislation and beach clean-up action. (Student permission has been given for using these materials.)

Conclusion

The mind map poster requires, on the one hand effective understanding, evaluation and creation of visual symbols to encode complex messages; and, on the other hand, the ability to decode nuanced visual messages. In this way, the poster teaches a variety of skills ranging from visual literacy to critical and creative thinking, team collaboration, and not least, communication skills. The decoding of visual messages can be very effective to also enhance verbal learning since, according to Sinatra (1986), visual symbols are nonverbal representations that precede verbal symbols. This allows learners to interpret and transform their own and others' thinking.

Therefore, the preparation of the mind map poster is a turning point in the role-play learning process for most learners especially because of the restriction on the use of electronically mediated technology. This is the stage when team members are compelled to physically come together to discuss, question, analyse, synthesize information and distil their understanding. It is during these interactions that learning is crystallised. The fact that learners are compelled to express their learning in a visual form away from the filter and support of computer software genuinely pushes them out of their comfort zone in a way that stimulates their critical and creative thinking. The role-play procedural framework ensures versatile support through the provision of guiding content references as well as a variety of analytical tools and complex visual literacy skills, as well as empowering the learners to construct their own learning journey. While electronically mediated technologies are prohibited for production of mind map poster, these are extensively employed as a scaffold for the preparation of this task. Hence, the success of this learning experience is thoroughly dependent on the fine-tuned blend of the electronically mediated technology with stripped-down original expression.

Limitations

Some of the limitations of this educational approach are related to the learners' abilities to express their ideas visually in the absence of advanced technological support. Those who are not confident with their drawing skills may find the task extremely demanding especially at the early stages of preparing the poster due to insufficient familiarity with the assessment criteria. This can create a sense of frustration in some teams and even demotivate some learners at the start of the task. Some learners need more time to adapt than others but ultimately all participate actively and appreciate the challenge as an enriching learning experience. Not only learners but also educators need to adjust to this teaching/learning approach (Dougherty, 2013). They need to allocate more time to clarifying the learning goals and, most importantly, reassuring learners that the mastery of drawing skills and sketching is not key to the success of the mind map poster but the relevance and complexity of the visual message conveyed.

To overcome these challenges, educators introduce the learning goals at the beginning stages of the task and explain each component providing some examples of previous posters especially the ones that are more aesthetically pleasing and demonstrate above-average drawing skills but do not entirely meet the assessment criteria in terms of the insight and complexity of the message delivered. This is especially important at the stage when team members produce their mind map posters. This not only alleviates learners' frustration learners but also assists in directing their attention to the learning goals and reduces any chance of diverging from the focus of the task.

Learner Testimonials

The following testimonials extracted from the 2016 *The Plastic Age?* Role-play participants' debriefing reports reinforce from the learners' perspective some of the learning design achievements illustrated above. Student permission has been given for using these materials.

The Role Play has been the most exciting and unique assessment that somehow doesn't feel like an assessment. It engaged a large group of students sharing information and communicating with each other on the Internet and face to face - just like in the real world. I have never experienced this before. (A role-play participant representing the 5 Gyres Institute – www.5gyres.org)

One of the most notable experiences I've had during the Role Play was designing the mind map poster. Trying to visually represent concepts made me look at them in a different way. Without words, every other element such as shape, colour and size couldn't be overlooked. I had to think of ways to use them to get the maximum effect. I had to think about what MBA Polymer would put on the paper, what they would want the eyes of the viewer to focus on and what impression they wanted to give about the issue and their company's role. It was challenging to try and both give an honest picture of the issue and keep in mind what parts of that image MBA Polymer liked people to see. It was significant for me because it made me think a lot about the balance between the honest truth and the truth someone with bias wants to show others. It taught me to recognize bias. (A role-play participant representing MBA Polymer – www.mbapolymers.com)

The most frustrating stage for us has been creating the Mind Map Poster. We abandoned many drafts before finalizing the most satisfying one. It almost seemed

impossible to achieve a quality mind map poster at first. Accepting the challenge, we reviewed the video of introductory scenario as well as the comments our team made in Vialogues several times and summarized the forces and impacts of plastic pollution in order to capture the main information for our mind map. This proved to be very effective later. In addition, we've learnt that combining the components of issues with visual literacy involved decision on images, positions, sizes and colours to illustrate an integrated and logical mind map. We were very surprised at our creativity when we finished the task. Moreover, we found that the mind map poster was such a direct, powerful and interesting tool to reveal the complexity of the wicked problem. (The 5 Gyres Institute Team – the authors of the Poster analysed in this paper)

Acknowledgement

According to the Research Ethics and Compliance Support at the University of New South Wales (UNSW), our paper refers to our students' work to exemplify our pedagogical practice and illustrate the educational principles underpinning our teaching strategies; as such, it does not need to get ethics clearance. The privacy of our students is respected and the information provided in our study is anonymous.

A previous version of this article was included in the proceedings of *The Asian Conference on Technology in the Classroom 2017*: Adina Stan, A, Armat, M, Leigh, E, Rosser, E, and Hayes, N. (2016). CALL to Arms: Generations Clash Over Digital Technology in the Foreign Language Classroom. *The Asian Conference on Technology in the Classroom 2017*. Kobe, Japan, May 11-May 14, 2017. Proceedings, pp. 1-21. ISSN: 2186-4705. http://papers.iafor.org/conference-proceedings/ACTC/ACTC2017_proceedings.pdf

References

- Ainsworth, S., Prain, V., & Tytler, R. (2011). Drawing to learn in science. *Representations*, 3, 1–5. <https://doi.org/10.1126/science.1204153>
- Aitken, V. (2013). Dorothy Heathcote’s mantle of the expert approach to teaching and learning: A brief introduction. In D. Fraser, V. Aitken, & B. Whyte (Eds.), *Connecting curriculum, linking learning* (pp. 34–56). Wellington: NZCER Press.
- Albers, P. (2007). Visual discourse analysis: An introduction to the analysis of school-generated visual texts. In D. W. Rowe, R. T. Jiménez, D. L. Compton, D. K. Dickinson, Y. Kim, K. M. Leander, & V. J. Risko (Eds.), *56th yearbook of the National Reading Conference* (pp. 81–95). Oak Creek, WI: National Reading Conference.
- Andrianoff, S. K., & Levine, D. B. (2002). Role-playing in an object-oriented world. *ACM SIGCSE Bulletin*, 34(1), 121–125. <https://doi.org/10.1145/563517.563386>
- Avgerinou, M., & Ericson, J. (1997). A Review of the concept of visual literacy. *British Journal of Educational Technology*, 28, 280–291. <https://doi.org/10.1111/1467-8535.00035>
- Baca, J. C., & Braden, R. A. (1990). The Delphi study: A proposed method for resolving visual literacy uncertainties. In R. A. Braden, D. G. Beauchamp, & J. Clark Baca (Eds.), *Perceptions of visual literacy* (pp. 99–106). Conway, AR: International Visual Literacy Association.
- Barr, R. B., & TAGG, J. (1995). From teaching to learning – A new paradigm for undergraduate education. *Change: The Magazine of Higher Learning*, 27, 12–25. <https://doi.org/10.1080/00091383.1995.10544672>
- Baron J., & Maier H. R. (2004). A community of inquiry evaluation of Mekong e-Sim: An online collaborative simulation. Proceedings of the International Conference on Educational Technology (ICET2004), Singapore.
- Benson, P. J. (1997). Problems in picturing text: A study of visual/verbal problem solving. *Technical Communication Quarterly*, 6(2), 141–160. https://doi.org/10.1207/s15427625tcq0602_2
- Bloomfield, L. P., & Padelford, N. J. (1959). Teaching Note: Three experiments in political gaming. *American Political Science Review*, 53(4), 1105–15. <https://doi.org/10.2307/1952078>
- Bonk, C. J., & Graham, C. R. (2006). *The Handbook of blended learning: Global perspectives, local designs*. San Francisco: Pfeiffer.
- Boyer, M. A. (2000). Coalitions, Motives, and Payoffs: A Simulation of mixed-motive negotiations. In J. S. Lantis, L. Kuzma, & J. Bohrer (Eds.), *The New International Studies Classroom: Active Teaching, Active Learning*, Boulder: Lynne Rienner.
- Braden, R. A. (2001). Visual literacy. *The Handbook of Research for Education Communications and Technology*. Retrieved from <https://www.aect.org/edtech/ed1/16/index.html>.
- Bredemeier, M.E., & Greenblat, C.S. (1981). The educational effectiveness of simulation games: A synthesis of findings. *Simulation & Games*, 12(3), 307–32.

<https://doi.org/10.1177/104687818101200304>

- Brill, J. M., Kim, D., & Branch, R. M. (2007). Visual literacy defined: The results of a Delphi study: Can IVLA (operationally) define visual literacy? *Journal of Visual Literacy*, 27(1), 47–60. <https://doi.org/10.1080/23796529.2007.11674645>
- Brown, S. (2014). *The doodle revolution*. New York: The Penguin Group.
- Christopher, E., & Smith, L. (1988). *Leadership training through gaming*. Newbury Park, CA: Sage.
- Clark, J. M., & Paivio, A. (1991). Dual coding theory and education. *Educational Psychology Review*, (3), 149–210. <https://doi.org/10.1007/BF01320076>
- Dallow, P. (2008). The visual complex: Mapping some interdisciplinary dimensions of visual literacy. In J. Elkins (Ed.) *Visual literacy*, (pp. 91–104). New York: Routledge.
- Dougherty, B.K. (2003). Byzantine politics: Using simulations to make sense of the Middle East. *PS: Political Science and Politics* (36), 239–44. <https://doi.org/10.1017/S1049096503002154>
- Felton, P. (2008). Visual literacy. *Change: The Magazine of Higher Learning*, 40(6), 60–64. <https://doi.org/10.3200/CHNG.40.6.60-64>
- Finke, R. A. (1990). *Creative imagery: Discoveries and inventions in visualization*. Hillsdale, N.J: L. Erlbaum Associates.
- Fox, R. L., & Ronkowski, S.A. (1997). Learning Styles of political science students. *PS: Political Science and Politics*, 30, 732–737. <https://doi.org/10.1017/S1049096500047363>
- Freie, J. (1997). A dramaturgical approach to teaching political science. *PS: Political Science and Politics*, 30(4), 728–732. <https://doi.org/10.1017/S1049096500047351>
- Gardner, H. (1983). *Frames of mind: The theory of multiple intelligences*. New York: Basic Books.
- Gardner, H. (1991). *The unschooled mind: How children think and how schools should teach*. New York: Basic Books.
- Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *The Internet and Higher Education*, 7(2), 95–105. <https://doi.org/10.1016/j.iheduc.2004.02.001>
- Giorgis, C., Johnson, N. J., Bonomo, A., Colbert, C., et al. (1999). Visual literacy. *Reading Teacher*, 53(2), 146–153.
- Hailey D., Miller A., & Yenawine P. (2015). Understanding visual literacy: The visual thinking strategies approach. In: D. Baylen & A. D’Alba (Eds), *Essentials of Teaching and Integrating Visual and Media Literacy*. Springer, Cham. https://doi.org/10.1007/978-3-319-05837-5_3
- Heathcote, D., & Bolton, G. (1995). *Drama for learning: Dorothy Heathcote’s mantle of the expert approach to education*. Portsmouth: Heinemann.

- Honeyford, M. A., & Boyd, K. (2015). Learning through play. *Journal of Adolescent & Adult Literacy*, 59(1), 63–73. <https://doi.org/10.1002/jaal.428>
- Horton, J. (1983). Visual literacy and visual thinking. In L. Burbank & D. Pett (Eds.), *Contributions of the study of visual literacy*, (pp. 92–106). Blooming, IN: International Visual Literacy Association.
- Houston, J. (1995). *Thesaurus of ERIC descriptors*. Phoenix, AZ: Orynx Press.
- Jensen, E. (1998). *Teaching with the brain in mind*. Alexandria, VA: Association for Supervision and Curricular Development.
- Kariel, H. S. (1977). *Beyond liberalism, where relations grow*. San Francisco: Chandler & Sharp Publishers.
- Khaira, H. G., & Yambo, D. (2005). The practicality of authentic assessment. Paper presented at the first international conference on enhancing teaching and learning through assessment. The Hong Kong Polytechnic University, June.
- Kirkley, S. E., & Kirkley, J.R. (2005). Creating next generation blended learning environments using mixed reality, video games, and simulations. *TechTrends*, 49(3). <https://doi.org/10.1007/BF02763646>
- Kolb, David A. (1976). Management and the learning process. *California Management Review* 18(3), 22–31.
- Kolb, David A. (1984). *Experimental learning: experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice-Hall. <https://doi.org/10.2307/41164649>
- Kolb, David A. (1988). Learning styles and disciplinary differences. In A.W. Chickering and Associates (Eds.) *The Modern American College*, San Francisco, CA: Jossey-Bass.
- Kosar, G. (2016). A Study of EFL instructors' perceptions of blended learning. *Procedia - Social and Behavioral Sciences*, 232, 736–744. <https://doi.org/10.1016/j.sbspro.2016.10.100>
- Krain, M., & Nurse, A. (2004). Teaching human rights through service learning. *Human Rights Quarterly* 26, 189–207. <https://doi.org/10.1353/hrq.2004.0005>
- Krain, M., & Shadle, C. J. (2006). Starving for knowledge: An active learning approach to teaching about world hunger. *International Studies Perspectives* 7(1), 51–66. <https://doi.org/10.1111/j.1528-3577.2006.00230.x>
- Kuzma, L. M. & Haney, P. J. (2001). And . . . Action! Using film to learn about foreign policy. *International Studies Perspectives*, 2, 33–50. <https://doi.org/10.1111/1528-3577.00036>
- Lai, E. R., Phan, H., Rivas, J., & Song, T. (2011). *Collaboration: A Literature Review*. Retrieved from <https://pdfs.semanticscholar.org/7203/e8afc7e48d802b3233ed961bd40bdec39040.pdf>
- Lederman, L. C. (1984). Debriefing: A critical reexamination of the postexperience analytic process with implications for its effective use. *Simulation & Games*, 15(4), 415–31. <https://doi.org/10.1177/0037550084154002>

- Mathewson, J. H. (1999). Visual-spatial thinking: An aspect of science overlooked by educators. *Science Education*, 83(1), 33–54. [https://doi.org/10.1002/\(SICI\)1098-237X\(199901\)83:1<33::AID-SCE2>3.0.CO;2-Z](https://doi.org/10.1002/(SICI)1098-237X(199901)83:1<33::AID-SCE2>3.0.CO;2-Z)
- Mayer, R. E. (2009). *Multimedia learning* (2nd ed.). New York: Cambridge University Press. <https://doi.org/10.1017/CBO9780511811678>
- Mayer, R. E., & Moreno, R. (2003). Nine ways to reduce cognitive load in multimedia learning. *Educational Psychologist*, 38(1), 43–52. https://doi.org/10.1207/S15326985EP3801_6
- McLoughlin, C., & Krakowski, K. (2001, September 23-26). Technological tools for visual thinking: What does the research tell us? Paper presented at *The Apple University Consortium Academic and Developers Conference*, James Cook University, Townsville, Queensland, Australia.
- Mills, S. C., & Tincher, R. C. (2003). Be the technology: A developmental model for evaluating technology integration. *Journal of Research on Technology in Education*, 35(3), 382. <https://doi.org/10.1080/15391523.2003.10782392>
- Mueller, J. (2006). *Authentic assessment toolbox*. Retrieved from <http://jonathan.mueller.faculty.noctrl.edu/toolbox/whatisit.htm#looklike>
- Rasul, S., Bukhsh, Q., & Batool, S. (2011). A study to analyze the effectiveness of audio visual aids in teaching learning process at university level. *Procedia - Social and Behavioral Sciences*, 28, 78–81. <https://doi.org/10.1016/j.sbspro.2011.11.016>
- Rieber, L. P. (1995). A historical review of visualisation in human cognition. *Educational Technology, Research and Development*, 43(1), 1042–1629. <https://doi.org/10.1007/BF02300481>
- Rittel, W. J., & Webber, M. (1973). Dilemmas in a general theory of planning. *Policy Sciences*, 4(2), 155–169. <https://doi.org/10.1007/BF01405730>
- Roschelle, J. (1992). Learning by collaborating: Convergent conceptual change. *Journal of the Learning Sciences*, 2, 235–276. https://doi.org/10.1207/s15327809jls0203_1
- Roschelle, J., & Teasley, S. D. (1995). The construction of shared knowledge in collaborative problem-solving. In C. E. O'Malley (Ed.), *Computer-supported collaborative learning*, (pp. 69–97). Berlin: Springer-Verlag. https://doi.org/10.1007/978-3-642-85098-1_5
- Scott, J. M. (2001). Changing Perspective: Teaching undergraduates about the new inequality. *International Studies Perspectives* 4, 340–8.
- Sinatra, R. (1986). *Visual literacy connections to thinking, reading and writing*. Springfield, IL: Charles C. Thomas.
- Smith, E. T., & Boyer, M. A. (1996). Designing in-class simulations. *PS: Political Science and Politics* 29(4), 690–4. <https://doi.org/10.1017/S1049096500045686>
- Stokes, S. (2002). Visual literacy in teaching and learning: A literature perspective. *Electronic Journal for the Integration of technology in Education*, 1(1), 10–19.
- Sutcliffe, M. (2002) Simulations, games and role-play. In P. Davies (ed.) *The Handbook for Economics Lectures*. Bristol: The Higher Education Academy Education Network.

- Sweller, J., & Chandler, P. (1994). Why some material is difficult to learn. *Cognition and Instruction*, 12(3), 185–233. https://doi.org/10.1207/s1532690xci1203_1
- Tarquin, P., & Walker, S. (1997). *Creating success in the classroom! Visual organizers and how to use them*. Englewood, CO: Teacher Ideas Press.
- Torrissi-Steele, G. (2011). This thing called blended learning – A definition and planning approach. In Krause, K., Buckridge, M., Grimmer, C. and Purbrick-Illek, S. (Eds.) *Research and Development in Higher Education: Reshaping Higher Education*, 34, (pp. 360–371). Gold Coast, Australia, 4–7 July 2011.
- Torrissi, G., & Drew, S. (2013). The literature landscape of blended learning in higher education: the need for better understanding of academic blended practice. *International Journal for Academic Development*. 18(4), 371–383. <https://doi.org/10.1080/1360144X.2013.786720>
- Trowbridge, J. E., & Wandersee, J. H. (1998). Theory-driven graphic organizers. In Mintzes, J.J., Wandersee, J.H. and Novak, J.D. (Eds.). *Teaching science for understanding: A human constructivist view*. (pp. 95–131). London: Academic Press.
- van Ments, M. (1989). *The effective use of role play*. UK: Kogan Page.
- White, C., Breslow, L., & Hastings, D. (2015). Exploring visual literacy as a global competency: An international study of the teaching and learning of communication. *2015 International Conference on Interactive Collaborative Learning (ICL)*, Florence, 771–778. <https://doi.org/10.1109/ICL.2015.7318126>
- Wilson, M. L. (2011). *Students' learning style preferences and teachers' instructional strategies: Correlations between matched styles and academic achievement*. Retrieved from <http://digitalcommons.liberty.edu/cgi/viewcontent.cgi?article=1504&context=doctoral>
- Wileman, R. E. (1993). *Visual communicating*. Englewood Cliffs, NJ: Educational Technology Publications.
- Yunus, M. M., Salehi, H., & John, D. S. A. (2013). Using visual aids as a motivational tool in enhancing students' interest in reading literary texts. *Recent Advances in Education Technologies*, 114–117.
- Zeyab, Alaa J. A. M. (2017). *Educational technology and visual literacy: the effect of using doodling on student learning performance* (PhD thesis). Retrieved from <http://digscholarship.unco.edu/cgi/viewcontent.cgi?article=1400&context=dissertations>

Corresponding author: Adina Stan

Email: A.Stan@unswglobal.unsw.edu.au