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TAMING A WICKED PROBLEM THROUGH
VIRTUAL PRE-SIMULATION GAMING

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INTRODUCTION

Wicked problems are those problems that are not clearly defined or able to be stated, but which are inherent in solving the problem – issues in which changes may be made and aspects of the problem solved therefore resulting in a more acceptable outcome (Rittel & Webber, 1973). In nursing education, wicked problems arise from challenges in providing quality undergraduate nursing education in an ever-changing educational landscape affected by attrition, conflicting student commitments, and global pandemics. As a nursing educator, this means balancing the essential elements required for safe and competent practice within the confines of academic timing and process.

Part of the role of nursing education is to ensure students are safe to practise at their educational (and experience) level. For second-year nursing students within a Bachelor of Nursing program, being able to respond, assess, and intervene appropriately are considered essential 'safety to practise' elements before entering an inpatient clinical placement. The challenge for a teaching team in a year two Bachelor of Nursing Inpatient and Ambulatory Care clinical course that has limited allocated theory hours was to provide learning opportunities and resources students are able to understand, and to use frameworks needed to develop their clinical practice to practise safely in the 'real' clinical environment.

WICKED PROBLEMS

Rittel and Webber (1973) first coined the phrase "wicked problem" when referring to complex problems inherent in pluralistic societies. In contrast to a "tame problem" for which there will be a clear solution, wicked problems require consideration of possible solutions to identify the problem (Rittel & Webber, 1973). Wicked problems are widely considered at a macro level to examine major global issues such as planning or public health, or at a more micro level to examine issues such as higher education and curriculum design (Hamshire et al., 2019). Both have layers of complexity and include aspects of Rittel and Webber's (1973) characteristics of a wicked problem.

Ruth (2014) discusses the concept of wicked problems within one's teaching; that the understanding and resolution of a wicked problem occurs concurrently. The aim is not to solve the wicked problem but to evolve a satisfactory resolution. Even with quality improvements, wicked problems do not disappear. The concept of a wicked problem can be applied at a basic level to problems encountered within undergraduate nursing education (Hamshire et al., 2019). Nurse educators need to understand, analyse and critique wicked problems to identify possible strategies to manage the problem if not solutions (Glasgow & Colbert, 2022; Krause, 2012). For example, attrition rates of student nurses are a complex issue, and one which requires multiple possible ways of managing, yet is not a problem easily resolved (Hamshire et al., 2019). Innovation is one way in which wicked problems can be managed, requiring flexible reassessment and refinement as part of the problem-solving process (Veltman et al., 2021).

THE CHALLENGE

At the start of their second year, nursing students enrolled in the Inpatient and Ambulatory Care clinical course undertake simulation-based learning over the first seven weeks. This aims to develop nursing students who can apply a systematic approach to patient assessment, identify and manage patient deterioration, and undertake medication management in a culturally safe manner. Prior to clinical placement, students are required to demonstrate these 'safety to practise' elements in a practical Objective Structured Clinical Examination (OSCE) assessment. Students were provided with pre-simulation activities such as exposure to the simulated patient's background, and activities to review the relevant pathophysiology and pharmacology. These activities provided students with guidance to the knowledge needed to navigate the simulation, but there was no structured method for students to cognitively prepare pre-simulation. Our observations were that students who completed pre-simulation activities were better prepared for the simulation, and those who came unprepared often experienced significant anxiety. The wicked problem was how to provide students with safe, effective, quality learning opportunities within this limited timeframe, and how to engage them to prepare for the learning opportunities afforded by simulation. Virtual pre-simulation games were introduced as a way of providing another option for preparation and to engage students to complete the preparation work.

PREPARATION FOR SIMULATION

Simulation-based learning is an identified method of education found successful in the development of clinical decision-making (CDM) in nursing (Dileone et al., 2020; Gaba, 2004; Tyerman et al., 2019). A difficulty experienced by educators delivering simulation is engaging students to complete learning activities before a simulation class, despite this being a crucial part of simulation preparation (Tyerman et al., 2019; Verkuyl & Hughes, 2019). Research has identified that psychological preparation pre-simulation is an important factor in nursing simulation, providing a safe and effective learning environment, and resulting in improved student outcomes and simulation satisfaction (Dileone et al., 2020; Stephen et al., 2020). Tyerman et al. (2019) report that students often do not complete pre-simulation activities and are therefore inadequately prepared for simulation. Engaging students in pre-simulation activities results in positive learning experiences and reduces anxiety related to simulation (Tyerman et al., 2019). Kim et al. (2019) identified the positive effect of pre-simulation preparation on students' confidence and clinical decision-making related to simulation. Nonetheless, challenges exist in motivating students to do the preparation required prior to live simulations (Lucktar-Flude et al., 2021).

Over the last three years, there has been a huge increase in the use of virtual simulation and simulation gaming which is perceived by students as engaging (Cobbett & Snelgrove-Clarke, 2016; Lucktar-Flude et al., 2019). Virtual pre-simulation games have been identified as more engaging than similar case studies or one-dimensional preparation activities, offering the potential to prepare at the student's own time and pace (Bektaş & Yardimci, 2018; Cobbett & Snelgrove-Clarke, 2016; Lucktar-Flude et al., 2021; Verkuyl et al., 2017). A significant advantage of virtual simulation used as pre-simulation preparation is that students can repeat the experience numerous times. Pre-simulation gaming was introduced into the second-year inpatient and ambulatory care course to form part of the preparation for simulation to bring through core soft and hard skills from year one of the degree, and orientates students to the simulation scenario. This provides a way for students to practise cognitively prior to OSCE exams, and facilitates the development of self-reflection and clinical decision-making skills.

VIRTUAL SIMULATION GAMES

Virtual simulation games (VSGs) are serious games designed for educational purposes, depicting real-world events and designed for specific learning outcomes (Agency for Healthcare Research and Quality, 2020), using various gaming design principles aligned with Kolb's (1984) experiential learning and simulation pedagogy. The research and teaching team for the course developed VSGs for pre-simulation preparation online prior to clinical laboratory-based hybrid medium fidelity simulation and for further practice toward their OSCEs. Three

simulation scenarios were already developed and had been used in clinical simulations in previous years, forming the framework for game development. Research was undertaken to analyse this teaching and learning strategy to prepare students better psychologically for simulation, and reduce simulation and exam anxiety associated with year two summative OSCE assessments (Sadd, 2023).

DEVELOPMENT OF GAMES

The decision was made to use the H5P interactive software program branching scenario format (<https://h5p.org/>) already contained as a plug-in within our Learning Management System (LMS) Moodle. Video recording was done using a Go-Pro camera, and uploaded to a YouTube (video platform) situated on the Moodle game development page. No extra software or licenses were required. This was chosen as a cost-effective way to develop and deliver the games. Once templates were developed, the primary cost per game was time – approximately 20 hours for the preparation of learning outcomes, decision points, and scripts, and eight hours for the filming, preparation, and uploading of content within the H5P branching format. Game testing was undertaken by teaching peers and year three students who had previously completed the course. H5P makes it easy to share interactive games within courses and Moodle sites. Games are then able to be updated or adapted without creating a whole new game. Learning analytics and game metrics are able to be accessed and utilised from within the H5P program and LMS.

H5P's branching scenario format is a form of "choose your own activity" (Chen et al., 2021, p. 84). Students are provided with scenario proceeding to a decision or activity that may have multiple options and paths depending on the student's response. Choices may be set to lead to any other node within the interactivity tree structure with any number of branches and endings possible with different feedback per ending (Figure 1). Other H5P content forms such as image or drag-and-drop activities can be included as a stage in the branching scenario. H5P interactive content facilitates students to develop their clinical decision-making and reflective practice skills in a flexible learning environment (Singleton & Charlton, 2019).

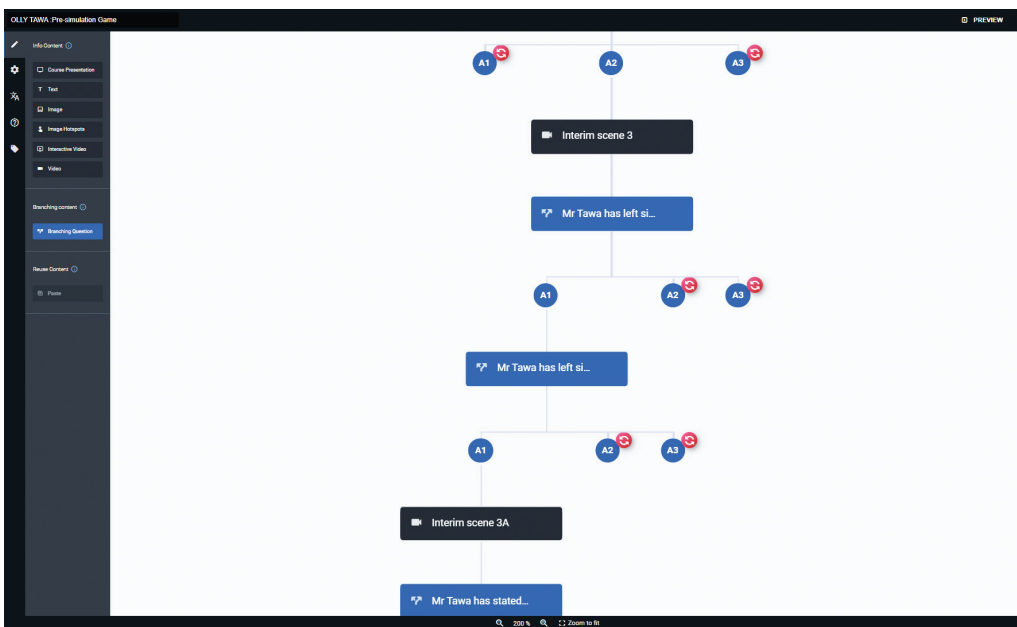


Figure 1. H5P Branching Scenario decision tree.

The three virtual pre-simulation games were developed to provide students the opportunity to prepare cognitively and familiarise themselves prior to participating in each of the three live simulations. The aim for the second-year nursing students is to be able to complete an initial assessment systematically, using a primary survey approach, respond to cues to complete a more focused assessment, and initiate appropriate actions including medication rights. The systematic approach that was already used within the simulations is replicated in the games. The pre-simulation VSGs reinforce basic 'soft skills' from year one of the degree, such as patient consent and basic clinical skills such as hand hygiene, while encouraging students to respond to assessment cues and decide upon appropriate nursing interventions at five key decision points. The VSGs prompt students to make decisions which they will then demonstrate in their live simulation such as focused assessments. All three games follow a similar format, individualised to each simulation scenario.

The VSGs use a branching loop (H5P) where students need to choose the 'best answer' to proceed. Other choices are looped back to the original question.

Students are introduced to their patient as a virtual whānau avatar via Moodle and the pre-simulation game. Virtual whānau are family groups developed for within the Bachelor of Nursing who students get to know throughout the curriculum. Virtual whānau members represent the rohe and have connections with other whānau and families. An outline of the whānau member's background and history is provided. The example provided is from Olly Tawa who has suffered a stroke (Figure 2).

Meet Olly Tawa

Mr Olly Tawa is 88 years of age.
He lives with his wife Lucy and together they have two sons, one daughter, and a total of five mokopuna.

Olly is a retired carpenter and has lived in Rotorua all his life.
He is a native speaker of Te Reo, enjoys long walks with his wife and has a passion for gardening.

Mr Tawa has a medical history of hypertension, hyperlipidaemia and atrial fibrillation.
He usually takes metoprolol, digoxin and simvastatin.

Olly usually eats well, exercises regularly and plays a round of golf each week.
His wife has been unwell recently and Olly reports he has been feeling 'run down' over the past few weeks.



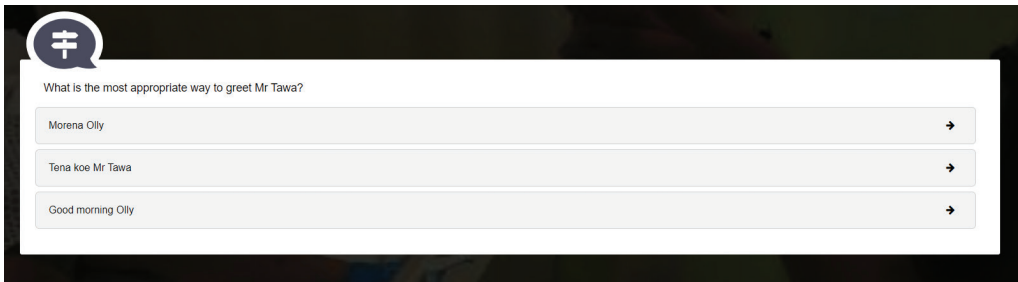
Figure 2. Scenario setting: Olly Tawa.

Subtle cues are given as part of the game to trigger familiarity with the basics learned in year one (Figure 3).



Figure 3. Role modelling: Hand hygiene.

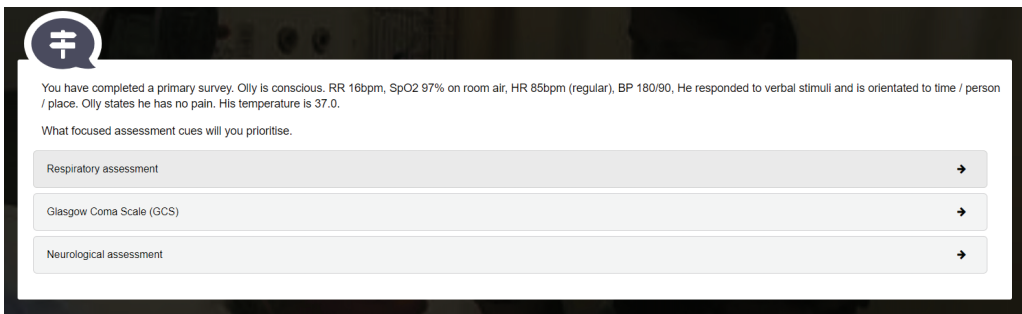
In this simulation, Olly identifies as Māori. Students are prompted to consider cultural approaches and professional communication such as how they introduce themselves (Figure 4).



A screenshot of a simulation interface. At the top left, there is a circular icon with a Māori symbol. Below it, the text reads: "What is the most appropriate way to greet Mr Tawa?". There are three selectable options, each in a light grey box with a right-pointing arrow: "Morena Olly", "Tena koe Mr Tawa", and "Good morning Olly".

Figure 4. Soft skills: Culturally appropriate introduction.

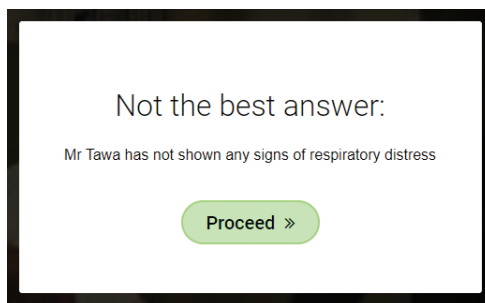
Olly has had a stroke. After initial assessment students are prompted to identify the most appropriate focused assessment. Students are required to select the 'best' answer (Figure 5). It is important students are not given potentially unsafe choices which may then be role modelled.



A screenshot of a simulation interface. At the top left, there is a circular icon with a Māori symbol. Below it, the text reads: "You have completed a primary survey. Olly is conscious. RR 16bpm, SpO2 97% on room air, HR 85bpm (regular), BP 180/90, He responded to verbal stimuli and is orientated to time / person / place. Olly states he has no pain. His temperature is 37.0. What focused assessment cues will you prioritise." There are three selectable options, each in a light grey box with a right-pointing arrow: "Respiratory assessment", "Glasgow Coma Scale (GCS)", and "Neurological assessment".

Figure 5. Clinical decision making.

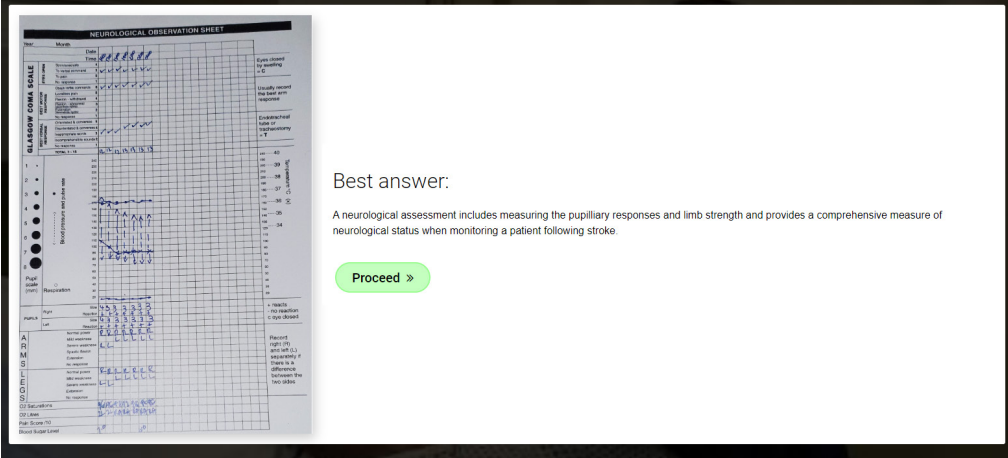
Once the student has made their choice feedback is provided (Figure 6).



A screenshot of a feedback screen. The text reads: "Not the best answer:" followed by "Mr Tawa has not shown any signs of respiratory distress". Below this is a green button with the text "Proceed »".

Figure 6. Decision and feedback: Not the best answer.

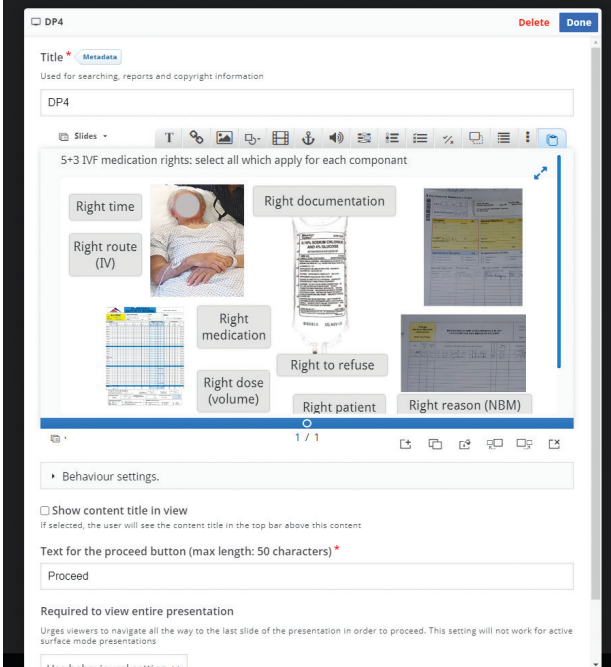
If the decision is not the best answer students are looped back to the question and promoted again to make a decision (Figure 7).



The image shows a 'NEUROLOGICAL OBSERVATION SHEET' with various scales and graphs. To the right, a feedback message reads: 'Best answer: A neurological assessment includes measuring the pupillary responses and limb strength and provides a comprehensive measure of neurological status when monitoring a patient following stroke.' Below the message is a green button labeled 'Proceed »'.

Figure 7. Decision and feedback: The best answer.

Sub-decisions include drag and drop or matching activities to support critical thinking and safe practice such as identifying the correct steps in medication checking and rights (Figure 8).



The image shows a digital interface for a drag-and-drop activity. The title is 'DP4' and the content is '5+3 IVF medication rights: select all which apply for each component'. There are several icons representing different medication rights: 'Right time' (a clock), 'Right documentation' (a clipboard), 'Right route (IV)' (a person's arm), 'Right medication' (a vial), 'Right dose (volume)' (a syringe), 'Right to refuse' (a hand with a red 'X'), 'Right patient' (a person's face), and 'Right reason (NBM)' (a clipboard). Below the activity, there are settings for 'Behaviour settings', 'Show content title in view', and 'Text for the proceed button (max length: 50 characters)'. The 'Proceed' button is visible.

Figure 8. Skill acquisition (drag and drop): Medication rights.

Each VSG takes approximately 10 to 15 minutes to complete and concludes with the student providing a nursing care handover to their supervising registered nurse to conclude the episode of care. Students receive recognition for their achievements on the final game page. VSGs are made available to students via the LMS before the simulation, and games remain available for practice post-simulation to prepare for OSCE assessments. Of the 116 students enrolled in the course when VSGs were introduced, each student on average accessed each game nine times – more than 1000 times per game from the time each VSG became available pre-simulation to the time of their OSCE assessment.

After three years, pre-simulation VSGs have become a routine aspect of the preparation for clinical simulation at the start of year two. Research was undertaken after the first introduction of VSGs into the course to explore the role of VSGs in reducing the anxiety associated with OSCE assessments. The research used self-reporting scales (Levett-Jones et al., 2011; White, 2011) to examine student perceptions of VSGs on the simulation experiences, clinical learning, and anxiety and self-confidence with clinical decision-making, noting that virtual pre-simulation gaming helped students prepare cognitively and emotionally for simulation (Sadd, 2023). Positive outcomes were reported satisfaction with simulation and clinical learning, and high levels of confidence with clinical decision-making. Further research is needed to explore the cognitive learning effects of pre-simulation gaming on student learning and knowledge retention.

CONCLUSION

The issue of students completing preparation prior to clinical simulation will always remain, with students balancing competing priorities in their studies and life. Virtual pre-simulation games have shown to be well utilised by nursing students in preparation for clinical simulations. The 'wicked problem' was not solely about time; there is also the added pressure and anxiety that students feel when they are to be assessed in an OSCE. While the teaching team could not add more clinical practice time, the introduction of VSG did encourage cognitive practice – a possible 'taming' of a wicked problem. Pre-simulation VSGs are a cost effective, flexible mode of experiential learning providing students with flexibility in where, how and when they prepare for class; there is the added advantage of VSGs providing students with a way to revise or revisit a simulation, therefore embedding the learning from clinical simulation in preparation for safe clinical practice.

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