# Design Science Research as an Iterative Assessment Redesign Approach for a Gamified Assessment

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**Abstract:** A custom board game was developed in conjunction with an industry partner as an assessment in an introductory Business Management course. The objective of this serious game is to develop the business acumen of students enrolled in an Accountancy degree which culminates in the professional designation of Chartered Accountant recognised by the South African Institute of Chartered Accountants. The custom board game was originally designed in 2014 and this serious game has been used as an assessment annually; minor updates occurred in 2016 and 2017 in terms of updating rules to the board game which updated key game mechanics. Qualitative data collection involves multi-year after action feedback surveys from students, reflection notes made annually by the researcher and meeting minutes between the industry partner and researcher. Institutional ethical clearance has been received for the research project from the University, as well as permission from the industry partner and informed consent from each participant that chose to complete the surveys. The objective of the research is to document the 2026 revision and update of the board game using Design Sciences as the methodological paradigm. Design Sciences Research is well suited to the development and subsequent evaluation of artifacts. This research considers the board game itself, game pieces, rules and training materials used to prepare students for participation as artifacts, with the goal of developing students business acumen. Applying Design Science to the iterative development of a custom assessment is a novel approach, as this paradigm is more frequently used for engineering and information system applications. However, utilising games as assessments for the purpose of serious learning is an area of research receiving growing attention and robust systematic, literature informed approaches to the development and testing of tools and artifacts where assurance of learning is increasingly important can prove helpful to scholars.

**Keywords:** Design Science Research, Artifact Evaluation, Board Game, Assessment Design, Serious Games, Management Education

## 1. Introduction

As is characteristic of serious games the Boardroom Challenge was developed with a learning objective in mind, namely to develop the business acumen of students. Even though changes have been made since the original design in 2014 the changes were made with the concern of limiting cost of new materials and maximising the use of originally developed artifacts, such as the physical board and cards. Consequently, the changes were limited to theory card reprints – when the textbook was updated, and rule changes, as well as the addition of share tokens to add another level they can be promoted to. The first larger scale redesign is taking place in 2026 with key considerations revolving around whether the game is still fit for purpose to develop students' business acumen and in this vein to update the game mechanics and artifacts to ensure contemporary relevance and fidelity of the game. The methodological approach that will be used in this iterative redesign process to build and evaluate the updated board game is Design Sciences Research.

## 2. Background

To participate in the board game challenge students are randomly allocated six to a board with an industry based game master seated at each table. The students participate in a connection quiz, comprised of true and false theory questions. Students with the most correct answers select the industry that they will be representing in the Boardroom challenge first. The six industries that students can choose from, include; Pharmaceuticals and healthcare, Financial Services, Telecommunications, Construction, Automotive and Mining (see figure 1). Once game play starts students roll the dice to determine which scenario they will respond to. Each block displays an icon, representing a scenario the student must respond to, including; Theory – from the prescribed textbook, World Event, Risk and Enabler cards. For scenario cards students need to answer the generic scenario by first contextualising it to their chosen industry, then discussing how they will manage the situation and finally how they will recover (in the case of a risk card) or benefit (in the case of an enabler or world event card) from the situation. The game master decides if the answer is correct and this entitles the player to earn the rewards made possible by the card they are responding to (see figure 2). The grading of the game aligns with the achievement mechanisms in the game as students play the goal is to accumulate game cash and promotions through answering questions correctly.

**Figure 1: Board game overview**

There are also chair icons representing the opportunity for promotions and demotions, and finally lucky break cards. Additionally, the promotion in the game represents their career progression through the accounting field, from; Accounting Clerk, Accountant, Group Accountant, Finance Manager, Finance Director and Chief Executive Officer. Annual after action surveys have been completed by student participants and game masters providing feedback and suggestions about their experience with the board game.


**Figure 2: Overview of icons on the board game**

## 3. Problem Statement and Research Question

A crucial element in conducting design sciences research is the articulation of a relevant problem. In the case of this research the goal of the Boardroom Challenge is to develop students' business acumen, to bridge the gap between theory and practice. According to the industry partner, the trainees that are onboarded annually, straight from their university studies, have good technical proficiency, but translating theoretical insights into practical scenarios and in client engagement presents a knowledge gap. The board game was originally designed to create an experiential learning and assessment opportunity where students are required to use critical thinking and creativity to respond to dynamic scenarios afflicting their selected industries.

While updates have tweaked game dynamics, student preparation and some secondary mechanics, the essence of the board game has remained unchanged since its inception. The research aimed to use DSR as an iterative redesign methodology, thus the problem at hand is;

*Updating and redesigning the board game as an artifact using DSR to develop students' business acumen*

## 4. Review of the Literature

Design sciences research will be contextualised, common methodological choices embedded in the process will be introduced and the importance of the evaluation of artifacts will be conveyed, setting the scene for DSR as an appropriate methodological choice for this study.

### 4.1 Design Sciences Research

DSR can be characterised as a research approach and paradigm (Venable et al, 2017; Baskerville & Pries-Heje, 2019). Natural sciences investigates physics, chemistry and biology, social sciences answer questions emanating from anthropology, politics, economics and sociology while design science is suited to inquiries in medicine, engineering and management (Dresch, Lacerda & Miguel, 2015). DSR can be applied to a variety of problem classes, ranging from strategic alignment, best practices and governance to process modelling, skills development and organisational culture (Goecks, de Souza & Librelato, 2021). In contrast to more traditional research methods, design science is not only concerned with understanding a research problem, but also with providing possible solutions (Dresch et al, 2015). DSR projects are focused on generating innovative solutions to these real-world problems (Tuunanen & Winter, 2026).

A contribution of DSR to the field of management is that it reduces "the distance between rigor and relevance" (Dresch et al., 2015). Relevance of management research is contextualised by Dresch et al (2015) as knowledge that has been produced by the academy which also has a significant practical impact on the field. The process of building and evaluating artifacts are regarded as the two key activities in design science (Herselman & Botha, 2015).

DSR proposes an iterative process flowing from awareness of the problem and ultimately to evaluation of the artifact. Most authors present DSR as having iterative sequential steps (figure three below), that may differ slightly but generally include a phase of identifying the problem at hand, defining the objectives to be achieved, designing and developing theory and/or artifacts in response, demonstration of the artifact and finally evaluating the artifact (Tuunanen & Winter, 2026; Venable et al, 2017). The iterative nature comes into effect when the operationalised knowledge is put to the test and evaluated against the original problem identified (Dresch et al, 2015). Tuunanen et al, (2024) described the process as starting with a problem statement, design requirements, followed by solution design (design and development), and proof of concept (demonstration), and finally proof of value (the evaluation phase). This characterization highlights the practical side of DSR in artifact creation.

This research deals with the iterative redesign of a board game assessment and as output, deals with the proposal and attempt to make changes, which will result in an updated artifact. The timeline for the design of the artifact is August 2026, with the first round of testing from demonstration coming when the board game can be played by students as an assessment in October 2026.

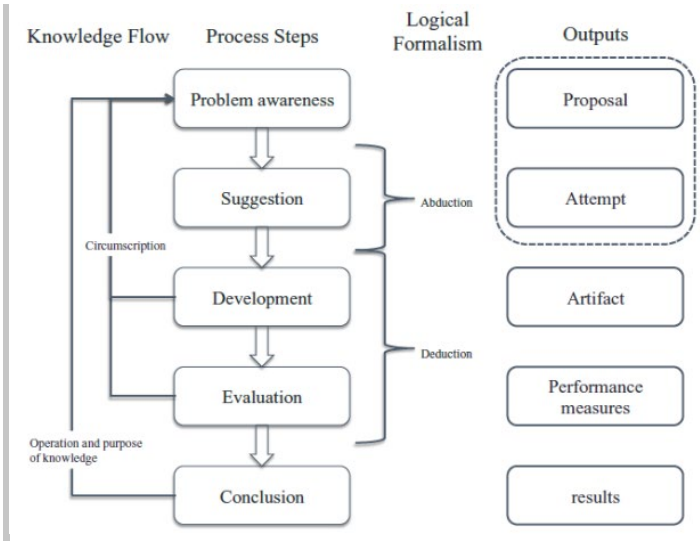


**Figure 3: Main stages and deliverables of DSR**

Source: Dresch et al, (2015)

A variety of artifacts can represent the outcome of DSR, including algorithms, models, frameworks, and methods, with the end result notably being that the artifact is in a functional state (Goecks et al, 2021). Design theory outlines the product – properties the artifact should have, as well as the process – the design principles that should be used for artifact development. Certain properties need to be incorporated in artifact development and this should simultaneously enable later testing of the artifact by ensuring testable hypotheses and an artifact that meets requirements (Prat, Comyn-Wattiau & Akoka, 2015). What sets DSR apart from other methodologies which are solely concerned with designing solutions, is the evaluation component which is intrinsically tethered to the original scientific aims.

## 4.2 Methodologies Employed in DSR

While DSR is the overarching method, the DSR steps which involve data collection and the process of generating the artifact rely on more traditional qualitative and quantitative methodological approaches. Systematic and coherently organised research methods are critical in ensuring the rigour of the research, reliability or trustworthiness of results and of course answering the research problem (Dresch et al, 2015).

According to Tuunanen et al, (2024) each phase in the DSR process has intermediate artifacts, criteria for validation and techniques that can be used for validation as pictured in figure four below, for every step in the DSR process. The validation techniques represent different methodological tools and choices available to researchers in the development process. Each step in the DSR process has a variety of methodological options, during the problem analysis phase, for example, a literature review, surveys and expert interviews can be conducted to validate the problem at hand. In the case of this research annual surveys are completed by student participants and game masters soliciting feedback. In the context of this particular redesign process a meeting with the industry partner representatives who also manage graduate recruitment was held, representing the validation technique.

| Design echelon type | Intermediate artifact | Validation criteria | Validation techniques | Design knowledge |
|---|---|---|---|---|
| Problem analysis | Problem statement | • Degree to which the problem has been solved<br>• Solvability (continuum, degree) | • Literature review<br>• Review practitioner initiatives<br>• Expert interview<br>• Focus group<br>• Surveys | Validated problem statement |

**Figure 4: Activities and design contributions per step**

Source: Tuunanen, Winter and vom Brocke, (2024)

The most common methodological tools listed as evaluation techniques by Tuunanen et al., (2024) are literature reviews, expert interviews, focus groups, surveys, benchmarking, mathematical proof, simulation, demonstration or experiment with prototype, and case studies. Dresch et al., (2015) concurs with the use of simulations, and experiments being primary methodological tools for the evaluation phase. It is however important to note that a variety of methodological tools play a role throughout the process, notably case studies – if the bounded nature of the inquiry supports this and action research, as an overarching approach of co-development if the researcher has an opportunity to work within an organisation to develop the artifact (Dresch et al, 2015; Peffers, Tuunanen & Niehaves, 2018).

## 4.3 Artifact Evaluation

While DSR is gaining popularity, the evaluation of artifacts in particular has not reached maturity (Prat, Comyn-Wattiau and Akoka, 2015). Different methods can be used to evaluate the outcome of the artifact in action, while observation is popular, case studies, action research, focus groups, experiments and simulations can all play a role (Goecks et al, 2021).Ultimately, for DSR to live up to the *science* in its name, it means the evaluation should be relevant and rigorous, evaluating the utility of the artifact, its quality and its contribution to knowledge (Venable et al, 2017).

Demonstration is often the primary evaluation tool. While demonstration does serve a purpose, such as confirming that the artifact works, more formal evaluation, demonstrating the true utility and feasibility of the artifact is necessary (Prat et al, 2015). Hevner (2010) proposes five kinds of evaluation methods; observational, analytical, experimental, testing and descriptive, however guidance on which method to use and why needs clarification. Prat et al, (2015) propose a taxonomy for testing different types of artifacts, including;

criterion, evaluation technique, form of evaluation, secondary participants, level of evaluation and relativeness of evaluation.

There are a variety of dimensions for artifact evaluation, ex ante – formative evaluation during artifact development and ex post – summative evaluation after the artifact has been developed (Venable et al, 2012; Venable et al, 2014). Evaluations can also be naturalistic – conducted with real users performing a task (Sun & Kantor, 2006), or artificial – and thus 'unreal' in one of the aforementioned conditions (Venable et al, 2016). Additionally, evaluation should not simply determine if an artifact worked, but also how and why it worked, or perhaps did not work (Herselman & Botha, 2015).

Ultimately, the purpose of evaluation of an artifact is to determine if it reaches the set goal and is useful (Prat et al, 2015). Based on their systematic review Prat et al, (2015) found that efficacy was by far the most common criteria, followed by usefulness, technical feasibility, accuracy, performance and effectiveness, with ease of use, robustness, scalability and operational feasibility rounding out the picture. A major challenge with regards to evaluation is that it extends the duration of a given study and consequently can incur high costs and time commitment (Baskerville et al, 2026). Planning to evaluate the artifact early in the DSR process can play an important role by ensuring that important inputs are preserved or created as needed to enable efficient and best practice evaluation later (Baskerville et al, 2026).

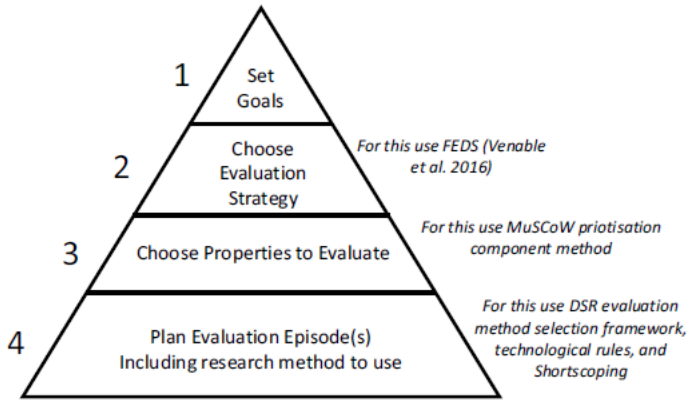


**Figure 5: Overview of Methodology for Evaluation in Design Science**

Source: Baskerville et al (2026)

While authors agree on setting goals (in this case its for the evaluation) and choosing the evaluation strategy Baskerville et al's, (2026) contribution adds step three, MuSCoW prioritisation and step four, careful planning of when the evaluation episodes will occur (see figure five) . The MuSCoW evaluation is about prioritising which criteria is appropriate in the context of the research question, it is also important that too many criteria are not used to evaluate because then it will become inefficient which is the reason evaluations often fall short. MuSCoW means dividing the potential evaluation criteria into four categories; properties that Must be evaluated, Should be evaluated, Could be evaluated and Would be nice to include (Baskerville et al, 2026).

## 5. The Study

The Board game was first developed in 2014. Since being originally designed, the only cards that have been frequently updated are the theory cards, updated and reprinted as new textbooks are prescribed. The evolution of the board game has primarily involved updates to rules, training for game masters (facilitators) and pre-game challenges, which enables people to select the industries they are competing in. As the figure six below illustrates, changes were made in a way that minimized costs and maximised the use of existing artifacts in pursuit of ensuring a return on investment regarding the original design and printing of artifacts. Arguably, all changes that were possible to finetune the board game in light of the aforementioned constraints had been made.

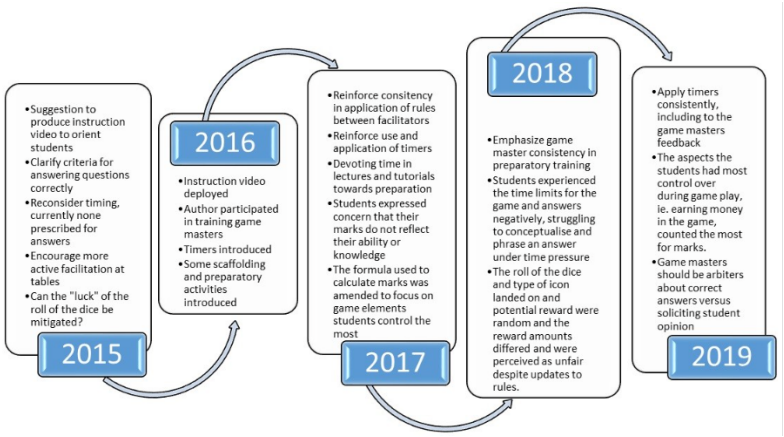


**Figure 6: Overview of board game changes**

In 2026 an opportunity arose to engage in the most significant redesign of the board game to date. Engaging in this redesign in a systematic manner is the focus of this article.

## 5.1 Data Collection and Analysis

Qualitative data collection includes multi-year after action feedback surveys completed by students, reflection notes made by the researcher and meeting minutes between the industry partner and researcher. In particular, the planning and redesign meeting was transcribed with the consent of participants and forms the basis of textual data analysed.

Upon reviewing the game, and changes made up to 2025 the following emerged:

- The primary mechanics of the board game are currently focused on the advancement of the individual player, measured by the achievement of promotions (after reaching the level of CEO, shares are earned) and game cash earned (for correct answers). While the students select an industry and present all their answers from the perspective of a chosen business, with the game creating opportunities for critical thinking and creative solutions, the answers remain conceptual and no game mechanics relate to the company students are representing in the game, only players personal advancement.
- A consistent point of feedback that students provide annually relates to their discomfort with the role of luck. The icons that students game pieces land on are determined by the roll of the dice, correct answers for a theory card earns 100 bucks, but no promotion, correct answers for a risk and enabler card earns 100 bucks and a promotion and correct answers to world events earns 200 bucks and a promotion. Thus, students perceive that their ability to do well is hampered by what icons they land on, thus consecutive world event cards are far more favourable than consecutive theory cards.
- Even though students are seated six to a board game they play independently and take turns, in between turns students are waiting. If their student engagement could be increased in between rounds that would be beneficial to their engagement in the learning experience.
- The dimensions of the original board mean that in the time allocated for game play students only navigate around a quarter of the board.
- In order to address procedural justice concerns by students' timers were introduced for all answers and feedback and in 2025 the decision was made for every student to have six turns, thus equating the opportunity to earn benefits, but also limiting their potential to accrue benefits.

The meeting where planning for board game updates took place can be summarised by figure seven below. The discussion regarding changes, updates and improvements centred around three themes:

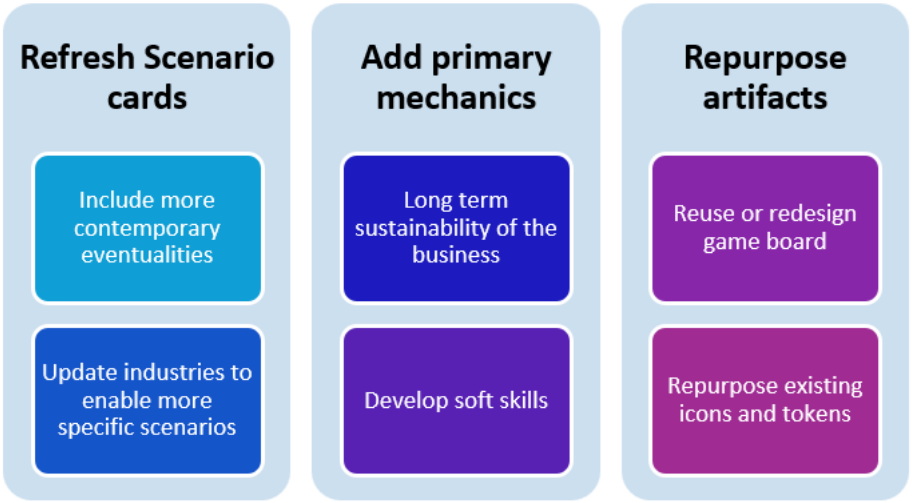


**Figure 7: Overview of identified themes from planning meeting**

### 5.2 Theme 1: Refresh Scenario Cards

At first the discussion centred around updating scenarios for the world event, risk and enabler cards to reflect more contemporary goings on. This is low hanging fruit as reprinting cards is an affordable redesign option. Since the original printing of scenario cards several world events have transpired, including Covid-19, Economic sanctions and complex regional conflicts that have influenced food and oil prices and the advent and increasing use of Artificial Intelligence, have proliferated.

The current scenario cards are very broad precisely so that they can be answered by students with businesses nested in the diversity of industries presented by the existing board (see figure one). The suggestion is to narrow down the industries present in the game so that scenarios that are updated can be more customised, focusing on either services or manufacturing.

### 5.3 Theme 2: Add Primary Mechanics

Based on the analysis of changes up to 2025, a goal is to add game mechanics that relate to the sustainable performance of the business. Ideas include layering in dynamics about key investments for the business in sustainability, governance, risk management, and capital investment products. A goal that can be added in is that they have to aim for the competitive advantage of the business they represent, and not just their own career advancement. A particular request from the industry partner is to incorporate soft skill development opportunities through scenarios. This could include interpersonal scenarios and ethical dilemmas. An objective is to layer these changes into the game using existing icons and tokens?

In the current game set-up, after completing the connection quiz the highest ranked students can select the industry they want to be in for the rest of the game. They proceed to design a business card with a logo for their imaginary company, and they answer all the scenario questions from the perspective of this company. If industries are narrowed down (instead of one business per industry) and mechanics are added which relate to the advancement of the business then the business card design can become a higher stake activity in the game. In order to achieve this, students have to pitch their business to the game master, a score for this activity can be added to their marks.

### 5.4 Theme 3: Repurpose Artifacts

An important idea in repurposing artifacts and existing cards is to standardize the opportunity presented by each type of card, meaning that whichever opportunity card someone lands on they have the same potential to earn money and gain a promotion. The tokens currently used to represent shares can be repurposed to represent commodities. If resources or commodities are added as game play goals then the mechanics can be updated to incorporate ‘pauses’ or rounds for bartering, to layer in opportunities for business advancement. This can take place after every three rounds, with 15 minutes given to negotiate for their business advancement – this can also be connected to rolling the dice but with a different range of benefits to pre-existing icons, related

to advancing their business. Possible outcomes can include launching a new product for their business, building a new facility, or making a capital acquisition. As in business, resource limitations means that trade-offs need to be made in order to save, trade or invest in commodities.

| DSR Evaluation Method Selection Framework | Formative (some adaptable for summative) | Summative (some adaptable for formative) |
|---|---|---|
| Naturalistic | • Action Research<br>• Interview/Focus Group<br>• Field Experiment<br>• Think Aloud Protocol Analysis<br>• Qualitative Survey | • Quantitative Survey<br>• Participant Observation<br>• Pilot Study<br>• Field Study or Case Study<br>• Ethnography |
| Artificial | • Criteria-Based Evaluation<br>• Scenarios<br>• Prototype Demo<br>• Lab Experiment<br>• Theorem Proof | • Lab Experiment<br>• Optimisation Analysis<br>• Testing<br>• Role Playing Simulation<br>• Computer Simulation |

**Figure 8: DSR Evaluation method selection framework**

Source: Baskerville et al (2026)

In line with the best practices proposed by Baskerville et al., (2026) the changes to the board game will be made with the evaluation of the updated artifact in mind (see figure eight). The industry partner is open to updating the board if this can be done cost effectively. Both ex-ante and ex-post evaluations will be conducted. In terms of ex-ante evaluations, formative checks will be put in place during development, selected game masters with previous involvement in the board game during previous iterations will play the game and provide feedback.

In terms of ex-post evaluations, the summative evaluation envisioned will be naturalistic – involving students actually participating in the board game assessment and completing a self-reporting questionnaire, as well as facilitators (game masters) completing a questionnaire. In both cases the researcher will be observing and noting changes.

## 6. Implications for Practice

As the Board game has clear educational goals, which were originally problematised in the context of cultivating the business acumen of undergraduate students pursuing a qualification in accounting, DSR is an appropriate methodological tool. Gamified assessments are increasing in popularity and use and DSR presents a robust and systematic methodology to use in their iterative development and improvement.

## 7. Conclusion

The study investigates the use of DSR in the redesign of a board game used as an assessment. The process of how the board game was originally developed and evolved was presented. Both the criteria and considerations pertinent to the redesign process were discussed. Due to the timeline for development and the planned board game assessment date, the evaluation component of the board game falls outside the scope of this article. The evaluation phase will be designed alongside the implementation of changes to enable efficient evaluation of the artifact.

## Ethics Declaration

The study required ethical clearance from the relevant committees at the University which was granted from November 2023 until November 2026, the ethical clearance code is: 23SOM/BM44. Only a subset of the data collected is utilised for this study. In particular, the industry partner granted permission for staff members to participate in the study and each individual participant consented to participate.

## AI Declaration

No AI was used in the compilation of this paper.

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