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# Educational principles in Tabletop Simulation: an overview

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## Abstract

Tabletop simulation (TTX) has emerged as an innovative educational tool within medical training, offering a unique approach to experiential learning. By simulating real-world scenarios, TTX allows learners to practice skills and make critical decisions in a low-risk environment. Traditionally associated with disaster preparedness and emergency response, TTX has now expanded into various non-emergency applications, demonstrating broad potential across healthcare domains. TTX's structured yet flexible format allows for the enhancement of cognitive and interpersonal skills, such as communication, leadership, and teamwork, through collaborative gameplay.

This paper explores the current state of TTX, its educational principles, and its strengths and limitations. It provides up-to-date evidence-linked insights for educators and facilitators. Key essay themes include: 1) the role of prior learner knowledge and ability to facilitate learning, 2) specific motivational theories identifiable in current TTX games, and 3) the current state of TTX debriefing.

Within this work, several impressive, peer-reviewed studies linking TTX to educational practice are identified, and key underlying learning processes that can and should be exploited in TTX are explored. Overall, there is a clear trend towards developmental progression in the field of TTX on both commercial and home-grown levels. However, we find the current body of work is lacking and systematic work needs to be done in order to develop a coherent evidence base.

## Introduction

In 2004, Gaba stated 'Simulation is a technique – not a technology – to replace or amplify real experiences with guided experiences that evoke or replicate substantial aspects of the real world in a fully interactive manner' [1]. This experiential learning allows deliberate development of skills, practice of scenarios and use of systems without exposing patients to unnecessary risk. The field of simulation has grown exponentially in the 21st century [2] and is now a cornerstone of medical education with training colleges and institutions advocating for it to be a part of training [3–5]. One burgeoning field of medical simulation is Tabletop Simulation (TTX). Historically, TTX has been defined solely in terms of emergency healthcare scenarios [6]. This was typically used in disaster medicine to evaluate an organization's preparedness as well as educating healthcare professionals on their roles during a response [7–10]. However more recently, appreciation has developed for non-emergency, non-clinical TTX training which has led to a suggestion of a broader definition: 'a scenario-based activity that utilizes physical objects (character pieces/representations, game board, cards, dice, chips, coins, spinners, etc.) with or without role-play or a storyline/narrative that facilitates learning, discourse, and discovery' [11].

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Currently, TTX is in a state of rapid development, outpacing the healthcare research community's ability to evaluate its effects [12]. Despite this challenge, the aim of this essay is to outline what TTX is, how the simulation technique has developed, and explore three key areas: (1) 'Knowledge and ability' discusses tailoring a TTX educational event to an individual's level with the aim to achieve a productive learning experience, (2) 'Motivation' showcases some of the unique gamification-type attributes of TTX which used correctly can provide captivating appeal during play and (3) 'Debrief' reviews the methodologies that have been used in TTX. Overall, this article focuses on games that simulate a clinical role as a core game feature rather than simply an educational board game, although the line is often somewhat blurred.

## Tabletop Simulation history and overview

The earliest publication of a dedicated medical TTX appears to be a game called 'Intern' (see Figure 1) which simulated the life of a doctor in a large teaching hospital. It could be played at an 'intellectual level wherein knowledge of medicine is important' [13]. Within the 1979 patent application, the authors state that 'no board game of which we are aware deals with delivery of medical services from the point of view of a physician' [14]; a statement that does not appear to have been subsequently contested.

As implied from the game 'Intern', TTXs aim to have an explicit educational component delivered through simulation. A facilitator is typically needed who can use the TTX environment to try and reach the planned learning objectives. Facilitators are appreciably uncommon in leisure board games, although the 'Dungeon Master' in the Dungeons and Dragons [15] board game could be considered one of the more notable exceptions. Having a facilitator allows for more adaptability and less dogmatic adherence to rules. Collaboration rather than a focus on winning is usual for TTXs, although this is sometimes seen in leisure board games, such as 'Pandemic Legacy' [16].

In comparison with manikin-based simulation education, TTX plays a relatively minor role, with pockets of enthusiasts creating games. These creators usually aim to facilitate education in a specific area that they themselves have identified. For example:

- A group of PhD psychology students adapting the classic board game 'A Game of Life' in order to highlight the difficulties of balancing large and small life events whilst undertaking doctoral programmes [17].
- A specialty oncology doctor producing 'Mindset Tabletop Simulation Board Game' which bills itself as a run-through of an on-call shift, in which clinicians encounter scenarios to manage [18].

**Figure 1:** Playing board of the 'Intern' board game [14]

- A specialist nurse with specialist interest in domestic violence developing a game tackling different scenarios with the end goal of reaching a 'Safety Zone' [19].

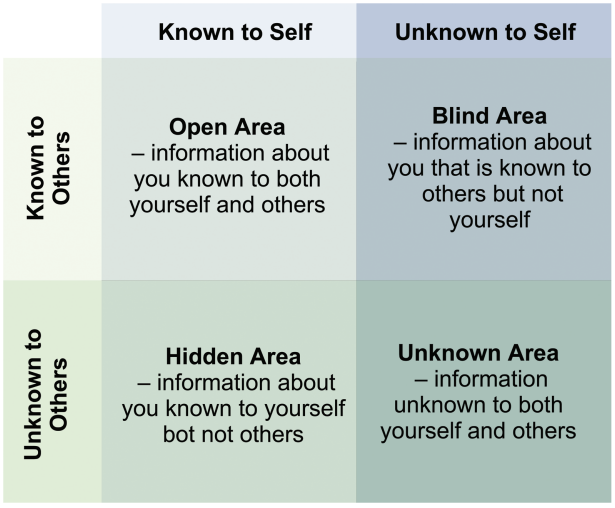
Each individual simulation modality will lend itself to certain educational circumstances depending on what is trying to be achieved and how. Overall, TTX lends itself well to the task management and resource allocation aspects of healthcare, whereas high-fidelity manikins offer more of an opportunity to train for certain clinical skills, such as venepuncture or laryngoscopy. These are circumstances in which TTX will likely never provide a suitable training alternative; however, there are situations where TTX-based resuscitation simulators have been successfully incorporated within national training programmes due to local resource pressures [20].

## Knowledge and ability

While training grade or years of experience can offer some insight, these could be seen as crude measures that don't finely capture an individual's expertise of what they know or don't know. One of the classic methods of outlining a learner's level of knowledge and ability is the Johari Window (see Figure 2) [21]. This psychological tool provides a useful model to represent different levels of self-awareness and interpersonal knowledge.

Each of the four areas represents a different state of a person's relationship to knowledge: Open, Hidden, Blind and Unknown [21]. The Johari Window has been used to conceptualize concepts such as blind spots, foster self-awareness, promote open communication and build interpersonal relationships [22,23], all of which are arguably critical for strong team dynamics in high-stakes settings. Integrating the Johari framework into the start of a TTX event can offer a practical way to frame facilitated discussions with learners. It offers learners a simple and intuitive model to conceptualize their knowledge gaps to address their 'unknown areas'. For example, facilitators can help individual learners identify their personal blind spots, which can be overcome as a team due to pooled attributes and/or knowledge base. Targeted TTX implementation may move aspects of knowledge gaps into the realms of the 'known'. TTX environments themselves emphasize cognitive and interpersonal skills – such as communication, leadership and collaboration – all areas that the Johari Window can be used to improve [23]. Whilst there is no published use of the Johari Window specifically in TTX there has been a published suggestion of a TTX game based around the Johari Window as a core game mechanic. Players start with different zones of information that they are privy to; players share their access to the information in order to identify their roles within the group.

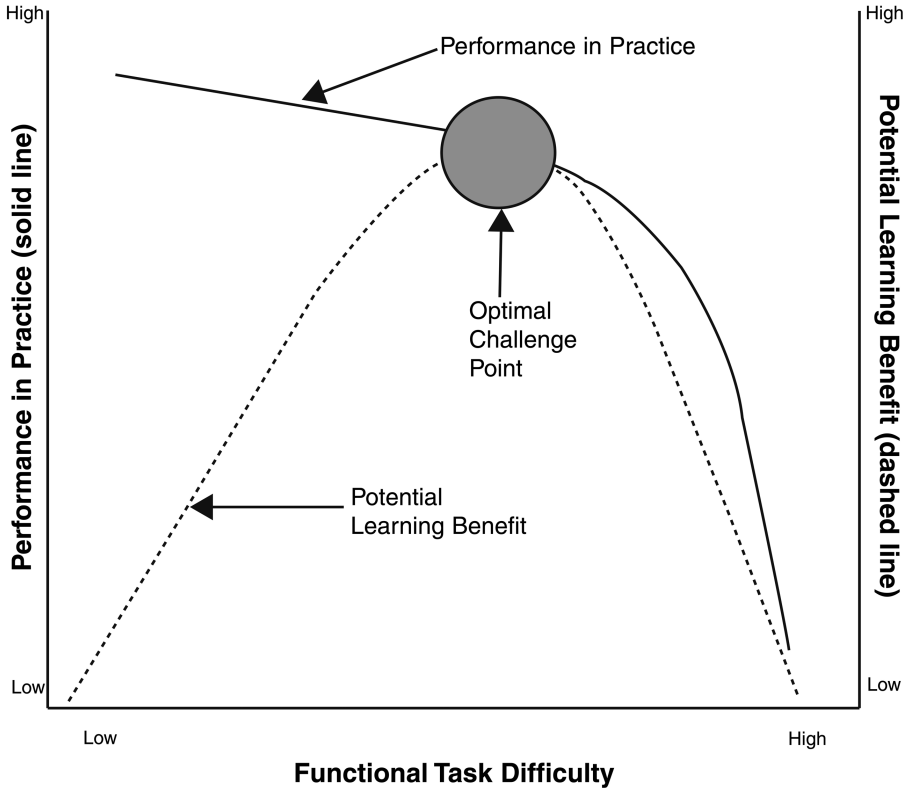
**Figure 2:** The Johari Window [21]




Facilitators can further optimize an educational event by striving to aim for a learners' 'Optimal Challenge Point' (OCP; see Figure 3). The OCP helps conceptualize the point at which an individual will gain most from a task or simulation by looking at the functional task difficulty and plotting against performance and potential learning benefit [24]. Simply put, there may well be a way of making a TTX simulation 'easier' or more 'difficult'. What a learner will find more or less difficult is likely to depend on the individual, their training and their lived experience. However, finding the point at which the Functional Task Difficulty is at a level at which stimulates the learner and induces the most learning benefit is the task for the simulation facilitator. If the Functional Task Difficulty is too low, this risks the learner becoming bored and potentially disengaged, if too high then the risk is that the learners may feel overwhelmed and disengaged. An example of optimizing the challenge of a simulation can be seen in the Emergency Department TTX 'The Floor' [25], doctors early in their ED career typically focus more on the clinical management aspects within the game. Whereas, with the doctors approaching consultancy, the clinical aspects within the game are still present but an additional pressure of departmental flow by the reduction of in-game resources (e.g. reduction in available in-game beds for patients to be placed into within the same given available time limit).

TTX has been shown to provide opportunities to develop decision-making and problem-solving skills based solely on the knowledge that the participants bring to the scenario [26]. This can be seen at many scales but arguably one of the biggest strengths of TTX is that it allows learners to practise and refine larger-scale management skills without endangering whole hospital(s) and system(s) safety. This sandbox environment allows learners to work as an active team member who debates, hypothesizes, interrogates and develops opinions on subject matter in a self-controlled, social and situational environment – all core pillars elements of constructivism [27,28]. Constructivism educational theory is based on the premise that knowledge acquisition develops from individual experience and interactions, learners build new ideas using their own discoveries. Engagement comes from application of existing knowledge and real-world experience – this means the individual hypothesizes and tests their theories on the world, looking at the results and ultimately drawing conclusions [29]. Such full-blown experimentation in a clinical environment can arguably only be done safely within a simulation, with the caveat that it is indeed not

**Figure 3:** The relationship between learning curves, performance curves and the optimal challenge point (copied with permission) [24]




real life. Published research on TTX has identified 'transfer of learning' which enables the application of knowledge learned in one setting to future novel circumstances [30,31]. A local example of constructivist learning is the current beta testing of an Intensive Care Unit TTX entitled 'The Unit' [32] at The Royal Sussex County Hospital, Brighton. The game includes playing pieces representing doctors and nurses of varying seniority and skill level. Multidisciplinary clinical teams play together, managing evolving scenarios by applying their expertise in a helicopter-view style of a hospital. This active experiential problem-based learning within groups shows TTX simulation is positioned well to educate through the constructivist maxim [30].

TTX can also be used to maintain a knowledge level and prevent its decay. This is important as the acquisition of new knowledge requires more effort than maintaining old knowledge [33]. Evidence suggests that knowledge and skills decay by 6 months to 1 year after completing Advanced Life Support training [34] (a course for which the certification lasts 4 years before expiring). The Canadian Neonatal Resuscitation Program identified problems with course information retention [20]. To address this, a neonatal resuscitation TTX paired with simulations was developed called REsuscitation TrAINing (RETAIN) [35]. One study reported a 12% increase in knowledge retention [36], although the study notably lacked a control group.

## Motivation

Board games used in a learning environment have been shown to foster motivation [37]. Even using TTX to simply increase awareness can increase reported motivation to learn about a subject [38]. Understanding and harnessing this factor is likely to be beneficial in providing educational tabletop simulation.

Motivation can be defined as 'the process whereby goal-directed activities are instigated and sustained' [39]. There are a number of theories surrounding motivation [40], however, a cornerstone of educational theory proposes motivation can be divided into intrinsic or extrinsic [41]. The former is related to a learner's inner desire and is considered deeper, while the latter comes from external pressure and is considered to promote more superficial learning [42]. That said these two motivational aspects are likely to be complimentary; a learner's internal desire to succeed will likely be met with an external praise [43]. Motivation to play TTX may come from a combination of the game, the game mechanics or from a desire to learn.

## Game-induced motivation

Recent work on alternative reality game motivation [44] describes six elements of educational motivational game mechanics:

- Completion: completing objectives;
- Narrative: following a storyline and journeying with characters;
- Creation: building, developing ideas;
- Competition: achieving things better or faster than other players;
- Community: communicating with others, collaboration;
- Puzzle-Solving: problem-solving, lateral thinking.

Using this framework to review published TTX games, it appears that these motivational elements are rarely found in isolation. Competition and Puzzle-Solving can be seen with games such as 'Doctor Jargon' [45], a card game in which clinicians compete in teams to relay key words on cards, without using medical jargon, against the clock. Narrative and Creation motivational elements can be seen in the game 'Essential Diagnosis' [46] a game aimed at medical students which facilitates role-playing classical clinical diagnoses to each other in order to simulate history taking and examination. Competition, whilst common in leisure board games, is often replaced with Community in TTX, emphasizing collaborative working, which is key to working within healthcare teams. Teamwork is emphasized in our own in-house anaesthetic game entitled 'The Bleep Test'[47] (see Figure 4), and in the aforementioned 'The Floor' [25], which can have a multi-disciplinary team playing co-operatively to solve issues.

These game mechanics, curated appropriately within the TTX format, could well foster intrinsic motivation. Unrestrained extrapolation of TTX motivational element based on other educational game formats could well be misleading due to differences in the technologies. In some situations, motivation in board game-based education has been shown to be higher compared to computer game equivalents [48]. Each technology will have advantages and disadvantages. It does seem, however, that the most persistent games are often the simplest due to a focus on gameplay – a statement that is likely to be important to remember when implementing or designing TTX.

## Learner motivation

Learner motivation is increased by identification of specific goals, and this can result in higher performance [49]. Goal-orientated theory divides this motivation into three main camps [50]:

1. mastery goal: desire to master content;
2. performance-approach goal: doing better than others;
3. performance-avoid goal: avoiding failure, which produces the least favourable outcomes.

Ideally, TTX simulation should be facilitated so that learners aim to progress towards 'mastering' content. With this direction, learners believe that intelligence and ability can improve through learning which results in engagement. If learners believe that intelligence or ability is simply a fixed trait then they are motivated by performance goals and are simply concerned about simply performing well which is thought to limit potential [40].

A conceivable issue with learning through highly developed TTX game design is that the gamification may itself leave an imprint on the educational content itself; therefore mastery of the TTX simulation could theoretically result in poor mastery of reality. Inclusion of excessive and unnecessarily gamification should therefore be avoided as it may detract from the ultimate aim of the TTX educational event. It is indeed possible to develop and implement TTX almost completely devoid of gamification elements which, with the right facilitation can provide a positive learning environment. An example of this is 'Moulage Roulette' [51] used in the charity Air Ambulance Kent Surrey and Sussex. Within a 13-page laminated booklet there are five sequential steps that aim to randomly combine a number of features (e.g. age, site of injury, location of incident, etc.) to produce a randomized case. This case then goes on to form the basis of a facilitated discussion of scene and casualty management. This more 'basic' form of TTX could well require a more

**Figure 4:** The Bleep Test [47]

adept facilitator with substantial medical knowledge to make the aim of learner goal mastery achievable. Nevertheless, TTX has the advantage over other simulation modalities of enabling rapid iteration of simulated situations with minimal faculty. The opportunities to practise using TTX more frequently may therefore facilitate goal mastery better than complex simulation; however, the evidence behind this hypothesis is currently lacking.

### Debrief

The importance of debrief has been recognized since 1933 when Dewey founded the idea of reflective practice as a deliberate and active process with the immortal phrase 'We do not learn from experience. We learn from reflecting on experience' [52]. There is no clear reason why this would be any different within TTX methodology. There are a large number of models to choose from which often have a degree of overlap [53]. The Promoting Excellence And Reflective Learning in Simulation (PEARLS) debrief method [54] has been successfully used in the debrief of an MDT TTX which aimed to simulate challenges during transfers of care on a labour ward [55]. Another TTX based around education of medical students in mass causality incidents [56] explicitly employed the formal debriefing technique TALK [57]. No specific reason was given for utilization of this method and no data was reported in its efficacy. In other published TTX the debrief approach was a much less prescribed affair and the faculty could use a structured debrief method such as the plus delta model 'if desired' [58]. In others, there is no explicit debrief method outlined [18]. What has been shown by these examples is that there is seemingly a lack of evidence to recommend one debriefing model over another for TTX. In order to progress TTX itself we must ensure that the debriefing development is a future priority to understand how one has consolidated the learning impact.

Looking at other TTX simulations, it shows there may well be the possibility to develop TTX-specific debriefing tools. In a TTX for military surgery personnel [59] a set of specifically designed key questions was used to stimulate discussion and thereby debrief the scenario. These questions were themselves designed in order to support fulfilment of the explicit learning objectives of the simulation. Additionally, to this, there were examples of alternative scenario management approaches which were presented in the debrief to provide a stimulus for evaluation. This latter technique arguably displays an advantage of TTX where a photograph of a gameboard could display a large amount of information, be easily stored and thereby easily utilized as a complete visual record. Perhaps with this technique, there is a risk of straying into the realm of feedback rather than debrief, but used in the correct way this may well be a way of providing additional material to reflect upon to facilitate a more profound educational event.

## Analysis

This essay represents a 'tip of the iceberg' view of the current TTX game landscape and the learning processes surrounding it. Due to the infancy of the discipline, there is likely a large cohort of unpublished or inconspicuous work. In addition, a lack of cohesive nomenclature in the literature inhibits effective literature review. Indeed, there are likely to be many more TTXs which have not been examined here. Nonetheless, TTX appears here to stay and will likely inhabit a key role in the future of simulation training. As with all methods of teaching, TTX has advantages and limitations (see Table 1), and these factors must be appreciated in order to maximize the teaching event if the method is employed.

Many questions surround the most effective methods of TTX design and implementation – further work should, and is, being done to start to bring light onto this area. The widespread presence of board games in human culture highlights an inherent desire to play games, serious or otherwise. Developing the area of TTX educational theory will be crucial to harness this potential. Fortunately, debriefing techniques from 'traditional' simulation are easily transposed to debrief TTX. However, there does appear to be a niche for TTX-specific debrief questions, raising the possibility of further development in this area. Despite these advancements, significant questions still remain surrounding the most effective method of TTX implementation to meet specific

**Table 1:** Advantages and disadvantages to TTX teaching methodology

| | Advantages | Disadvantages |
|---|---|---|
| TTX development | • Rapid prototyping<br>• Minimal long-term servicing requirement/cost | • Easy to produce so may result in more TTX with lower educational efficacy |
| TTX implementation | • Low initial cost outlay<br>• Low/No recurring cost<br>• Easy to set-up, operate and maintain<br>• Reduced faculty footprint requirement<br>• Easier to operate<br>• Low equipment requirement<br>• Inherent reliability due to low technological requirements<br>• Learning objective goal flexibility<br>• Avoids resource limitations<br>• Reduced scale<br>• Reduced time and/or cost implications | • Lower realism/fidelity may make reduce simulation efficacy<br>• Easier/cheaper to produce/implement could result in budget constrained departments implementing TTX where other simulation modalities maybe more appropriate<br>• TTX risks diverting attention from knowledge acquisition due to the novelty of game mechanic (e.g. rolling dice, counters, scoring, etc.)<br>• Individuals who do not normally play board games may be at disadvantage when playing TTX (although in one study TTX candidate performance was only marginally positively correlated to years of board game experience) [20] |

educational objectives. Many factors contribute to this including the time available for implementation as well as the proficiency of the learner and facilitator alike.

Overall, within the current literature, there does appear to be a distinction between TTX implemented in disaster medicine and hospital/primary care. In the former, TTX are typically tailored to a specific event combined with a specific place, are run less frequently, on a larger scale, include an MDT, and take more time to implement [8,9]. Some even have breakout educational events interdigitating the TTX gameplay to highlight specific learning points [10]. The hospital/primary care TTX seemingly have more of a leisure game environment (e.g. dice, counters, cards, etc.) with a more 'developed' game-playing boards [25,45,46]. This may reflect external factors such as a higher level of commercial development and the desire to appeal to the maximum audience.

## Conclusion

This essay has outlined what TTX is, how it has developed, and illustrated some of the key underlying learning processes. There is a clear trend towards developmental progression in the field of TTX. Although there is some impressive dedicated and focused peer-reviewed published work linking TTX to educational theory [48], currently this body of work is lacking. With the development of more TTX games, this field of research will undoubtedly grow in size and sophistication. With so many enthusiasts developing games, an evidence-based TTX learning theory toolkit to aid the non-educationalist TTX enthusiast could be invaluable. This may streamline game development efficacy with suggestions for game mechanics linked to educational theory, be a forum for mutual support and provide suggested standardized nomenclature in order to facilitate future comparisons and analysis. The future of TTX is currently very much open for exploration and development.

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## Availability of data and materials

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## Ethics approval and consent to participate

None declared.

## Competing interests

None declared.

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