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- 'docendo ac discendo' - 'by teaching and learning'

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We would like to take this opportunity to show appreciation to all those involved with the production of the International Journal of Clinical Skills (IJOCS). Many thanks to all members of the Editorial and Executive Boards.

The International Journal of Clinical Skills looks forward to contributing positively towards the training of all members of the healthcare profession.

Contents

Editorial Board for the International Journal of Clinical Skills

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Foreword

Head of Clinical Communication King's College London

Since its inception, the International Journal of Clinical Skills (IJOCS) has provided a unique platform for the teaching and learning of clinical skills in a variety of healthcare disciplines. It has become a well established peer reviewed Journal publishing a diverse range of clinical skills articles.

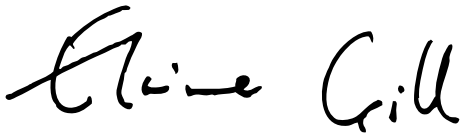
The Editorial Board consists of people active in the field of clinical skills teaching and this is reflected in the journals philosophy to encourage sharing of ideas and practice. Pertinent contributions aim to meet the current needs of researchers and practitioners.

Clinical skills teaching is going through a definite 'growth spurt' at present with increasingly responsive models, manikins and e-learning programmes - not dismissing financial investment that comes along with this. High quality clinical simulation is becoming more sophisticated as a teaching and learning methodology. The need to equip health professionals with the skills and competencies to improve patient-safety is one of the drivers behind this growth. However, alongside the purchase of the 'Sim'-men/women/babies and linked e-learning, let's not forget the importance of personal interactions through faculty support, i.e. experienced clinical teachers. In addition, simulated patients and the delivery of interprofessional sessions, bring clinical simulation closer to the realms of reality and validity, for both undergraduate and postgraduate health professionals.

The use of simulated patients, relatives and carers is well established in clinical communication education. More recently, additional interesting and innovative approaches to clinical communication teaching are in various stages of substantive core curricula and special study activity across medical schools in the UK.

The IJOCS is now established in the world of clinical skills publications by providing a niche specific arena that welcomes quality research, thereby promoting excellence in healthcare internationally. The wide range of papers covering research, discourse and reflection in clinical education and practice, plus the inclusivity of interprofessional approaches in one publication, raises the validity of this journal. There remains room for research based evidence to support teaching and practice of patient-centred clinical learning. The IJOCS welcomes additions to the literature that encourage critical debate.

Without doubt, the International Journal of Clinical Skills has continued to exceed its original ambitions and I wish it growing success.



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Learning diagnostic and clinical reasoning strategies through an interactive board-game

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Abstract

Background: A number of studies have reported the educational benefits of using games to reinforce aspects of teaching and learning. In this study we evaluate a novel, collaborative tool that can be used to reinforce clinical reasoning strategies in undergraduate medical students.

Methods: A pilot project was conducted with a cohort of 75 third year medical students at Dundee Medical School (UK). All participants were asked to evaluate the game after taking part in a small group session.

Results: The game was rated very highly in terms of its design, playability, perceived learning benefit and enjoyment.

Conclusion: There is scope for using this tool as a resource to encourage group learning, discussion and reflection across a broad range of curriculum content. A similar structure could be adopted by other health professionals at all stages of learning.

Introduction

In recent years, educationalists have utilised and evaluated a number of games to support teaching and learning in medicine [1]. The strength of many such projects is their dependence on active learning, strategic thinking and interactivity [2]. Typically games have been used to engage students in both tacit and explicit learning about subjects that may be difficult to teach satisfactorily using conventional means.

This paper reports on the use of a novel board game that utilises group learning and constructivist principles to bring about learning of clinical reasoning and diagnostic strategies in a challenging yet enjoyable format. The game was piloted with a group of third year undergraduate medical students. We report an evaluation and discuss the potential of the game for a variety of courses, disciplines and institutions.

Background – the role of games in medical education

Broadly the learning that results from the use of educational games can be thought of in terms of both the 'content' and the 'process' of the game. Most games that have been reported in the literature to date are restricted to learning about content [1]. These tend to be subject specific projects which use a game as a 'delivery vehicle' for subject specific knowledge, often in the basic sciences [3, 4]. Examples are as diverse and as specific as anti-microbial therapy [5], lymphocyte function [6], and chemotherapy [7] (Table 1).

Table 1: Examples of medical education board games

Author	Subject area	Type of game
P. Valente et al [5]	Bacteriology and antimicrobial therapy	Dice and luck game, two stage learning
N. A. Saunders and B. J. Wallis [8]	Emergency triage	Card game, two stage learning
K. D. Skinner [9]	Sexual health	Quiz-communication game, two stage learning
D. R. Tomlinson [10]	Pharmacology	Role-play, three stage learning

Most games that have been reported have been subject specific and utilise only one or two stage learning processes [1]. In contrast, the game discussed here is novel in that it combines learning of a wide breadth of content (which is not subject specific) with learning of generic processes. In this case the processes are those of diagnostic reasoning, information gathering and decision making. It therefore has the potential to apply to every field of medicine and every stage of learning.

Clinical reasoning is a vital skill to acquire in healthcare though it is often thought of as an emergent property rather than something which is taught explicitly [11]. This notion has been challenged by a number of stakeholders in undergraduate education [12]. There is growing evidence that teaching and learning clinical reasoning skills early on may lead to improved diagnostic accuracy [13], reduced error rates [14], reduced emotional distress [15] and improved satisfaction for both patient and doctor [16].

It is recognised that it may be difficult for undergraduate medical students to appreciate the principles of effective clinical reasoning and decision making for a number of reasons. Firstly, students have not had a wealth of practical experience and though they may appreciate the concept of pattern recognition it is difficult for them to appreciate its merits and demerits [17]. Secondly, students in the UK and elsewhere are increasingly taught in 'systems based' curricula. Such curricula have many benefits, but it is recognised that one of the challenges they present is encouraging the synthesis and integration of reasoning across systems [9, 18]. For example, a patient with breathlessness may be suffering from a respiratory, cardiac, endocrine or neurological condition and considering only one system in isolation is a diagnostic pitfall. Thirdly, it is difficult for students to reflect on their own strategies for reasoning and diagnosis in a safe yet challenging educational environment [19]. Consequently the game discussed in this paper was designed with these challenges in mind.

Gaming offers a number of qualities that have a solid grounding in adult learning theory [1, 2]. In particular, there is evidence that deep learning is more likely to result from activities that involve interactivity, stimulation, activation of prior learning and a constructive approach of building on group learning [20, 21].

Bochennek et al describe a classification system for medical board games whereby both the format of the game and the complexity of experiential learning are taken into account [1]. This game would be classified as a level 3 or 'thinking game' and one that utilises a four stage experiential learning cycle as described by Kolb [22]. This is therefore a higher order game, yet playing the game is remarkably simple.

Methods

This game was evaluated by a cohort of third year undergraduate medical students at the University of Dundee Medical School, UK. Dundee Medical School has adopted an integrated, progressive spiral curriculum [23]. This cohort of students was nearing completion of three years of systems based teaching. At the time of the study, students were undertaking an integrated course called the 'Transition Block'.

This course had been designed to explicitly cover issues of synthesis, reasoning and safety across body systems and disciplines and to bridge the transition towards specialty based teaching in years 4 and 5 of the curriculum. This course is currently being evaluated. This was an opportune point to use the game both as a teaching and revision aid. The game was designed to reflect course content from across the previous three academic years.

How to play the game

The overall aim of the game is to make a series of accurate diagnoses through the safe, accurate and efficient gathering of information. Firstly, each player takes a diagnosis card from a pile. These cards have been produced to sample across three years of curriculum content. The Dundee curriculum is structured around 110 core clinical problems that all Dundee graduates are expected to be familiar with by the end of the course.

These diagnosis cards are colour coded such that students could play with the first, second or third year cards or with the whole pack. When each player selects a card it is displayed on a mount such that all players can see each others diagnosis but not their own. The aim is for each player to identify his diagnosis by questioning his colleagues and accruing information in a safe, accurate and efficient manner. An image of the game being played is shown in Figure 1.

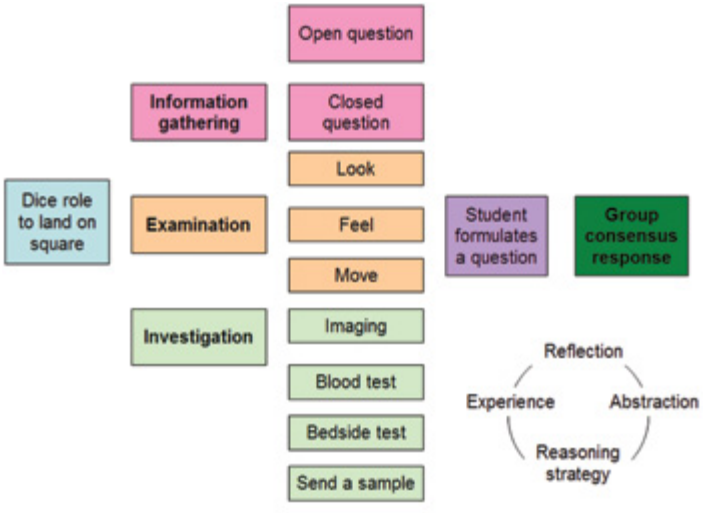
Figure 1: Example of the game being played

Note how each diagnosis is apparent to the rest of the group, but each player can not see their own diagnosis.

Players role a dice which moves them round various squares on a board. Each of these squares represents different sources of clinical information. All potential sources of diagnostic information are covered with a simple hierarchy. These are 'information gathering' (questioning and listening), 'examination', or 'investigation'.

When a player lands on such a square, they must then use a spinning wheel which directs them to a sub-category of clinical information (Figure 2). The player must then carefully choose a question to ask of their colleagues. A player is more likely to gather meaningful information if they carefully consider the type of question that they use and the utility of a potential answer. Having gathered some information the player then rolls the dice again and completes this cycle a further two times. The player will then have three pieces of clinical information. They may opt to make a diagnosis at this stage or to defer to the next round when they will have obtained a further three pieces of information. Again, they may offer a diagnosis or defer to another round. After three such cycles (nine items of information) a player must offer a diagnosis and whether correct or incorrect they must select another card and continue.

Figure 2: Schematic representation of possible sources of clinical information that a player may obtain from his/her colleague

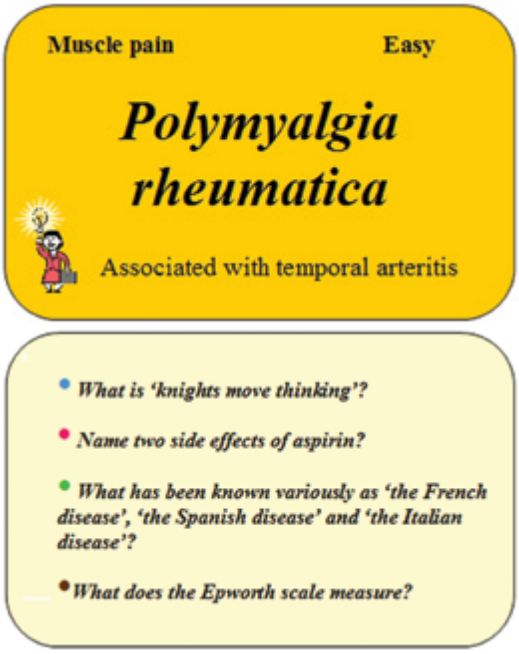


The game is designed to cover all categories of clinical information within a simple hierarchy. During each turn a player goes through three cycles of enquiry. They may have up to three turns (i.e. nine cycles) before they are compelled to offer a diagnosis.

The scoring of the game is designed to reward safety, accuracy and efficiency. If a player makes a correct diagnosis within one cycle they receive 3 points. If they are incorrect they receive minus 3 points. After two cycles a correct diagnosis receives 2 points and an incorrect diagnosis minus 2 points. After three cycles a correct diagnosis receives 1 point and an incorrect diagnosis minus 1.

In addition, two other types of squares are included on the board. One is a **'breakthrough' square**. If a player lands on this square they are given a clue regarding their diagnosis. These are printed on each card and are designed to strengthen factual associative learning and to aid the speed and fluency of the game. The second type of square is a **'spot diagnosis' square**. A player who lands on the latter square may select a 'spot diagnosis' card which contains a choice of general knowledge type questions on *'signs'*, *'symptoms'*, *'facts & figures'* and *'history of medicine'*. A correct answer scores 1 point and an incorrect answer minus 1 point. This was designed to incorporate variety, change of pace and further test of knowledge into the game.

Figure 3: A sample diagnosis card (top) and a sample spot diagnosis card (bottom)



In Figure 3, the core clinical problem that this diagnosis is an example of, is listed in the top left corner ('muscle pain'). The level of difficulty is ascribed in the top right corner. The card is colour coded to correlate with the year of the course that the clinical problem might be introduced in. The bottom text is a 'breakthrough' or diagnostic clue that a player would be given if they landed on the 'breakthrough square'. The sample spot diagnosis card incorporates an element of factual learning and general knowledge. Questions are colour coded under *'signs'*, *'symptoms'*, *'history of medicine'* and *'facts & figures'*.

Evaluation

The game was piloted on a sample of third year medical students who attended a routinely timetabled teaching session (n = 75). Students were given an instruction sheet, but were deliberately not given any additional information on how to play the game or succeed strategically. Students played either in groups of 4 or 6 (3 pairs). Each group played the game for 45 minutes and then completed an anonymous evaluation form.

No validated tool could be found in the literature for evaluating board games in healthcare. The evaluation questionnaire was designed primarily to assess the perceived learning benefit, validity, playability, challenge and enjoyment, of the game. A successful educational game must score highly in all these domains [24].

It was not desirable in this context to carry out a pre- and post-game test of knowledge. The game does not primarily reinforce factual knowledge alone and therefore such a comparison would not be helpful. Ethical approval was not required for this study and no identifiable student information was gathered.

Results

The evaluation results are summarised in Table 1. Overall evaluation was very positive. 82% of respondents agreed or strongly agreed that the game was well designed. 92% agreed or strongly agreed that the content was appropriate to their stage of learning and 81% agreed or strongly agreed that the game would be a beneficial learning tool.

One of the crucial factors in the efficacy of any game as a learning aid is the extent to which players would want to use it again and 89% of respondents agreed or strongly agreed that they would do so.

Table 1: Summary of evaluation results showing percentage (%) scores within each response (n = 75)

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Game Design					
The rules were clearly explained	5.4	23.0	18.9	45.9	6.8
The objectives of the game were clear	0.0	8.5	14.1	57.7	19.7
The board was well laid out	0.0	4.2	2.8	68.1	25.0
The game was too simple	9.7	75.0	12.5	2.8	0.0
The game was too complex	0.0	55.6	27.8	13.9	2.8
The duration of the game was about right	1.4	13.7	32.9	50.7	1.4
Overall, the game was well designed	1.4	4.1	12.2	66.2	16.2
Game Content					
The level of the challenge was about right	0.0	1.4	9.6	76.7	12.3
There was too much material	1.4	67.1	24.3	7.1	0.0
There was too little material	1.4	62.0	23.9	9.9	2.8
Overall, the content was appropriate	0.0	1.4	7.0	80.3	11.3
Learning					
The game was useful in improving my knowledge	0.0	9.6	4.1	61.6	24.7
A knowledgeable student would score more highly in the game	0.0	1.4	13.7	49.3	35.6
A student with good clinical reasoning would score more highly in the game	0.0	2.8	18.1	52.8	26.4
The game could help me study or revise	0.0	16.2	13.5	55.4	14.9
Overall, the game would be beneficial as a learning tool	0.0	8.2	11.0	63.0	17.8
Overall					
The game was fun	0.0	4.2	5.6	56.9	33.3
I would probably play the game again	0.0	8.3	2.8	55.6	33.3

The questionnaire included a free text response section for respondents to comment on strengths, weaknesses and suggestions for change. The commonest features that were noted as strengths were the interactivity, enjoyment and breadth of content. Examples of comments included: "interactive learning two way challenge"; "integrating fun into learning"; "thinking outside the box through all systems"; "improved clinical reasoning skills" and "had good fun playing and learning at the same time".

The commonest weakness that was reported was that answers to *'spot diagnosis'* questions were not given (instead groups had to reach a consensus themselves). There were two comments that the instruction sheet could have been simplified.

Discussion

This novel board game offers a number of advantages as a learning tool. The key strengths are its interactivity, fun and constructivist approach to group learning whereby students consolidate, question and challenge each other. Most other medical board games that have been reported depend on relatively complex structures and are restricted to narrow subject areas. In contrast, this game utilises a relatively simple gaming process to cover a potentially limitless field of content.

Gaming can be thought of as an experiential learning cycle. All players in this game will use a three stage learning cycle whereby experience (question and answer) leads to reflection and then a new plan for further information gathering [25]. Many will go further and use a four stage model whereby information gathering and reflection lead to abstraction and the development of a reasoning strategy [6]. The appeal of this game is therefore higher order thinking and deep learning based on a very simple format.

There are two main weaknesses of this study. Firstly, it was conducted with only one cohort of students in one medical school. Nevertheless it could be argued that the generic qualities that are emphasised in this game are much more generalisable than other subject or course specific games that have been reported elsewhere. In theory there is no reason why it could not be used by any medical or healthcare student at any level.

Secondly, as with many learning interventions, it is not known whether this would have a meaningful long term impact on reasoning strategies. In order to assess this fully it would be necessary to design either a pre- and post-intervention comparison, or to develop a randomised controlled trial whereby some students use the game and some do not. This has never been done with an educational game but would be the gold standard. The final aspect that one would wish to evaluate in such a longitudinal study is the 'repeat playability' of a game and in particular whether students choose to play it again in their own time. Again, this has not been reported before in similar studies, but it would be essential information if a game were to be disseminated to a wider audience.

In determining the utility and sustainability of an educational intervention one should also consider material cost, use of other resources and sustainability [26]. This game cost approx £200 to produce the materials for the entire session. No staff are required to facilitate sessions and the cost of the game would be negligible for future use. It is hoped that the game could be made available for students to use in their own self-study time.

There are a number of potential ways in which the game could be developed. The same game structure could be used with a virtually infinite array of 'diagnoses'. Thus, a version could be played with first year medical students, postgraduates, midwives, paramedics and so on. It could also be used with single specialties e.g. dermatology, neurology or cardiology. Players could select for themselves which diagnoses they wish to use depending on their context and learning needs. Indeed, the game could be adapted whereby players could construct their own diagnosis cards at the start of the game. As much of the 'content' is derived from shared group experience, the game is not as liable as others to becoming obsolete or out-dated.

Finally, the game depends on the interactivity and enthusiasm of a group of students (although it could be played by as few as two players). A single player version is currently under development using a web-based platform. A similar process of information gathering would be used, but a database of conditions and parameters would be used as a basis rather than group knowledge. It is hoped that the board-game and the single player version will be available to other healthcare institutions from 2010.

Conclusion

This game offers a generic template for teaching and learning about diagnostic skills that could be adapted for a number of courses, professions and subject areas in healthcare. It was evaluated very favourably by undergraduate medical students and offers an additional mode and route of learning that could be incorporated into a variety of courses. It also has potential as a revision or study aid and could assist students in identifying their own learning needs.

Acknowledgements

Many thanks to Colm Sheehan for help in summarising the evaluation data and to the students of Dundee Medical School (UK) for their comments and suggestions.

Declarations

It is hoped to offer the game discussed in this paper as a not-for-profit fundraising venture to support Dundee University's collaboration with the Medical School in Malawi.

If you would like further information about the game or wish to use it in your institution, please contact the author at:
kct1@st-andrews.ac.uk or via www.medicaldiagnosisgame.com

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