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Using game format to teach psychopharmacology to medical students

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Abstract

Background: Most psychiatric programs provide lectures on basic principles of psychopharmacology. Yet, this traditional approach has been criticized due to excessive information and passive transfer of expert knowledge. An alternative teaching method is the use of "academic games."

Aims: To investigate medical students' acquisition of knowledge on psychopharmacology, and their perception of a game playing approach compared to traditional lectures.

Methods: Two senior residents designed, implemented, and executed a randomized pretest–posttest study to teach psychopharmacology, using an academic game and a lecture format, to third-year medical students during a 6-week Psychiatry clerkship. Both didactic interventions were delivered concurrently for five consecutive weeks covering five psychopharmacology modules: antidepressants I (selective serotonin reuptake inhibitors and atypical antidepressants), antidepressants II (monoamine oxidase inhibitors and tricyclic antidepressants), mood stabilizers, antipsychotics, and anti-anxiety agents/sedatives/hypnotics. The game follows similar rules of the famous TV show, "Jeopardy" using a power point grid and a multiple choice question format.

Results: Forty-three medical students participated (29 assigned to the game approach, 14 to the traditional lecture approach). None of the demographic variables (age, gender, years after graduation, Graduate Point Averages, and United States Medical Licensing Examination 1) were significantly associated with the pre/posttest score difference between groups. Both groups improved their knowledge on psychotropic drugs [(game group $t = 10.86$, $p < 0.001$); control $t = 4.82$, $p < 0.001$)] throughout the 6-week Psychiatry rotation. Students in the game group had a better perception of this educational method as measured by perceived enjoyment, increased knowledge of psychopharmacology, and stimulating interest in the subject compared to those in the lecture group ($p < 0.05$).

Conclusions: Teaching psychopharmacology in medical students by using academic games can make the learning experience more enjoyable and motivating; however, future studies with higher quality methodology and design are needed to determine the role of educational games in acquiring new psychopharmacological knowledge.

Background

Traditional teaching methods such as lectures and seminars are often used in medical student and resident education. These methods are described as dense, fostering students' passivity transfer process of knowledge, and minimizing their personal responsibility in the task of learning. Education experts have developed multiple alternatives to make learning more accessible and interesting. "Academic games" are a group of these relatively new approaches, known for promoting the use of groups, reducing anxiety, helping to identify precise areas of improvement, and providing reviews prior to examinations (Russell et al. 1984; Zisook et al. 2005).

A variety of games have been used in medical education including "war games" to enhance high-risk clinical decision making (Hedrick & Young 2008), a quiz-type board game to teach medical microbiology (Beylefeld & Struwig 2007), a "Survivor" game to review pulmonary physiology (Howard et al. 2002), and a "Jeopardy" game to teach about ectopic pregnancy (O'Leary et al. 2005). In fact, a recent survey of the program directors of internal medicine and family medicine residency programs in the United States found that educational games, particularly Jeopardy-like games are very popular and are most commonly used as teaching tools.

These didactic methods stimulate interactive participation and make the process of learning more enjoyable. However, there is a paucity of pharmacology games, for instance, in

Practice points

- Innovative educational game format to teach psychopharmacology is as effective as standard lectures in regards of acquisition of knowledge.
- The process of informal learning while using a game format enhances motivation and enjoyment.
- Effectiveness of educational games as a teaching strategy in medical students requires further assessment with particular consideration of methodological designs.

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psychiatric education literature, and none of them have been used with medical students. In our review of pertinent bibliography, we found a board game developed to teach and evaluate knowledge about psychotropic medications by nursing students (Tankel 2001) and, various format games used with small group of pharmacy students as an alternative to discuss pharmacotherapeutic case studies (Patel 2008).

In this study, we aimed to assess third-year medical students' knowledge of psychopharmacology by using an interactive power point grid. In turn, we attempted to evaluate the students' perception of game playing as a teaching method compared to traditional lectures.

Material and methods

The study was conducted during a 6-week Psychiatry clerkship of third-year medical students at an academically affiliated community mental health center in a large city. The exercise was presented and executed for exclusive research purposes, not being a standard component of the medical students' didactic curriculum. Medical students provided informed consent and the Institutional Review Board (IRB) approved the study.

Two senior residents drafted 140 multiple choice questions (MCQs) using up-to-date published literature in psychopharmacology. A senior Psychiatry consultant with expertise in psychopharmacology judged face and content validity of the questions. One hundred twenty-five MCQs were selected and edited for the final gaming version, and classified into five psychopharmacology modules, each one having 25 questions: antidepressants I: selective serotonin reuptake inhibitors (SSRIs) and atypical antidepressants, antidepressants II: monoamine oxidase inhibitors (MAOIs) and tricyclic antidepressants (TCAs), mood stabilizers, antipsychotics, and anti-anxiety agents/sedatives/hypnotics.

On day 1 of a 6-week rotation, a senior resident informed the students about the purpose and the logistics of the exercise. After recruitment and enrollment and signing of informed consent, students provided demographic information and answered a 20-item MCQs pretest to assess their general knowledge of psychopharmacology. The test questions were extracted from the test bank developed for the game. The participants were, then, randomly assigned in a 2 : 1 ratio to two teaching groups: (1) The game group, which was randomly subdivided into two competing teams and (2) The control group that concurrently received identical factual content as the game group but in a lecture format. Thus, we obtained three groups in each cohort with equivalent number of participants. This interactive lecture was standardized on content and length, and delivered by the same senior resident throughout the entire intervention. The senior resident did not remain blind to the aims of this didactic exercise, so we minimized intervention biases by compelling the senior resident to strictly adhere to the designed format. Furthermore, both groups received a 45-min lecture series delivered by faculty members as part of a pre-established curriculum, before the experimental interventions were executed each week. The topic of each module purposely correlated with that in the lecture series.

In a 45-min presentation, the senior resident serving as a quizmaster provided the game rules, formulated the questions, and controlled the time for answering. Each cell of a point grid consisting of four columns and five rows was assigned a particular point value, with higher scores representing more difficult questions (25, 50, 75, 100, and 125). Each point value was hyperlinked to another power point presentation of two slides, one with a MCQ and another with the correct answer. Both playing teams received questions in an alternating fashion, and were awarded points based on the degree of difficulty and complexity of the questions they selected. If the team, in turn, answered the question correctly, its name was placed in the appropriate square of the grid. If the answer was incorrect or the team remained silent in the allotted time (1 min), the other team was allowed to "steal" the question. If both teams failed to answer correctly, an "X" was placed on the corresponding grids. After each question was played, the quizmaster provided a brief explanation on both the correct choice and the other alternatives.

After five modules were completed, students answered a 20 MCQs posttest (1 point per question) and a satisfaction survey. The posttest's questions, extracted also from the test bank, were different from those from the pretest, although with a similar level of difficulty. The satisfaction survey consisted of 5-point response categories (1 = lowest; 5 = highest) designed to measure difficulty and breadth of content, stimulation of student interest, enjoyment of the didactic exercise, and level of improvement in psychopharmacology knowledge.

We summarized the descriptive data as mean (SD; standard deviation) or percentage. Demographic variables between groups were compared by using independent sample *t*-tests for continuous data, and χ^2 test for categorical data. *t*-Tests were also used to estimate the average difference between the pretest and posttest scores within each group and between them, and to determine differences in responses on the satisfaction survey questions of both didactic methods. We also measured the strength of a linear association between pretest–posttest score differences and demographic variables by using Pearson correlation coefficient. All analyses were performed by a biostatistician blinded to the study hypothesis and calculated by using statistical software JMP 8 SAS Institute Inc. Cary, NC. The level of significance was set at a $p < 0.05$.

Results

During 18 weeks, all third-year medical students rotating in a 6-week Psychiatry clerkship voluntarily participated in the study. Twenty-nine students, subdivided into two groups with almost evenly number of participants (15 *versus* 14 students) composed the game format team. Other 14 students participated in the lecture format. We found no significant differences between groups in mean pretest–posttest score. There was also no difference between groups in terms of age, gender, graduation year, GPA, or USMLE 1 scores (Table 1). The entire cohort as a whole and each of the groups significantly increased their pretest scores during the clinical clerkship [(game group: $t = 10.86$, $p < 0.001$); control: $t = 4.82$, $p < 0.001$)]. Variability in pretest–posttest score difference was

explained by 14% of pretest scores ($p=0.04$) but not significantly associated with any of the demographic factors (Table 2).

A total of 43 students (100%) completed the satisfaction survey. There was a significant association between teaching method and enjoyment perception ($p=0.005$), increased general knowledge of psychopharmacology ($p=0.025$), and stimulating interest in the subject ($p=0.004$): participants in the game group rated the didactic approach higher than those in the lecture format. No significant difference on the level of difficulty of the pretest and posttest questions was perceived between groups ($p=0.105$; Figure 1).

Though the correlation between the survey responses and the demographic variables has not been conducted, it would not affect the results because it has been clearly established that the groups do not differ significantly in the demographic characteristics.

Table 1. Categorical and continuous variables of interest by the study groups.

Variable	Game ($N=29$) Mean (SD)/N (%)	Control ($N=14$) Mean (SD)/N (%)	P
Age (years)	26.48 (0.66)	25.85 (0.95)	0.59
Gender			
Male = 20	12 (60.00)	8 (40.00)	0.33
Female = 23	17 (73.91)	6 (26.09)	
Years post graduation	4.20 (2.58)	3.21 (1.25)	0.18
GPA[a]	3.21 (0.41)	3.21 (0.31)	0.96
USMLE[b] 1	202.13 (2.90)	205.35 (4.18)	0.81
Pretest–posttest difference	4.00 (0.44)	4.00 (0.63)	1.00

Notes: [a]Graduate Point Average at the start of the study; [b]United States Medical Licensing Examination.

Table 2. Unadjusted association between pretest–posttest score difference and variables of interest.

Variable	Correlation (r^2)	P	CI (95%)
Age (years)	0.04	0.18	−0.34, 0.06
Gender	0.05	0.12	−2.55, 0.31
Age after graduation	0.01	0.67	−0.37, 0.23
GPA[a]	0.04	0.18	−0.76, 2.90
USMLE[b] 1	0.01	0.58	−0.03, 0.06
Pretest score	0.14	0.04	−0.73, −0.1

Notes: [a]Graduate Point Average at the start of the study; [b]United States Medical Licensing Examination.

Discussion

During a 6-week Psychiatry rotation, the medical students in this sample improved their knowledge of psychopharmacology and, although the academic games were perceived as more enjoyable, stimulating and even more effective than traditional lectures in increasing knowledge, the difference was not statistically significant in the latter comparison.

The fact that academic games make the students' engagement in the learning process a more enjoyable experience than traditional lectures is corroborated by our results. The impression that the content was equally difficult to the participants in both groups even though the game approach was more likable than lectures, may suggest that the method *per se* was related to higher satisfaction among medical students. Educational games have several advantages including motivation through competition (Blenner 1991), enhancement of communication, and social interaction (Schmitz et al. 1991) and team work as well as increased collaboration through fostering alliances and mutual respect among group members (Sisson & Becker 1988).

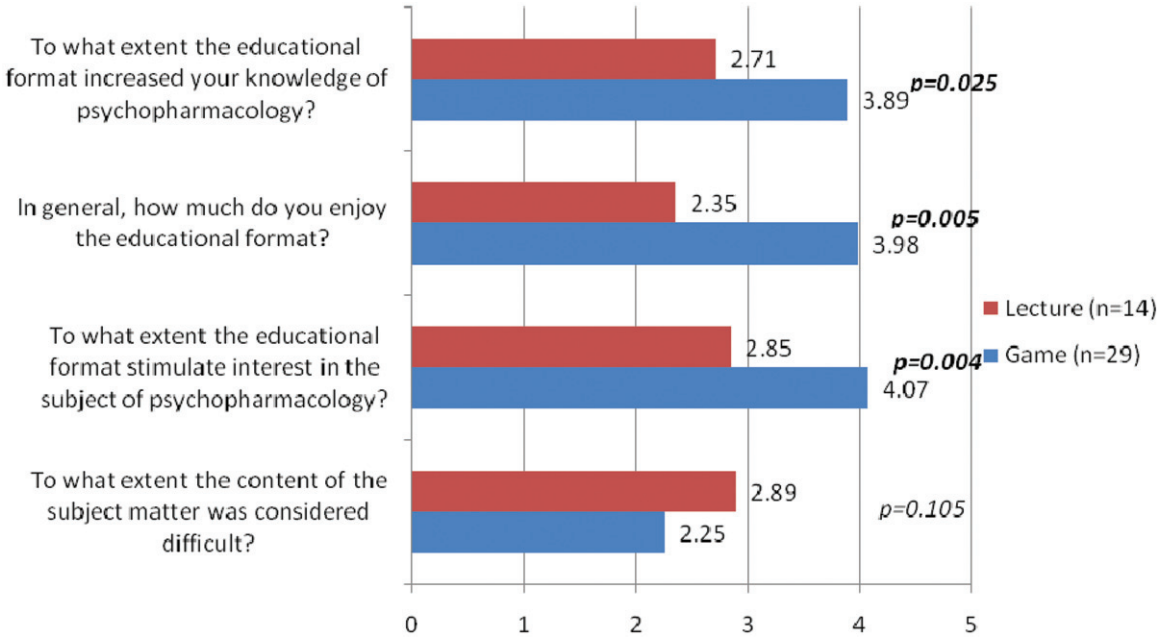

Figure 1. Satisfaction survey comparing students' perception on difficulty of content, interest, enjoyment, and improvement of psychopharmacology knowledge between game *versus* lecture groups using a 5-point Likert scale.

In the ongoing debate about which teaching method yields the best knowledge and better developed skills in the students, only few fairly designed trials have consistently demonstrated increased gain in knowledge of the subject matter using educational games in comparison to traditional didactics. For instance, a recent Cochrane Database Systematic Review (Bhoopathi & Sheoran 2006) on effectiveness of educational games for mental health professionals identified only one randomized controlled trial (RCT) aimed at teaching psychiatric topics to mental health nursing students. The study, called Trivia psychotic, was conducted in Northern Ireland, and showed that those allocated to the educational game scored six more points than control students on a test of questions relevant to psychosis. A similar systematic review of games (Akl et al. 2008) used with health care professionals identified only one eligible study (Burke 2001). This RCT study compared teaching methods of infectious disease control, and showed that a game format ("Family Feud") had a significantly higher effect on reinforcing knowledge retention in those initially exposed to a videotape as compared to those initially taught by a self-learning module.

Among medical students, trials that compared games *versus* traditional methods in a pretest–posttest design found no significant difference (Steinman & Blastos 2002; Sward et al. 2008). Furthermore, a randomized study on teaching child development to fifth-year medical students revealed that interactive lectures were more effective in the short-term acquisition of factual knowledge than role playing games. While students enjoyed the game-playing aspect of the intervention, there was no difference in the long-term performance between groups (Selby et al. 2007).

In this study, the utilization of a randomized design and a head-to-head comparison between an educational game and a traditional lecture, provide a balanced methodological approach. Nevertheless, several limitations should be taken into account. The small sample size may have prevented the generation of enough power to detect a statistically significant difference between interventions. Similarly, the level of experience and depth of knowledge of the instructors were not measured. More importantly, even if a difference exists in favor of the educational games, it must be pondered in the scope of several disadvantages. Games are time consuming and costly to create, set up, and execute (Walljasper 1982). They also can be embarrassing or generate stress on those learners who performed poorly in the game (Lewis et al. 1989). Finally, it may be difficult to decide on a particular evaluation outcome, and to find a validated tool to assess that outcome (Sisson & Becker 1988).

The use of a didactic game intervention was not intended to present new knowledge but rather to complement and reinforce existing knowledge. The basic fund of knowledge of psychotropic drugs as measured by the pretest score had a significant but small effect on the information gained (pretest–posttest difference) during the Psychiatric rotation. The game may have contributed to build up knowledge of psychotropic drugs also in a small proportion compared to primary sources of information such as lecture series, clinical discussions, and ward rounds. In addition, the frequency (once a week) and duration (5 weeks) of this didactic intervention may have been insufficient to demonstrate a significant advantage over traditional lectures. Future areas of investigation should include the effect of games on the durability of knowledge and the ability of games to reinforce and clarify concepts taught in lectures and reading assignments.

The impact of factors such as the medical students' "number of hours dedicated to study psychopharmacology" was not measured. This factor could have provided an interesting perspective to explain the lack of differences between methods in the acquisition of knowledge. While not clearly proven (Zdep & Irvine 1970), a phenomenon described in social psychology and named *the John Henry effect* or compensatory rivalry may confound the measure of experimental innovations. This principle postulates that the members of the control group, viewing themselves in disadvantageous competition with the treatment group, will perform in an atypical fashion. Thus, it is possible that in our study, the medical students assigned to the lecture group have adjusted the quantity and quality of their learning efforts to meet the testing requirements. It would also be interesting to explore whether subgroups of students with specific learning styles are more likely to take advantage of educational games.

In conclusion, although academic games do not provide thorough answers to all the demands of comprehensive learning task in a psychiatric curriculum, they could encourage the students' involvement and increase their motivation and interest in learning. There is a need for more research with higher methodological designs and tools to explore the role of games in a variety of medical education areas. How educational games can be effectively translated into increased knowledge, and measured with well-validated tools is indeed a challenge to the field.

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

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