

ORIGINAL RESEARCH PAPER

Viral Hepatitis: An Alternative Teaching Method

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ABSTRACT Objectives: *Our teaching experience has shown that dealing with the immunological aspects of viral hepatitis poses several difficulties. Therefore, we developed a game to verify whether or not this active-learning exercise could enhance students' learning and arouse their interest in subjects that are basically complex.*

Methods: *Fifteen cards with clinical cases of hepatitis A, B, C, D, and E, and 50 explanatory cards with the description of epidemiological, clinical, and immunological aspects of the hepatitis mentioned above. The objective of the game was to match the explanatory cards with the respective clinical case. Pre- and post-tests were used to assess students' grade improvement.*

Findings: *One-hundred-and-forty students participated in the activity. The overall response of the students to the game was very positive: 129 (92.1%) found the game encouraged clinical thinking, and 105 (75%) regarded the game as an important way of consolidating learning. The students' grades significantly improved ($p < 0.05$).*

Conclusion: *Games allow understanding the subject matter through global knowledge. They also foster the student-professor relationship, simplifying the solution to the questions that may arise from a more comprehensive study.*

KEYWORDS *Viral hepatitis, alternative method, active-learning card game, medical education.*

Introduction

Hepatitis is an inflammatory process that affects the liver. It may be caused by viruses, drugs, toxins (e.g., alcohol), poor oxygen distribution to the liver, overweight of fats, or autoimmunity reactions. In some cases, the etiology is not clear.

There are five viruses (A, B, C, D, and E) that primarily infect the human liver and cause hepatitis (hepatotropic viruses) and many other viruses

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that inflame the liver when there is a systemic infection (nonhepatotropic viruses).

Although these agents can be distinguished by their molecular and antigenic properties, all types of viral hepatitis produce clinically similar illnesses. Prior to the availability of serological tests for hepatitis viruses, all cases of viral hepatitis were labeled either as “infectious” or “serum” hepatitis. Modes of transmission overlap; thus a clear distinction between the different types of viral hepatitis cannot be exclusively based on clinical or epidemiological features, since the types of viral hepatitis involve specific serological tests (Dienstag & Isselbacher, 2001). Our teaching experience has shown that using only words to explain serological markers for hepatitis is complicated. For that reason, there is a need for an approach that combines both verbal and visual information.

At the School of Medicine of Universidade Federal do Rio Grande do Sul, Brazil, medical immunology is taught during the fourth semester, along with courses such as Pathology and Introduction to Clinical Medicine, which emphasize the practice of Medicine; the comparison between medical immunology and these other subjects may discourage students from the study of more theoretical subjects. We previously developed teaching aids, for example, a poster for the study of the complement system (Scroferneker *et al.*, 1995) and a game for the study of cellular and humoral responses (Colombo *et al.*, 1998). In both cases, we had satisfactory results. Siqueira *et al.* (1992, 1998) developed two methods for teaching biochemistry, which they called “The Krebs Cycle Game” and “The Dynamic Metabolic Diagrams”. Both were games that involved a logical sequence of thoughts, and proved valid as a tool for stimulating the learning process. Another game approach using case-based, small-group discussion format to teach ethics in medical school was described by Baldor *et al.* (2001). Moy *et al.* (2000) developed an educational game in pulmonary physiology for first-year medical students based on a popular television game show, evincing that the educational tool enhanced students’ learning process and their ability to understand and retain information. Finally, Da Rosa *et al.* (2003) created a panel board about immune response regulation, showing the importance of using the panel board when trying to approach a subject that is vast and complex not only for students but also for professors.

The present study uses a card game as a method for teaching viral hepatitis. Our aim was to verify whether this active-learning exercise could enhance students’ learning and arouse their interest in subjects that are basically theoretical and complex, thus stimulating their memory and creativity.

Material and Methods

About the Game

The game consists of two types of cards with different colors: 15 cards containing cases of hepatitis A, B, C, D, and E, and 50 cards describing

epidemiological, prophylactic, diagnostic and immunological aspects of the hepatitis mentioned above (the game is available from the authors upon request).

Creating the Game

The cases for the Hepatitis Game were based on the clinical files of the Department of Gastroenterology of the local university hospital – clinical cases of hepatitis A, B, and C; and on medical books (Dienstag & Isselbacher, 2001; Hoofnagle & Lindsay, 2000; Lindsay & Hoofnagle, 2000) for hepatitis D and E.

The epidemiological, prophylactic, diagnostic, and immunological aspects were written in a short, abbreviated way, based on medical books on the subject (Dienstag & Isselbacher, 2001; Hoofnagle & Lindsay, 2000; Lindsay & Hoofnagle, 2000).

Monitors

We selected previous-year undergraduate medical students by applying a written test on viral hepatitis. A total of 28 students were selected and then trained by the head professor. The topic was brought up in every training session by the head professor and the game was played by the monitors until there were no questions regarding its application. Four sessions were run, with a 7-day interval in between.

Suggestions for Play

One week before playing the game, students were told to study about hepatitis and a bibliography was indicated (Dienstag & Isselbacher, 2001; Hoofnagle & Lindsay, 2000; Lindsay & Hoofnagle, 2000; Fischer *et al.*, 2001).

On the day of the game, the head professor conducted a 30-minute review session about hepatitis. After that, all students were randomly split into two groups (A and B) and were asked to answer a test (Pretest), so that their previous knowledge could be checked. There were two different pretests (A and B), both including 10 statements. Students in group A answered pretest A and students in group B, pretest B. Both groups had the same number of students. All students were asked to mark true or false to each one of the selections (the pre- and post-tests are available from the authors upon request).

Afterwards, students were once again split, but this time, they formed small groups (five students per group) to enhance student's engagement. Each group had a monitor of the Medical Immunology course to explain the rules and to conduct the game.

This was followed with each student randomly receiving three yellow cards and six blue cards. The objective of the game was to match a clinical case (yellow card) with three blue cards explaining three different aspects (epidemiological, prophylactic, and immunological) of the case. For this purpose, in each round, each student was allowed to swap one of his blue cards for another blue card that had not been distributed, keeping, however, the same

clinical cases. The first student to match any of his clinical cases (yellow card) with three blue cards won the game if he could discuss the case. Monitors completed the session by answering any relevant questions.

The overall time for playing the game and answering the evaluation instruments was two hours.

Evaluation

To determine the effectiveness of the educational tool, students were asked to answer a questionnaire (Table 1) and a second test (post-test) after playing the game. Ten statements were employed to evaluate four general aspects of the active-learning exercise (goals and objectives, content, motivation and participation, organization and structure). Students were asked to evaluate the extent to which they agreed with the statements by answering yes or no to each question (selections 1 to 9) or rating the activity as excellent, good, average, or poor (selection 10). The post-tests were exactly the same tests used

Table 1. Evaluation instrument designed to assess the educational tool, including results expressed as rates. Students responded to the following: the following statements evaluate general aspects of the materials. Mark *yes* or *no* and rate the activity considering the way you feel regarding each statement

Questions	Answers (%) (N = 140)			
1. Is the game interesting?	Yes	95.0 (114)	No	5.0 (6)
2. Did the game help you to understand the subject matter more easily?	Yes	85.0 (119)	No	15.0 (21)
3. Is the subject difficult?	Yes	43.6 (61)	No	57.4 (79)
4. Was the subject previously studied?	Yes	70.0 (98)	No	30.0 (42)
5. Do you think the game improved your knowledge about the subject?	Yes	90.7 (127) [†]		
6. Was the recommended literature appropriate?	Yes	90.0 (88) [†]		
7. Was the structure of the game clear?	Yes	96.4 (135)	No	0
8. Did the activity encourage clinical thinking?	Yes	92.1 (129)	No	47.9 (11)
9. Do you consider the game an important way of consolidating learning?	Yes	75.0 (105)	No	25.0 (35)
10. How do you rate the activity?	Excellent Average	35.71 (50) (1)	Good Poor	63.57 (89) 0

[†]90.7 % and 90% of 98 students who read the recommended literature.

as in the pretest. Students who answered test A as pretest (group A) were asked to complete test B as post-test and vice versa. Grades obtained on the pretest and post-tests were compared in order to assess students' improvement after playing the game (Table 2).

Data Analysis

The data were analyzed by means of Epi-Info version 6.04d (Center for Disease Control and Prevention, Atlanta, GA). Statistical methods employed for this analysis included frequency, mean, variance, and standard deviation. A paired *t*-test was used to analyze pre- and post-intervention change. Results are expressed as means \pm standard deviation. For all analyses, a two-tailed *p*-value of less than 0.05 was considered to indicate statistical significance.

Additionally, we checked whether there were differences between the grades of students who had read about viral hepatitis before playing the game and students who had not studied the recommended literature previously. Based on students' reports when answering the questionnaire, we took the tests from these two subgroups and analyzed them separately (Table 2).

Results

The overall response of the students to the game was very positive. Of 140 students: 135 (96.42%) found the activity clear; 61 (43.58%) considered the subject (viral hepatitis) difficult; 98 (70%) had studied the recommended literature before, of which 90% (88 students) considered the recommended literature appropriate; 119 (85%) students answered that the game helped them understand the subject matter more easily, while 129 (92.1%) students affirmed that the game encouraged clinical thinking. Finally, 105 (75%) students regarded the game as an important way of consolidating learning.

By analyzing the students' grades obtained through the pretest and post-test, we could verify that the game significantly improved their knowledge about the subject. In group A (students who answered test A as pretest and test B as

Table 2. Comparison of students' grades before (pretest) and after (posttest) playing the game

	Pretest	Posttest	<i>P</i> value [†]
W/ previous reading assignment	7.52 (\pm 2.1)	8.87 (\pm 1.08)	<i>p</i> < 0.0001
W/o previous reading assignment	5.84 (\pm 1.9)	8.58 (\pm 1.09)	<i>p</i> < 0.0001

Results are expressed as means \pm SD. Variance and *P* value were calculated with standard formulas using Epi-Info version 6.04d. [†]For all analyses, a two-tailed *p* value of less than 0.05 was considered to indicate statistical significance.

post-test), the median of grades was 7.60 (± 2.30) on the pretest and 9.48 (± 0.20) on the post-test ($p < 0.05$). In group B, (students who answered test B as pretest and test A as post-test) the median of correct answers was 7.56 (± 1.90) on the pretest and 9.34 (± 0.60) ($p < 0.05$) on the post-test. There was no statistically significant difference between groups A and B. When groups A and B were analyzed altogether, we found that students who had not studied the recommended literature before playing the game (25%) showed significant grade improvement (5.84 ± 1.90 as compared with 8.58 ± 1.09 [groups A and B]). The same occurred with the 98 students who had read about viral hepatitis previously (7.52 ± 2.1 as compared with 8.87 ± 1.08 [groups A and B]; $p < 0.05$).

Discussion

Our data show that the game is a useful teaching aid, playing a significant role in the teaching-learning process, even among medical students who had not read the recommended literature. Students are constantly exposed to a large amount of information in different fields or areas; therefore, a method that uses logical and active-learning material may provide more consistent memorization, as shown in the results of our study.

The use of creative illustrations and the division of students into small groups might have enhanced students' engagement, thus promoting their participation, increasing their interest, and facilitating the elucidation of relevant questions.

We could verify that the game significantly improved students' grades on the post-test as compared with the pretest. The results obtained show the importance of using this active-learning exercise when approaching a subject that is vast and complex not only for students but also for professors. The game was an interesting tool that may also have helped the monitors to get better prepared for the presentation of the seminar, making the activity more dynamic as shown in previous papers (Ogershok & Cottrell, 2004).

Limitations of our study are the lack of comparison between students' grades from past sessions (when this teaching method was not used) and students' grades after the introduction of the game exercise, and also the lack of a follow-up period to assess the retention of knowledge. Unfortunately, we did not keep a register of students' grades in past years to compare with grades obtained after the introduction of this activity. Other papers that describe the use of games as educational tools also found positive results despite no comparison with students' performance in previous years (Baldor *et al.*, 2001; Moy *et al.*, 2000). This assures that student opinion is a valuable evaluation parameter.

Another issue that could be considered a confounding factor refers to the effect of the review session on the learning process. It is possible that this activity increased students' learning. However, as we conducted a pretest after

the review session, we assumed that students' knowledge was evaluated up to that moment. After that activity, students were influenced only by the game itself. So, results observed on the post-test reflect basically what students learned during the game. Other games have used a similar approach and found out that students' performance was influenced mainly by the educational tool (Eckert *et al.*, 2004).

We would like to comment about possible differences in students' performance that could be based on the performance of the monitors who taught them. Obviously, there are differences between people in terms of ability to explain and expose ideas and these variations can influence students' learning. We tried to minimize these differences by running training sessions for all monitors. Still, we did not verify whether there was any significant variation between the small groups that could be attributed to the monitor's performance.

Finally, we think that this game could perfectly be adapted to a CD-ROM version to be used by students as an additional learning tool at home. Given that only 25% of students rated the game as "excellent", we believe that this computerized version could increase students' enthusiasm about the game.

Despite these few limitations, the game proved to be an important teaching aid. Students were challenged to learn immunology from a different perspective by interacting with monitors and working together with other students. It required all individuals involved to listen actively, not interrupt, encourage others, be open-minded, provide active feedback, and show respect for others even during a competitive activity such as a game. This is an important component because job opportunities in the future will require employees to work cooperatively to solve problems and develop solutions. As commented previously in another paper (Moy *et al.*, 2000), "The best teaching tools are those which make you feel like they aren't teaching tools".

Conclusion

As previously described, most students endorsed the use of games as a teaching method. They enable global understanding of the subject matter, helping to consolidate knowledge schematically and to elucidate complex concepts such as viral hepatitis. In addition, the presentation of this active-learning exercise was effective and achieved the expected goals.

Games are an alternative way of teaching that helps students, as demonstrated in previous studies, in the field of medical biochemistry and immunology. A large part of the medical curriculum may be explored using active-learning exercises. New teaching methods can be developed for easier learning of tedious medical topics.

We believe that the goals and objectives were accomplished. Moreover, we hope to incorporate other difficult topics in Immunology.

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References

- BALDOR, R.A., FIELD, T.S. & GURWITZ, J.H. (2001). Using the “Question of Scruples” game to teach managed ethics to students. *Academic Medicine*, 76, 510–511.
- COLOMBO, D., FRITSCH, A., ORDOVAS, K.G., SPODE, A. & SCROFERNEKER, M.L. (1998). Playing with cellular and humoral immunity. *Biochemical Education*, 26, 20–21.
- DA ROSA, A.C.M., OSOWSKI, L.F., TOCCHETTO, A.G., NIEDERAUER, C.E., ANDRADE, C.M.B. & SCROFERNEKER, M.L. (2003). An alternative method for the regulation of Immune response. *Medical Education Online* [serial online]; 8, 13. Available from <http://www.med-ed-online.org>.
- DIENSTAG, J.L. & ISSELBACHER, K.J. (2001). Acute viral hepatitis. In E. BRAUNWALD, A.S. FAUCI, D.L. KASPER, S.L. HAUSER, D.L. LONGO & J.L. JAMESON (Eds), *Harrison's Principles of Internal Medicine*, 15th edn (pp. 1721–1737). New York: McGraw-Hill.
- ECKERT, G.U., DA ROSA, A.C.M., BUSNELLO, R.G., MELCHIOR, R., MASIERO, P.R. & SCROFERNEKER, M.L. (2004). Learning from panel boards: T-lymphocyte and B-lymphocyte self-tolerance game. *Medical Teacher*, 26, 521–524. DOI: 10.1080/01421590412331285414.
- FISCHER, G.B. & MALLMAN, L.F. BENEDETTO, H. SANTOS, A. ANDRADE, B. C. & SCROFERNEKER, M.L. (2001). Viral hepatitis immunology. In M.L. SCROFERNEKER & P.R. POHLMANN (Eds), *Imunologia Básica e Aplicada* (pp. 540–554). Porto Alegre: Sagra Luzzato.
- HOOFNAGLE, J.H. & LINDSAY, K.L. (2000). Acute viral hepatitis. In L. GOLDMAN & J.C. BENNETT (Eds), *Cecil Textbook of Medicine*, 21st edn (pp. 783–790). Philadelphia: W. B. Saunders Company.
- LINDSAY, K.L. & HOOFNAGLE, J.H. (2000). Chronic hepatitis. In L. GOLDMAN & J.C. BENNETT (Eds), *Cecil Textbook of Medicine*, 21st edn (pp. 790–795). Philadelphia: W. B. Saunders Company.
- MOY, J.R., RODENBAUGHT, D.W., COLLINS, H.L. & DICARLO, S.E. (2000). Who wants to be a physician? An educational tool for reviewing pulmonary physiology. *Advances in Physiology Education*, 24, 30–37.
- OGERSHOK, P.R. & COTTRELL, S. (2004). The pediatric board game. *Medical Teacher*, 26, 514–517. DOI: 10.1080/01421590410001711553.
- SCROFERNEKER, M.L., SORIA, F.H.C. & SHIBA, A.S. (1995). An alternative method for teaching the complement system. *Biochemical Education*, 23, 67–68.
- SIQUEIRA, A.J.S., REMIÃO, J.O.R. & AZEVEDO, A.M. (1992). Dynamic metabolic diagrams in biochemistry. *Biochemical Education*, 20, 97–98.
- SIQUEIRA, A.J.S., REMIÃO, J.O.R. & AZEVEDO, A.M. (1998). Metabolograms to teach biochemistry. *Biochemical Education*, 16, 20–22.