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The Tragedy of the Commons fishing game

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Abstract

I present an interactive role-playing game for tertiary students illustrating the tragedy of the commons, particularly as it relates to fisheries management.

Each player or team of players represents the power brokers who control fisheries policy in hypothetical countries. Players take the role either of 'greedies' intent on converting fish to currency, or 'greenies', with a mission of sustainability and conservation. A key objective of the game is to develop students' insight into some of the practical problems of resource management while balancing stakeholder interests. This requires students to negotiate a path through various agendas. Conflicts both within and between teams are a major component of the game.

The effectiveness of the game is discussed in relation to existing research on role-playing games in education, and on student feedback. It is concluded that the game is an effective way of teaching negotiation skills, problem solving in resource management and self-knowledge.

Keywords

Quota management system, fisheries, tragedy of the commons, role-playing, simulation.

Introduction

Role-playing is a recognised educational tool involving taking on various roles that are clearly defined in real life. It can be compared with simulation and gaming, which are the imaginary structures and rules within which role play can occur (Van Ments, 1990; Errington, 1997).

Role-playing can be used for a variety of educational aims, including teaching about skills, issues and problems (Errington, 1997). Interactive role-playing games have also been used to teach management (Baldissin, de Toni, & Nonino, 2007), "problem based learning" (Sancho, Gomez, & Fernandez-Majon, 2008, p. 69), landscape architecture (Lawson 2003), geography (Sisler & Brom, 2008) and negotiation skills (Sauve, Renaud, Kaufman, & Marquis, 2007). De Freitas (2006) reviews case studies of role-



playing games used to teach high level physics, school level ecology, social skills and military strategy.

The subjects taught using role-playing games are diverse but what they all have in common is a requirement for empathy, social skills, communication and diplomacy. The ability of role-playing games to promote interaction has been considered as one of the important factors for learning (García-Murillo & MacInnes, 2008; Sauve et al., 2007; Sisler & Brom, 2008; Antonacci & Modares, 2008). Role-playing creates new mental models and ways of looking at issues (Tsuchiya & Tsuchiya, 1999), and involves students in direct, experiential learning (Errington, 1997).

Political role-playing games are examples of issues-based role-playing. They include elements of simulation and gaming and involve negotiation, conflict and co-operation. Laver's book *Playing Politics* (latest edition 1997) contains a variety of political games. These games demonstrate how politics involves a mixture of co-operation, switching alliances and backstabbing at crucial moments.

Laver's (1997) games have subsequently been used in classrooms focused on teaching politics (Singh, 2001; University of Waikato, 2011) and aspects of "social learning" (García-Murillo & MacInnes, 2008, p. 12). These games cover aspects of political life such as canvassing for votes, making and breaking coalition agreements and manipulating meetings, to suit specific purposes and agendas. However, one noticeable omission in these games is any consideration of resource management, especially when any group of political actors intends to exploit common resources for personal gain. Hardin (1968) described this phenomenon as the "tragedy of the commons" (p. 1242), which lends itself well to political role-playing games requiring skills of negotiation, coercion and compromise.

The purpose of this study is to design a game illustrating problems of managing common property, and test its effectiveness in environmental management education contexts.

The tragedy of the commons

Hardin (1968) described this political dilemma in terms of a literal "commons" such as that enjoyed by European farmers in the Middle Ages. This hypothetical Middle Ages commons is capable of sustaining the needs of the village providing villagers only graze a small number of cows on the common. However, it is in the individual short-term self-interest of villagers to increase herds as much as possible. But as villagers increase their herds, the capacity of the commons to feed the herds is exceeded, leading to a decline in productivity. In the long term, all villagers suffer, as does the health of their herds.

Hardin's (1968) view of humanity, however, is often considered to be too bleak, with little faith in appeals to altruism, insisting that the only solution to the exploitation of common property is "mutual coercion, mutually agreed upon" (Hardin, 1968, p. 1246). Monbiot (1994), for example, argues that Hardin's thesis is overstated in that it makes no distinction between well-managed commons and a free-for-all.

The problem of what is often seen as resource grabbing and unbridled greed in the 21st century is, however, not caused so much by individuals as the Middle Ages model suggests, but by corporations or states, with mandates to maximise production and profit for stakeholders (Mitchell, 2003a; Bakan, 2005, p. 56–57). While individuals

have a conscience, the behaviour of corporations can be described as psychopathic since corporations have no collective morality, being only obliged to return profits to shareholders (Bakan, 2005). While individual commoners may also co-operate to maximise returns for each other in the long term, this may lead to them becoming corporate polluters, or “tragic institutions” (Daniels, 2007, p. 515).

As long as corporate entities can grab more of what can be termed the global commons, attempts by individuals to live according to an environmental conscience may be self-defeating, possibly serving to marginalise the individuals concerned and to provide more for corporate polluters (Callicott, 1996;). Since corporate agendas appear to dominate our global commons (Beder, 2000), the “Tragedy of the Commons” is a live issue.

Fisheries management as a “tragedy of the commons”

Fisheries resources management is a quintessential example of a commons (Daniels, 2007; Mitchell, 2003a), in that individual corporations or states have specific interests in regulating fisheries, but few corporations appear to want to contribute to resolutions themselves. For this reason, international agreements to reduce fishing are hard to maintain or enforce (Mitchell, 2003a). Increasing populations, expectations of higher standards of living and improved technology have led to many productive areas of the ocean experiencing overfishing (Worm et al., 2006; Worm et al., 2009). Fisheries regulations therefore provide a useful case study for teaching about the issues related to resources through the “tragedy of the commons” game.

In New Zealand, the problem of overfishing in territorial waters has been addressed by a Quota Management System (QMS), in which the total allowable catch of each species is determined through scientific study and sold to fishing companies. Commercial fishers who meet eligibility criteria are allocated individual transferable quotas of commercial species, which they can sell to other eligible operators (Bess, 2005).

The reaction from experts over the success of the QMS in maintaining sustainable fishing stocks has been mixed. Bess (2005), for example, considers that the QMS has some problems, especially relating to fairer distribution of fisheries resources, but is confident that these can be addressed through legislative changes. The World Bank is more fulsome in its approval of the way the QMS improves the economy and sustainability of fisheries (Arbuckle, 2007).

In contrast, Worm et al. (2009) compiled data from various fisheries using catch information and ecological modelling. Their data show that New Zealand fish exploitation rates have accelerated species collapse over the last 10 years. It is to be noted, however, that these authors now consider that the average exploitation rate is sustainable. The lobby group Option 4 insists that the QMS unfairly allocates resources to commercial fishers so that recreational fishers miss out, contributing to a general decline in the fisheries stocks. The privatisation of the ocean “commons” to corporate interests is seen as a major factor in the failure of the QMS (Rea, 2009), since it appears to reduce access to fisheries commons for recreational fishers.

A positive feature of the QMS is that it is readily enforceable through national legislation and Ministry of Fisheries powers to monitor fishing boats and prosecute offenders. By contrast, many fisheries outside New Zealand waters that rely on

international agreements have exploitation rates far above sustainable levels (Worm et al., 2009). The parlous state of global fish stocks highlights the problems of international agreements which contain no enforcement provisions (Birnie & Boyle, 2002; Mitchell, 2003a, 2003b).

In the absence of enforceable standards, or “mutual coercion” with teeth, communication and negotiation are extremely important. The “tragedy of the commons” is therefore a concept that is well suited to being taught through role-playing games that teach skills of communication and negotiation.

Tragedy of the Commons game description

The *Tragedy of the Commons* game was designed for students in Marine and Environmental Management courses at degree level, and used in conjunction with other purposes/content (Oblinger, 2006) to fulfil specific learning outcomes (de Freitas, 2006). The game was therefore used as part of a wider objective to evaluate different ways of mitigating the effects of a commons being exploited. Students discussed Hardin’s (1968) original commons and had explored ways of equitably managing the commons, such as privatising (as exemplified by the QMS), regulating the use of common resources (Monbiot, 1994), and using various indigenous Māori models of environmental stewardship involving *Kaitiakitanga* (guardianship) of the ocean (e.g. Bess, 2001).

The game features a hypothetical global ocean “commons” that a number of states/countries compete for. An underlying assumption of the game is that countries are influenced by corporate fishing interests whose only mandate is to maximise profit. To make things more complex, each country is provided with a number of environmental lobbyists whose aim (unknown to the other players) is to protect the fish stocks.

The three major player types in the game are

- the game *Director*ⁱ (allocates resources depending on the health of the ecosystem and the number of trawlers, collects payment for trawlers and determines when the fishing season can start or finish);
- the ‘*greedy*’ (has just one aim: to maximise profit); and
- the ‘*greeny*’ (whose object is conservation).

Both *greenies* and *greedies* have the same limited knowledge—in other words, they are unaware of each other’s agenda.

Equipment needed

The game relies on computer technology to calculate returns on fishing. At present this is a simple spreadsheet.ⁱⁱ The main game, however, relies on face-to-face interactions, because the nuances of voice, physical expression and proximity provide a more realistic learning experience (Lim et al., 2009). It is the elements of inter team and intra team interaction and conflict that distinguishes this game from a similar online “tragedy of the commons” simulation (see Mitchell, 2003b).

Game procedure

Before starting, all players are handed a *greeny* or *greedy* mission card (Appendix 1), and told that this represents their purpose. Players are told not to reveal their mission to anyone. Players divide into teams representing 5–6 hypothetical fishing countries; where there is more than one player per country, players within each team are to elect or appoint a leader because the Director will only deal directly with the leader. Each country starts with 50 million barrels of oil (hereafter abbreviated to MBO) and two trawlers. Also, the players are told that all countries can create deals with each other, but that all agreements and enforcements have to be sorted out between players and not by the Director. The game then repeats in a series of rounds (Appendix 2), until an agreed time for ending has elapsed. The repetitive nature of role-playing games and the opportunity they provide for instant feedback on decisions are factors believed to promote learning (Oblinger, 2006; Sauve et al., 2007; García-Murillo & MacInnes, 2008).

Formula for calculating yield

The yield of fishⁱⁱⁱ caught is a function not only of the number of trawlers in the water during the current fishing season, but also the total amount of fish in the ocean. The total yield of fish available in the next season $T(t+1)$ depends upon the growth rate of the fishery (r), the carrying capacity (K) and the number of fish left in the current season $T(t)$. The spreadsheet calculates this using the Ricker (1954) formula $T(t+1) = T(t)e^{r((K-T(t))/K)}$ for population growth. $T(t)$ is dependent on the amount of fish caught by all players. Overfishing therefore affects not only the catch per trawler in the season the overfishing took place, but can diminish the amount of fish available in future seasons.

Evaluation of the game

The *Tragedy of the Commons* game was tested four times. A pilot test to iron out major weaknesses was conducted among six colleagues. The game was then used as part of a university module, “Natural Resource Management”, at Level 7 on the National Qualifications Framework (Year 3 bachelor degree) in 2008. A class of 30 Marine and Environmental Management students who had attended classes on the tragedy of the commons were briefed on the game, played for a two-hour session followed by discussion and debriefing. This latter part is considered important in role-playing (de Freitas, 2006; Fanning & Gaba, 2007). A *greeny:greedy* ratio of 1:5 was used. The prime aim of this session was education, as the session ran during regular class time. Secondary aims were evaluating the educational benefits of the game, and further refining the game procedures.

Part of the debrief after the game was to make the *greedies* and *greenies* aware of each other. Students were then given an assessment on the game, which also counted as 0.5% towards their final grade. This self-debriefing allowed students to “experience an event, reflect on it, discuss it with others, and learn and modify behaviours” (Fanning & Gaba, 2007, p. 117). Individual debriefings have been shown to be an effective, non-threatening way of enhancing learning (Li, 2010). Seventeen students agreed for their assessment to be used in this analysis. The following questions were asked in the assessment:

1. What differences did it make to overall fisheries management having the *greenies* present? What implication does this have for resource management policy in the real world?
2. Would you prefer playing a *greeny* or a *greedy*, why?
3. What overall strategies were useful in ensuring enforcement of agreements?
4. What strategies did the *greenies* use to reduce overfishing?
5. What strategies did the *greedies* use to increase yield for themselves?
6. What problems does the game highlight about ways to manage the world's fisheries?

One difficulty identified with the game during the pilot test was that the formula, based only on the total number of trawlers, caused fish numbers to drop very quickly. Accordingly, after consulting colleagues with expertise in fisheries ecology, the Ricker (1954) formula was used for subsequent games.

The revised game was later tested with five students and staff from the Political Sciences Department at the University of Waikato. These players had not studied resource management or the QMS, but proved to be adept players and expert negotiators, possibly due to their political understanding and familiarity with Laver's (1997) role-playing games. The purpose of this session was to test the effectiveness of the revised rules, and its value as an educational tool for students from a different field of study. After discussions following the game, minor improvements were made to the rules.

The newly revised game was demonstrated on 10 participants at the New Zealand Environmental Education Conference (Morris, 2010), ranging in age and educational ability from year 13 secondary school students to post-graduate and retired people. A *greeny:greedy* ratio of 1:2 was used.

Educational effectiveness of the game

Participants from the University of Waikato and from the Environmental Education conference showed high motivation and enthusiasm, and quickly grasped the principle that too much greed in the short term can lead to long-term losses. This reinforces the multi-disciplinary nature of role-playing games and their effectiveness in teaching social skills and interaction regardless of the field of knowledge requiring these skills (de Freitas, 2006; Sancho et al., 2008; Antonacci & Modaress, 2008).

Student feedback from self-debriefing

In answer to question 1 (outlined above), five out of 17 students stated that the *greenies* made some difference in fisheries management, including using subterfuge to give questionable advice. For example, one of the *greedies* commented:

The *greenie* suggested that by down loading all boats in that round, we could then buy back boats later in the game when fish stocks were depleted and other teams would want to off load their boats cheaply. This strategy did not work in our favour, and at the end of the game we were the team with the least value of assets; maybe a plus for the *greenie*. (1)

Three students stated the *greenies* made little difference initially, with one commenting that “It wasn’t until the *greedies* realised what all the expenses involved were that they started to listen to the *greenies*”. (2) One student commented that the *greenies* made a difference if they were the team leaders, but not otherwise:

As our leader was the *greenie*, no matter what we planned as a group (without the leader) in regards to fishing, buying boats, or putting them on the water, the final decision was not ours to make. It was frustrating to see other “countries” gaining fish (common stock) and money that by right was also ours for the taking, as it was common resource. (3)

Most students expressed a pessimistic attitude to the implications for resource policy in the real world. However, one student stated that the *greenies* “calmed us down”, and then went on to describe how their team worked together and incorporated both types of player:

Instead of rushing in blind with greed, once we realised that we had a *greenie* on our team, it made us pause and consider our tactics. I think it calmed us down, we were getting a little hyped and into winning ... as a team we decided that we would compromise and try to meet both the *greenies*’ and the *greedies*’ needs. (4)

Students equally preferred playing *greedies* and *greenies* (eight each). The most common reason for playing a *greedy* was that it was the “easier” option (five students), and four suggested it was “fun”. Five students wanted to play a *greeny* because it was the view they identified with.

Strategies for enforcing agreements included those involving deception (three students) and coercion (six students). One student commented that the only check to unbridled plunder were the forces of nature, saying that “The main strategies that worked were the ones [the Director] had put in place” (5). Two students mentioned building up a trustworthy reputation as a strategy. For one of them, it was the image that was important, though the second student believed genuine honesty was the best policy. The first said that “I think the most important strategy was to show an honest face (whether it was true or not)” (6), while the second said:

The best strategy our team had was honesty. While other teams were trying to steal, lie and cheat each other, we sat at the back watching. In the beginning of the game the other teams were not interested in working with us—we weren’t powerful enough, but by the end of the game they were all keen to work with us. (7)

The most common *greeny* strategy mentioned was buying fewer boats or exiting totally (13 students). One student commented that this did not work, as it just meant more for the rest: “The *greenies* just excluded themselves from exploitation of fish, however this was ineffective because it just meant more for everybody else” (8).

Greedy strategies mostly considered in a negative light were theft and treachery (11 students) or maximising the number of boats (seven students). However, some other proposed strategies included boycotts and alliances (two students each). Each of the following were mentioned by one student each: co-operation, negotiation and restricting the number of ships.

In the final question, seven students stated the necessity for enforceable laws set by neutral bodies. Four had a pessimistic attitude about the future of sustainable management and two stated that it was important to take into account different values. Two students discussed the need for accurate information, and two for communication:

It highlights that in order for sustainability there really needs to be one committee/group of neutral status to allocate quotas fairly and sustainably. This group needs to have scientific and conservation knowledge. (9)

One student commented on how the game highlighted his own “personal naivety”. Another suggested privatisation as a possible solution, though another pointed out that “Restriction through legislation would work better than ownership. As the game highlighted, richer countries would always defeat smaller, poorer nations” (10).

Discussion on student feedback

Role-playing games have been commended for their ability to relate learning to real life (Oblinger, 2006; García-Murillo & MacInnes, 2007). Responses by students in their assessment task strongly suggest that they have understood many of the dilemmas of resource management. Answers to the final question indicate an understanding of the need for “mutual coercion”, privatisation, communication and up to date knowledge (eg response 9). Responses to this question also demonstrate that students have understood the dilemma expressed by Callicott (1996) that personal sacrifice achieves very little without social constraints (see response 8).

Errington (1997) describes the skills gained through role-playing. The answers to the first question show that students were relating what they learned to the real world of fisheries management and enforcement, and political lobbying. Students playing *greenies* were also able to use problem-solving and negotiation skills to alter the outcome of the game to their advantage in spite of being in the minority. This provides students with reason for optimism and demonstrates the effectiveness that Margaret Mead’s “small group of thoughtful, committed citizens” (Bearzi, 2007, p. 2) can have on changing the world for the better when it comes to conservation.

The importance of maintaining trust was emphasised several times (e.g. response 7). One group described how they worked co-operatively with the sole *greeny* on the team and came to a compromise on the number of boats they would buy. This demonstrates the difference (discussed earlier) between the action of individuals who can act altruistically, and corporations, which may have a more selfish agenda. However, there is a limitation to this game. It appears that students failed to fully engage in the role of “greedy”, because participants were still thinking in terms of getting on with their classmates. As one member of the co-operative group put it:

I think that the problem with our team was that none of us have the ability to be a “greedy”—we are all greenies at heart. So we wanted to just continue to take a sustainable amount each time so that we made a profit but did not “go nuts” and try to please all our country! (11)

This shows that positive results for the environment require stakeholders to know and respect one another if they are to come up with solutions that take into account all their values.

Questions on the roles played

According to de Freitas (2006) and Sisler and Brom (2008), if students are given a choice of role, they are more likely to learn better and become more engaged in the game-playing process. However this is not possible in the *Tragedy of the Commons* game, which relies on hidden agendas as part of its appeal. Answers to questions about students' experiences of their roles are therefore important in determining whether this is a weakness in the game. In the context of this study, data from students about their roles indicate that they learned from playing roles they did not necessarily agree with. Three students playing *greedies*, for example, wrote that it was more fun to play out of character. Other responses include:

In this game I'd prefer playing *greedy*, as it was a lot easier to accomplish the goal of obtaining as much oil as possible. If I were playing a *greenie*, I'd be in the minority, which makes it automatically harder to achieve anything. (12)

I preferred playing a *greedy* because it was easy and fun with large amounts of support. (13)

Playing a *greedy* led to a "win at all costs" mentality, and therefore had the potential for more satisfaction within the context of this game. (14)

Two students stated that playing out of role gave them a chance to think about themselves, demonstrating self-knowledge ("social" learning in the terminology of Illeris, 2004, p. 80). On the other hand, all students playing the *greenies* stated that they enjoyed playing a role they identified with.

Conclusions

Students' feedback demonstrated instances of problem solving, negotiating skills, and self-knowledge. These are factors identified as being present in other role-playing games (Oblinger, 2006; García-Murillo & MacInnes, 2007). Students also discovered for themselves the importance of collective action and mutual respect as ways of resolving the *Tragedy*. Students experienced something of the difficulties involved in making policy decisions. They also become emotionally involved in the decision-making process, and got caught up in their role, demonstrating both enthusiasm and self-knowledge. By understanding their own "naivety" and reflecting on their learning, students demonstrated metacognitive behaviours. Students therefore experienced social, emotional as well as cognitive learning (as described by Illeris, 2004).

The *Tragedy of the Commons* role-playing game therefore makes a valuable addition to political role-playing games and is useful in teaching the social and political skills required for resource management. The game can also be further refined. For example, introducing several new roles with different gradations of ideology would be one way to overcome the rather rigid *greedy/greenie* dichotomy. Some players, for example,

could favour privatisation, some regulation, some a traditional approach to fisheries management, and others could represent different sector groups.

The student suggestion of allowing boycotts could also be incorporated into the game. Other suggestions made by players and colleagues included demonstrating the value of research by allowing countries to purchase predictions.

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Appendix 1: Text of the mission cards

Greedy text: “The aim of the game is to grab as many fish as possible from the ocean and convert them to oil (the universal currency) so your country can keep its factories and dairy farms going, and so be the wealthiest on the planet. There is no room in this game for anyone who will not accept commercial reality”

Greeny text: “The aim of the game is to do all you can to protect the world’s fish from the greedy capitalists who make up most of the human race”

Appendix 2: Game procedure

Buying and maintaining trawlers

1. Each country, in secret, buys extra trawlers from the Director if they want them. Countries may also sell unmaintained trawlers to the Director as scrap during this step. Each trawler costs 8MBO to buy, and players are told that because coastlines are long and contain secret bunkers, teams can effectively keep their total number of trawlers secret from each other.
2. Each country pays maintenance of 1MBO for each trawler they wish to retain. Players may opt not to keep their trawlers maintained. However, getting a trawler into shipshape condition once they have been unmaintained for a round will cost 4MBO. If a trawler has been unmaintained for 2 rounds, the only thing it is good for is selling back to the Director as scrap.

Internal negotiations

3. Players now have 10 minutes to decide strategy and to make any deals they wish before the fishing season starts. This can include (but is not limited to) buying, selling and leasing trawlers or making deals on how many trawlers each country will be limited to.

Fishing season

4. After 10 minutes, each leader holds on to the number of trawlers they wish to put into the ocean, together with 1MBO per trawler. This represents the

marginal costs of putting the trawler to sea (including such costs as crew wages), and is separate from maintenance costs.

5. The Director checks that each trawler is maintained and properly crewed. Trawlers that are not currently maintained sink with all hands and vanish without trace.
6. The Director divides the spoils of the ocean depending on the number of trawlers still afloat, and the number of fish in the ocean. This is calculated automatically once all numbers have been entered on the spreadsheet. The spreadsheet is displayed on a projector or the numbers are written on a whiteboard so everyone can see them. Players are not aware of the formulae used for working out fish numbers, though more astute players may be able to work this out.

ⁱ Laver (1997) refers to the Game Overall Director, with the humorous acronym GOD. To avoid offending religious sensibilities, I use the more neutral term Director.

ⁱⁱ Available (together with other gaming materials and detailed instructions) on request.

ⁱⁱⁱ At a conference on animal advocacy (Minding Animals, Newcastle NSW, 2009) there was a general consensus that showing proper respect to nonhuman animals as individuals requires the plural “fishes”, and they are caught by “numbers” not “amount” or “yield”. The plural “fish” reinforces the notion that animals are just bulk commodities. Since this is the position of the *greedies* in the role play and the commercial fishing industry generally, I have decided to keep the terms “fish”, “amount” and “yield” in the description, while drawing readers’ attention to the underlying assumption highlighted here.

