‘Voyager’: an educational card game

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Abstract

‘Voyager’ is an educational card game involving scientific satellites, developed for use in schools with children aged 9 to 13 years. The idea of the game is to improve pupils’ knowledge about the large number of scientific satellites there are in space in a fun way, while also practising numeracy skills. Several copies of the game were produced using funding obtained from the Particle Physics and Astronomy Research Council (PPARC) as a Public Understanding of Science (PUS) award. These initial ‘trial’ versions of the game were taken to three different schools where feedback obtained from both pupils and staff was used to produce a final copy of the game that can be distributed to other schools along with a set of companion notes to form the basis of a science lesson. This article reports the findings of the school trials and indicates possible future developments of other scientific card games that could be beneficial to the classroom.

Fun in the classroom

The card game used as the basis of this project was initially designed in September 2001. Entitled ‘Voyager: Satellites’, the game was designed with the intention of providing school children and members of the general public with information in a fun and entertaining way, about the large number of Earth-orbiting astronomical, space science and Earth observation satellites.

The game consists of 32 ‘satellite cards’, a front cover, index card and instruction card. Figure 1 shows a photograph of the complete game. Each of the 32 satellite cards describes a specific scientific satellite, providing a picture, the full name of the satellite, the user (an indication of which countries are involved with the design, development and operation of the satellite) and a brief description of what the satellite does. The satellites were chosen in an attempt to cover a wide range of different scientific goals while including satellites from the past, present and future, from a number of different space agencies.

The UK involvement in space activities is emphasized by the inclusion of a Union flag on every card where there was, or is, a UK involvement with the satellite either in the design of the satellite itself or the scientific payload. Pupils are encouraged to find out more information about this involvement by the inclusion of a satellite-specific web address on each card. In the deck of 32 cards there are 21 with a Union flag, emphasizing the importance of the UK contribution to space activities now and in the past. The final components of each card are the six characteristics required for playing the game. These are: Launch (year of launch), Lifetime (in years), Mass (in kilograms), Power (in watts), Range (maximum distance from Earth, in kilometres) and Orbit (orbital period, in hours). All values stated on the cards are obtained from web sources, and the satellite-specific web address

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Figure 1. The Voyager game.

on each card can again be used by the pupils to find out more detailed information. An example card from the game is shown in figure 2.

The game is very simple to play, the aim being to win all 32 cards from the other players, giving a strong competition element. The rules, as stated in the 'Instructions' for the game, are as follows:

> Cards are dealt out equally among the players. Using their top card the lead player chooses a category from the six available: Launch, Lifetime, Mass, Power, Range and Orbit. The player with the highest value (or lowest in the case of Launch) wins the round and takes their opponents' top cards, placing them, and their own top card, at the back of their deck. If the round is a draw, the cards are placed in a pile and the lead player chooses again from their next card, the winner of this round taking all. The person to collect all 32 cards is the winner.

Figure 2. An example Voyager card (size $\sim X$ mm $\times Y$ mm).

The PPARC PUS award allowed the production of a number of copies of the initial game for use in a pilot study, to assess the reaction of both pupils and staff to the game, to deduce if the game had any educational value and to improve on the game's design. The overall aim of the project was to produce a final version of the game that could be sent out to schools, along with a companion set of notes, and used by teachers as the basis of a science lesson.

Taking Voyager to school

In addition to the 40 trial packs of the game produced to use in the pilot study, a short questionnaire was also devised to be given to pupils before and after playing the game to assess their reaction to the game and ask for any suggestions and comments they might have. The questionnaire was in two parts to assess whether pupils had learned any of the information on the cards, by asking certain questions both before and after they had played the game. Most of the questions were to be answered by ticking a box; in relevant cases a 'don't know' box was provided to try to limit the number of pupils guessing.

On the recommendation of PPARC the game was trialled in both a primary school and two secondary schools to deduce the most receptive age group, while including both male and female pupils in the study. The three schools that took part in the pilot study were: Thomas Estley Community College, Broughton Astley; Highcliffe Primary School, Birstall; Bourne Grammar School, Bourne. In total 143 pupils from age 9 to 13 years played the game and provided feedback by answering the questionnaires.

The trial sessions were carried out with questionnaires handed out to each pupil at the start of a science lesson. Pupils were then instructed to answer the first eight questions before the packs of cards were handed out for them to play in groups of 2–4 people. The pupils were monitored while playing the game so any problems with instructions or questions about the game could be asked. After about 30 minutes, the cards were

Table 1. The percentage of students selecting certain answers to the five questions asked both before and after they played the game. All possible answers to the first question in the table are given, while only 'don't know' and the correct answer are shown for the other questions.

Question	Answer	% before	% after
How many scientific satellites can you name?	None	65	7
	1–5	35	59
	6–10	0	23
	> 10	0	11
What fraction of scientific satellites do you think the UK is involved in?	Don't know	30	8
	More than a quarter	15	52
How long do you think scientific satellites work for?	Don't know	13	1
	A few years	32	64
How far above Earth do you think scientific satellites are located?	Don't know	20	4
	A few 1000–10 000 km	70	86
How long do you think it takes for a scientific satellite to orbit the Earth?	Don't know	12	1
	A few days	10	31

Table 2. A comparison of answers from male and female pupils and from primary and secondary schools.

	Total	Female	Male	Primary	Secondary
Average mark out of 10 awarded	8.9	8.5	9.2	9.3	8.6
Percentage wanting their own copy of the game	93	90	94	97	88
Percentage who would like more information about scientific satellites	69	59	77	85	56
Percentage who said they would use the web addresses given on the cards	49	37	60	60	40

collected again and the pupils were asked to fill in the second part of the questionnaire. Each trial session took around 50 minutes to complete.

Results, feedback and suggestions

Each school trial was greeted by enthusiastic pupils and staff, who agreed that Voyager made for an interesting lesson. A breakdown of some of the questionnaire results is given in tables 1 and 2. It should be noted that when discussing 'total' results, the percentages given are always from a total of greater than 133 of the 143 pupils, accounting for those who did not answer a question. Of the total number of pupils, 54% were male and 46% were female, 45% were primary school pupils and 55% were secondary school pupils.

All of the 32 satellites featured in the game were mentioned at least three times in answer to the three questions, 'If you can, please write down the names of three satellites', 'Write down the name of your favourite card', and 'Write down the name of your least favourite card'.

The last question asked of the pupils was for any comments or suggestions they had about the game. The main point to come up in the responses received was that the instruction card was difficult to understand, although as soon as they obtained help from a supervisor the rules made sense. This point was addressed and a newer version of the rules (stated at the beginning of this article) is included in the latest version of the game. A vast majority of comments received were positive, a selection of which are given below:

- 'I really enjoyed playing this game. I think it is fun as well as educational.'
- 'I think the game was great, and I learnt a lot. When they are on sale I will buy them!'
- 'The game was the best game I had played.'
- 'I think the game was really fun. I enjoyed it a lot. I think this game should be out to the public.'
- 'I would really like a copy because I really enjoyed it in so many ways. I have no suggestions, I think it's great just the way it is. Thank you for letting us play with your cards.'

- 'It's a great game and I want it to go into the shops but it's going to sell too quick so I won't get a copy.'
- 'The game was absolutely brilliant. It was loads of fun. I haven't thought science will be fun until today! PS: When will they be in the shops?'
- 'You learn a lot from the game. I would definitely buy the game if it came out.'
- 'This is very enjoyable and interesting. Which shop can you buy them from?'
- 'Quite fun to play. I didn't know that there are so many satellites around.'
- 'The game was really fun and educational and I hope to see it in the shops soon!'

Discussions with staff at the three schools led to several suggestions for inclusion in a set of companion notes for the game. These notes have since been compiled and produced as a four-sided leaflet that includes information in five sections: What is 'Voyager'?; What do students gain from playing the game?; Ideas and suggestions for classroom activities after playing the card game; An explanation of the card information; A list of the 32 web addresses on the satellite cards.

Teachers also made several valuable points regarding the educational value of the game. At Key Stage 3 (age 11 to 14 years) in the Earth and Beyond section of the Physical Processes area of Science, the National Curriculum states that pupils should be taught 'about the use of artificial satellites and probes to observe the Earth and to explore the solar system'. The game addresses this area of the curriculum while pupils also practise numeracy skills in having to order and verbalize numbers while playing the game.

Conclusion

The results of the pilot study show that all the aims of the project were achieved. The reaction of both pupils and staff to the idea of using a card game as an educational tool was positive, with many appreciative comments and suggestions being made.

The game does provide pupils with knowledge of scientific satellites, the analysis of questionnaire results given by the pupils supporting this fact. Many pupils' views of some general satellite concepts were changed after playing the game, with most having a better understanding of the location and lifetime of satellites, and also the amount of involvement the UK has with scientific satellites. Nearly all the pupils who took part in the pilot study are now aware of the large number of scientific satellites there are and can name several of them.

The game has been found to have an educational value supporting relevant National Curriculum areas in science and mathematics.

The pilot study has shown that the game is enjoyed by both male and female pupils across the 9–13 year-old age range of the study, with a slight bias toward younger males.

All comments and suggestions made by pupils and staff during school visits have been addressed in the final version of the game, which in its current form can be sent with the companion notes to a school and used by a teacher as the basis of a science lesson, fulfilling the main aim of the project.

The future

The game cannot be used commercially because of copyright restrictions on the use of the satellite images in the game. The next stage of development for Voyager is therefore dependent on obtaining further funding which would be used to produce many copies of the game for distribution to schools nationally. Staff at the National Space Centre in Leicester have shown an interest in the game and have stated that they are willing to distribute the game to school pupils visiting the centre.

As a result of the success of the Voyager trials, several other ideas are being considered for future card games using the same principle. For example, 'Solar System Bodies', 'Mars Missions' or 'Physicists'. These games would once again be designed to improve the general knowledge of school children in these fields while moving away from any copyright restrictions, allowing possible commercial development.

For information about Voyager and possible future developments of educational card games, please get in touch via the contact e-mail at the beginning of this article.

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