Exploring the Potential of Educational Board Games for *affective learning in astronomy education*

Adriana Cardinot[1], Veronica McCauley[2] & Jessamyn Fairfield[1]

[1]School of Physics, University of Galway;
[2]School of Education, University of Galway

Game-based learning (GBL) is an innovative educational approach that uses games to enhance learning and teaching. Research has shown that incorporating GBL into the astronomy curriculum promotes student engagement, motivation, and learning outcomes. By allowing students to interact with problem-solving situations and models that simulate astronomical phenomena, GBL can deepen their understanding of complex concepts in a fun and interactive way. However, the potential of GBL to support affective learning in formal instruction of astronomy at the post-primary level has been underexplored, and further research is needed in this area.

RESEARCH DESIGN

This study employed a quasi-experimental design using a mixed-methods approach to investigate affective learning at the post-primary level.

METHODOLOGY

605 Post-primary students enrolled at Junior cycle level, divided into treatment (N=303) and control (N=302) groups.

10 Schools based across Ireland participated in the study, involving 20 teachers.

Data collection instruments included **pre- and post-surveys** to measure the affective domain constructs and **semi-structured focus groups.**

Participants took part in 6-week intervention. The questionnaire was administered to all groups in lower Irish secondary education level (12-15 years), yielding a 94.4% response rate.

EDUCATIONAL BOARD GAMES

Games offers unique opportunities to connect classroom science to the real world

In this study four educational board games were employed with multiple learning outcomes aligned to the new Irish science curriculum. The games tackled challenging topics in astronomy education as identified by teachers and reviewed by external researchers.

AFFECTIVE LEARNING

Enhances engagement, curiosity and interest in astronomical concepts.

Affective learning refers to the investigation of attitudes, emotions, motivations, and behaviours involved in the learning process. To investigate the potential of GBL beyond cognition, the study focused on two constructs of affective learning: motivation and attitude towards learning astronomy at the post-primary level.

TEACHING RESOURCES

There is a lack of resources for teaching astronomy.

At present, there are a limited number of teaching resources aligned with the new science curriculum [1] available for science teachers. The Junior Cycle official body only provides three lesson plans to support teachers.

IMPORTANCE OF ASTRONOMY

Astronomy has many links to other disciplines.

Learning astronomy is important to enhance students' understanding of our place in the universe. It has connections with many other scientific disciplines. Thus, astronomy can attract young people to science and technology as fields of study or potential careers.

RESEARCH QUESTIONS

- What are the effects of GBL instruction with non-digital games on students' affective learning?
- Does the GBL group have significantly higher affective learning than the non-game-based learning group?
- How does GBL impact students' perception of the value of astronomy?

MAPPING THE SIGNIFICANCE

FINDINGS

Results indicated that teaching through non-digital games can positively impact views of learning astronomy and encourage student participation. Attitudinal and motivational changes were also identified in the intervention group, suggesting that GBL as pedagogical approach in formal education could have a multidimensional effect on students' learning, regardless of prior experience with games or science, since there was no statistical difference between lower and senior students in the affective learning constructs scores. Mean differences are shown in Figure 1.

Self-efficacy

The intervention group revealed significantly **higher self-efficacy** for learning astronomy than the control group, implying that features of the game such as the provision of **constant feedback** (given during the gameplay), **peer modelling** (group work) and encouragement of **active participation** provided students with multiple mechanisms to **enhance belief in their own capability to learn astronomy**.

Motivation

The intervention group reported an **increase in both motivational constructs**, intrinsic and extrinsic, to learn astronomy. This increase was a predictor of students' positive perception of astronomy. **GBL encouraged students to persist and persevere through the different challenges** involved in the games to master astronomy concepts, **creating a sense of accomplishment and building confidence**.

Value of Astronomy

GBL positively influenced students' perception of astronomy. During gameplay, students explored and uncovered the content with various levels of difficulty to sustain engagement and active participation. Learning through **non-digital games** also exposed students to **experiential learning** in which they became immersed in authentic game tasks that could reflect real-world experiences, and thus, **influencing their perceived task value of learning astronomy.**

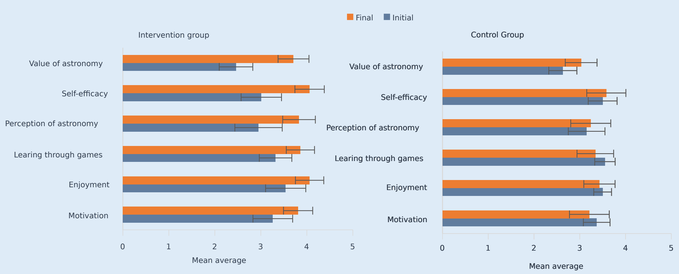

Figure 1. Pre- and Post-means

References

[1] STEM Education in the Irish School System (2016). Department of Education and Skills.

More information:
ascardinot@gmail.com

Poster design adapted from: Jennifer Loder et al., ePoster No. EP24180. (2016)