

Multimedia Project Critique 3

Dragon Box Algebra 12+ Critique

Maureen McHugh

Coastal Carolina University

EDIT 720: Psychology of Instructional Technology

Dr. David Tao

April 18, 2020

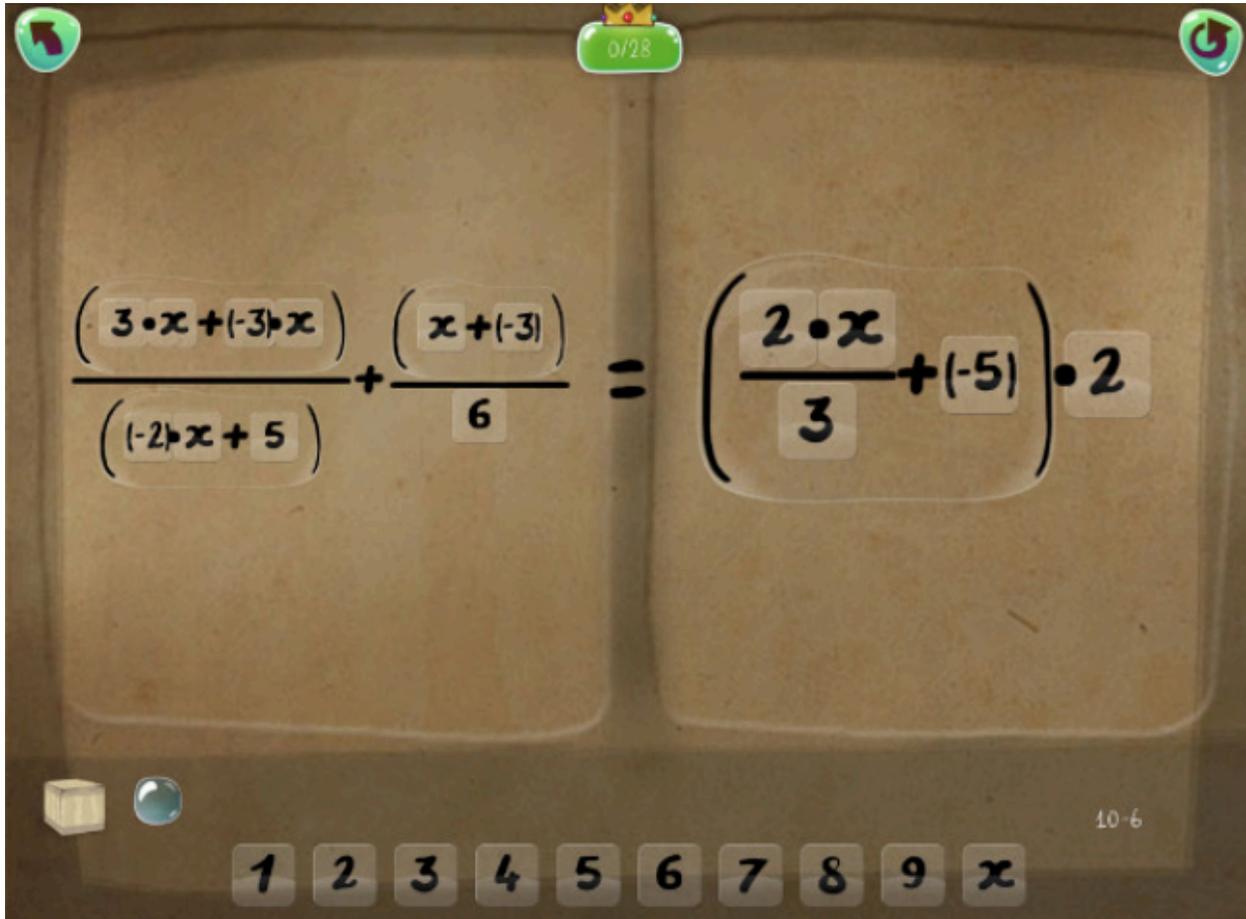
In the early twenty-first century, the emergence of mobile devices such as smart phones and tablets led to an explosion of educational apps and games geared to both classroom and individual use. As schools transitioned from having weekly computer lab classes to having daily (often constant) access to personal devices, a market emerged for creating educational products both fun and appealing for students, while demonstratively capable of helping students gain and attain content knowledge. One such product, an app called Dragon Box Algebra 12+, is the subject of this critique. Dragon Box consists of a collection of 6 apps which are developed for various ages from 4 up to 12+. Five of the apps - Numbers, Big Numbers, Algebra 5+, Algebra 12+, and Elements – are math related, while the remaining app is chess related. Due to the large amount of Dragon Box offerings, the scope of this paper will be limited to a critique solely of Dragon Box Algebra 12+.

Upon downloading and opening Dragon Box Algebra 12+, the user is prompted to choose an avatar and a short tutorial shows the goal (to grow and collect dragons) and how to move game pieces. After practicing, the game board is revealed (see image below):





By the end of the game (which consists of 10 levels of 20 games each), learners are solving puzzles that look much more like traditional algebra problems utilizing integers and variables:



In general, the focus of Dragon Box 12+ is to create a fun, low-stress game that slowly builds the conceptual understanding of equation solving through performing equivalent operations on each side to isolate the variable. The gamification of unlocking levels, creating more dragons, and collecting stars based on proficiency adds to the overall enjoyment and motivation for the player.

In terms of multimedia learning principles, Dragon Box Algebra 12+ will be considered a computer game. Tobias et al. (2014) warns about computer games:

The research indicates that if transfer from games to external tasks is desired, cognitive task analysis of both game and task are needed to determine the overlap in cognitive processes

they both engage. The greater the overlap, the more likely it is that transfer will occur.

Transfer cannot be assumed merely from superficial similarities between games and tasks, since such similarities do not necessarily indicate that task-relevant cognitive processes will be engaged by the games. (p. 763).

It is with this idea that Dragon Box Algebra 12+, while entertaining for users, does not fully realize its goal of teaching users Algebra 1. The game uses concrete pictures, even in the higher levels, which does not emulate a true equation solving task in a typical Algebra 1 class. Long and Alevan (2014) found that Dragon Box Algebra 12+ is ineffective at teaching students the skill of equation solving. As they state, “It is not that there is no learning in DragonBox – there is plenty of it, as evidenced by students’ progression through the game levels. However, the learning that happens in the game does not transfer out of the game, at least not to the standard equation solving format” (p. 9). The context of the game, with its pictures and prompting, does not seem to be able to help students with traditional problems using typical algebraic notation and rules. While various types of learning can occur from playing games, the real issue is how to achieve intended learning targets (Tobias et al., 2014, p. 777). In this case, Dragon Box Algebra 12+ fails to meet its purpose of teaching users how to solve algebraic equations because its design is not conducive to transference of knowledge.

Another multimedia principle observed as lacking in Dragon Box Algebra 12+ is adherence to the feedback principle. Johnson and Priest (2014) clarify “providing feedback can contribute to learning by allowing students to evaluate their responses, identify a discrepancy in their knowledge, and repair faulty knowledge” (p. 449). To that end, explanatory feedback – which explains why an answer is correct or not - is much more effective than corrective feedback alone (p. 453). While progressing through the levels of Dragon Box Algebra 12+, the feedback

is limited. For instance, when correcting solving the problem, the screen displays a “Yum”, indicating a correct answer:



There is no explanatory aspect to why the final answer was correct, only indication of a correct answer. In addition, a number of stars are awarded at the conclusion of each game:



The goal of each game is to collect 3 out of 3 stars, so only achieving two stars like the image above is feedback indicating there is a more effective method than the one used. Users may redo a level in an effort to earn more stars, but there is still no explanatory feedback ever being provided. According to Johnson & Priest (2014), when learners are only told they are wrong, they must then utilize more cognitive demand to determine why their answer was incorrect, which can lead to increased extraneous processing and potentially even lead to cognitive overload (p. 458). There are some cases where Dragon Box Algebra 12+ performs what could

be considered “partial” explanatory feedback, such as on-screen prompts when an additional step is needed. For instance, the screenshot below shows that the gameboard begins to visibly crack when a piece was placed on one side, but not the other (thus breaking the cardinal rule of equation solving – what you do to one side you must do to the other):



However, this is a very obvious hint or prompt, showing an empty tile space, rather than a true explanation of the correct process. Thus for several reasons, due its limited amount of feedback and severe lack of explanatory feedback, Dragon Box Algebra 12+ fails to adequately adhere to the feedback principle of multimedia learning.

Ultimately, Dragon Box 12+ is an attractive game-based app that promotes conceptual understanding of equation solving skills needed in Algebra 1. While the makers of the app claim it can lead to algebraic understanding in as little as one hour, the truth is that the in-game progress through the levels cannot be considered as indicative of outside-of-game transference of learning. As a computer game, Dragon Box Algebra 12+ is a fun and motivating puzzle game; as a multimedia learning product, Dragon Box Algebra 12+ is a poor instructional tool with limited transferrable skills. While there would be no harm in incorporating Dragon Box Algebra

12+ as an occasional classroom game, caution is advised towards utilizing Dragon Box Algebra 12+ as an instructional tool for achieving the learning target of equation solving. In this case, the entertainment value far outweighs any instructional value.

## References

Johnson, C & Priest, H. (2014) The feedback principle in multimedia learning. In R. E. Mayer (Ed.), *The Cambridge Handbook of Multimedia Learning*. (pp. 449 - 463). New York: Cambridge.

Long, Y., & Aleven, V. (2014). Gamification of Joint Student/System Control over Problem Selection in a Linear Equation Tutor. *Intelligent Tutoring Systems Lecture Notes in Computer Science*, 378–387. doi: 10.1007/978-3-319-07221-0\_47

Tobias, S., Fletcher, J. D., Bediou, B., Wind, A. P., & Chen, F. (2014). Multimedia learning with computer games. In R. E. Mayer (Ed.), *The Cambridge Handbook of Multimedia Learning* (pp. 762–784). New York: Cambridge.