The Evidence Games

Collaborative Online Video Games Engaging Middle School Students in the Evaluation of Scientific Evidence

Research Questions

Are the Evidence Games usable and feasible in a middle school educational setting?
- Is the game easy and enjoyable for students to use?
- Are teachers and students satisfied with the game experience and outcomes?

Are teachers able to use the Evidence Games with fidelity?
- Do teachers use the Evidence Games to support science instruction?
- Do teachers support the social component of scientific discourse through the games' interface?

Do teachers who use the Evidence Games understand scientific claims and qualifiers; difference between fact, opinion, data, theory; components of logic; and counterarguments?

Do students who use the Evidence Games understand scientific claims and qualifiers; difference between fact, opinion, data, theory; components of logic; and counterarguments?

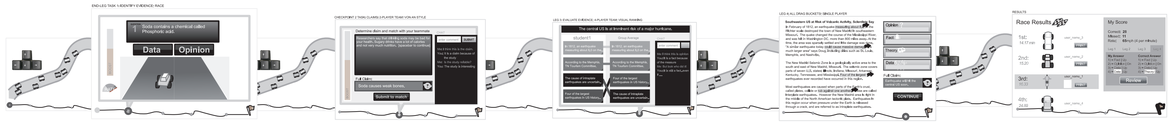
Are teachers who use the Evidence Games more successful in the use of an analysis of evidence and scientific argumentation as part of science instruction?

Are students who play the Evidence Games more successful in assessing scientific claims and making judgments about evidence?

Based on Toulmin, S. (2003). The uses of argument. Cambridge, UK: Cambridge University Press.

Development Products

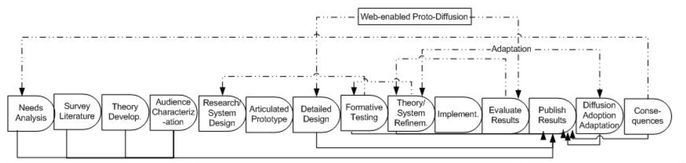
Our current production includes initial prototype development and the first iteration in wire prototypes that are being tested with target science students and teachers.



Design Process

We are engaged in an iterative design process, rotating through informed exploration providing basis for enactment. Evaluation is an ongoing process as we move through the project phases.

Figure 1
Questions and Methods for Design Research by ILDF Phase



ILD	Informed Exploration	Enactment	Evaluation: Local Impact	Evaluation: Broader Impact
Guiding Questions for Research	Questions: What are identified gaps/problems in theory, practice, and/or the marketplace? What information can be gleaned from existing data or research? How can we characterize the problem or learner need? What are the systemic social, cultural, and organizational influences or constraints on design? What are characteristics of the audience?	Questions: What are the learning targets for innovation? What design principles or strategies may be applicable? How to identify and operationalize cognitive and performance processes in design? To what extent does the design embody the theoretical model?	Questions: Is the enacted design usable, valid and relevant? Is the design instance accessible and efficient in delivering instruction or supporting learning? What is the local impact or effectiveness of the design instance? How effective is the design solution in achieving learning targets at its highest fidelity in full context?	Questions: What factors influence diffusion, adoption and adaption of innovation? What are the pragmatic demands of the learning environment that influences adoption of design? What policies and cultures shape participants use of innovation?
Applicable Research Methods	Methods: Benchmarking Performance/needs analysis Interviews Survey of Experts Focus Groups Observations/Role Modeling Case Studies	Methods: Task Analysis Contextual Analysis Designer Logs Expert Review Audience Review	Methods: Usability Testing Expert Review Observation or Video records Interviews Formative Evaluation Pre-post Comparative Studies Quasi-experimental studies	Methods: Analysis of computer log files Multi-site Interviews, Surveys and Observations Data mining Correlational studies Quasi-experimental studies

Context of Work

The Evidence Games will be designed for middle school science students and their teachers. Development of the games will occur with the help of middle school science students and teachers at Argentine Middle School in Kansas City, Kansas.

Classroom Observations: Fall 2010

Always Present

Making content relevant to students
- Stories
- Sports examples

Varied classroom activities
- Lectures
- Students working in groups/pairs
- Experiments/Labs
- Written instructions

Sometimes Present

Prompting a hypothesis
- Asking "what if" questions

Questioning techniques

Use of engaging technologies

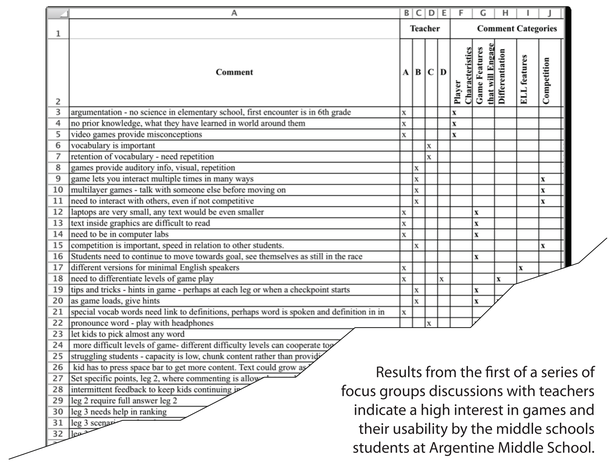
Use of game-like classroom activities

Never Present

Argumentation vocabulary
- Claim
- Evidence
- etc.

Discussion about evidence as it relates to accepting or refuting a claim or hypothesis

Use of technology-based games



	A	B	C	D	E	F	G	H	I	J
1		Teacher				Comment Categories				
2	Comment	A	B	C	D	Player Characteristics	Game Features	Instruction and Differentiation	ELL features	Competition
3	argumentation - no science in elementary school, first encounter is in 6th grade	x				x				
4	no prior knowledge, what they have learned in world around them	x				x				
5	video games provide misconceptions	x				x				
6	vocabulary is important			x						
7	retention of vocabulary - need repetition			x						
8	games provide auditory info, visual, repetition		x							
9	game lets you interact multiple times in many ways		x							x
10	multilayer games - talk with someone else before moving on		x							x
11	need to interact with others, even if not competitive		x							x
12	laptops are very small, any text would be even smaller	x					x			
13	text inside graphics are difficult to read	x					x			
14	need to be in computer labs	x					x			
15	competition is important, speed in relation to other students.		x							x
16	Students need to continue to move towards goal, see themselves as still in the race						x			
17	different versions for minimal English speakers	x							x	
18	need to differentiate levels of game play	x			x			x		
19	tips and tricks - hints in game - perhaps at each leg or when a checkpoint starts		x				x			
20	as game loads, give hints		x				x			
21	special vocab words need link to definitions, perhaps word is spoken and definition in in	x								
22	pronounce word - play with headphones			x						
23	let kids to pick almost any word									
24	more difficult levels of game- different difficulty levels can cooperate to									
25	struggling students - capacity is low, chunk content rather than provid									
26	kid has to press space bar to get more content. Text could grow as									
27	Set specific points, leg 2, where commenting is allow									
28	intermittent feedback to keep kids continuing									
29	leg 2 require full answer leg 2									
30	leg 3 needs help in ranking									
31	leg 3 scenar									
32	leg									

Results from the first of a series of focus groups discussions with teachers indicate a high interest in games and their usability by the middle schools students at Argentine Middle School.

Argumentation & Evaluation Guide

Topic_____ Name: _____
Title_____ Class: _____
Source_____ Date: _____

(1) What is the **Claim**, including any **Qualifiers**? Are there qualifiers? **Yes**.**No**. (If yes, underline them.)

(2) What **Evidence** is presented? In column 3, identify the type of evidence with the letter: **D**ata (D), **F**act (F), **O**pinion (O), **T**heory (T).	(3)	(5) What chain of **reasoning (warrant)** connects the evidence to the claim? In column 6, identify type of reasoning with the letter(s): for **AU**THORITY (**A**), THEORY (T), or type of LOGIC: **An**alogy (AN), **C**orrelation (C), **C**ause-**E**ffect (CE), **G**eneralization (G)	(6)

(4) **Evaluate** the quality of the evidence as poor, average or good. **Explain** your evaluation.	(7) **Evaluate** the quality of the chain of reasoning as poor, average or good. **Explain** your evaluation.
Reliable	Strength of Authority
Valid	Application of Theory
Objective (no bias)	Type of Logic
Controlled Experiment	

(8) What are your concerns about the believability of the claim? (your counterarguments, rebuttals or new questions)?

(9) Accept, reject, or withhold judgment about the claim. **Explain** your judgment.

© Bulgren revised 10/1/2008

Foundational research: Bulgren, J, Ellis, J, & Marquis, J. (2010). The Use and Effectiveness of an Argumentation and Evaluation Intervention in Science Classes. Research paper. The University of Kansas Center for Research on Learning, Lawrence KS.

Implications

Argumentation:
The goal is to increase middle school science students' and teachers' knowledge of and thinking related to scientific argumentation. The areas of argumentation addressed by the games include the following:

- Understanding a claim
- Judging the evidence about a claim based on type (fact, opinion, theory, or data) and quality (bias, reliability, or validity),
- Determining the reasoning applied to the claim (authority, analogy, correlation, causation, theory, principle, or generalization, considering rebuttals, and making judgments.

The series of experiences provided by this game are scaffolded to provide experiences in implementing the specific components of argumentation, as outlined by Toulmin (1984). It will culminate at its highest level of play in a collaborative game and ongoing discourse about important claims about which students use scientific reasoning.

Game Format:
Recognizing that there is not a whole lot "fun" about the challenge of making decisions about scientific claims and evidence, the proof-of-concept has to do with whether the target game features incorporated into the design of the Evidence Game will maintain engagement and make the game fun. These features include focused goals, ease of learning, rapid and frequent responding, multiplayer competitive play, various achievement levels for individual players and teams, choice and autonomy, and increasingly challenging tasks.

Investigators: Jan Bulgren, Marilyn Ault, Jim Ellis, Bruce Frey
Coordinator: Jana Craig Hare
The University of Kansas Center for Research on Learning and the School of Education