

Using Board Games to Support Learning in the Classroom

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Introduction

- ▶ Educators around the US
 - ▶ integrate CS into K-12
 - ▶ computational thinking skills
 - ▶ Funds or experienced teachers
- ▶ Board games
 - ▶ Cheap Solution
 - ▶ Defined rules and procedures

Outline

- ▶ Background
 - ▶ Self Determination Theory
 - ▶ Why use Board Games
 - ▶ Four phase model of interest
- ▶ Introducing Coding
- ▶ Python the Board Game
- ▶ Help Desk Board Game
- ▶ Final Thoughts
 - ▶ Discussion
 - ▶ Conclusion

Self Determination Theory

- ▶ Three psychological needs
 - ▶ Autonomy - control and agency over actions
 - ▶ Competence - behaviors as successful actions
 - ▶ Relatedness - interact foster relationships with others
- ▶ Driven towards activities
 - ▶ Intrinsic motivation - natural drive
 - ▶ Extrinsic motivation - external sources
 - ▶ Passion - Board Games
 - ▶ Do homework - points

Why use board games

- ▶ 'A game is a system in which players engage in an artificial conflict defined by rules, that results in a quantifiable outcome.' - Salen and Zimmerman Rules of Play
- ▶ 'With game-based learning, we work toward a goal, take action, experience consequences of our actions and make mistakes in a risk-free setting [1].'
- ▶ Increased motivation
 - ▶ Tangential learning

Triggering Interest to Tracking

- ▶ Four phase model of interest
 - ▶ 1-2 - Situational or extrinsic
 - ▶ 3-4 - Individual or intrinsic

Order/Phase	Description
1: Triggered	Short term change in cognitive and affective processing.
2: Maintained	Engage with the triggering incident for an extended period of time.
3: Emerging	An internal state of interest in the subject and an association with positive feelings, stored knowledge, and stored value.
4: Well Developed	An enduring affinity for the subject and continued engagement over long periods of time.

Introducing Coding - 8 week unit

- ▶ Learn On the Brink - 2 weeks
- ▶ Implement game in Scratch - 3 weeks
- ▶ Design their own levels - 2 weeks
- ▶ Sharing projects - 1 week

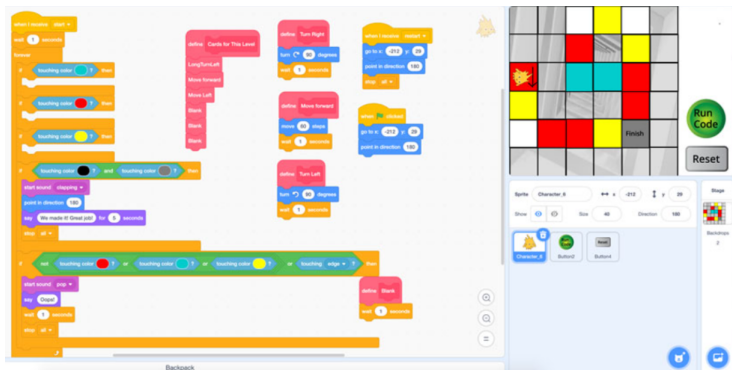
//Code On the Brink

- ▶ Developed by Mark Engleberg published by Thinkfun
- ▶ Player specifies actions - control panel
- ▶ Moving forward, turning 90, standing still



Scratch

- ▶ Free website for kids to learn coding (Image below from [4])
- ▶ Create games and animations
- ▶ Scratch Foundation - Non-profit organization



Primary Goals - 8 week unit

- ▶ Increase intrinsic interest in CS
 - ▶ Playing Board Game = Coding Scratch
- ▶ Pre and Post-hoc Survey
 - ▶ 32 likert scale items

	Pre		Post			Post-Pre
Teachers	M	Med	M	Med	N	Z
Shawn	4.45	5.00	3.45	3.44	29	-3.49***
Mandy	4.30	4.50	4.26	5.00	30	-0.93
Shelly	3.84	3.88	4.16	4.50	28	2.25*

Qualitative Analysis

- ▶ Discourse Analysis
 - ▶ Comparing teacher utterances
- ▶ Interest teacher talk
 - ▶ Statements leading lesson
 - ▶ Structure and content - varied
- ▶ Coding scheme
 - ▶ Label - content and function
 - ▶ Bottom-up approach
- ▶ Codes assigned
 - ▶ One analyst
 - ▶ Second analyst looked over codes

Analysis of Teachers

- ▶ Direct instruction
 - ▶ lecturing - long monologues
- ▶ Connections
 - ▶ familiar - tangential learning
 - ▶ intrinsic motivation
- ▶ Lesson trajectory
 - ▶ Where are we
 - ▶ Where are we going

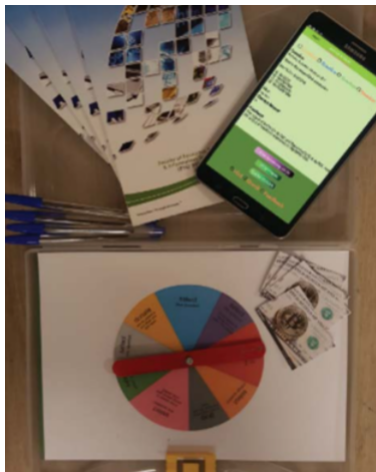
Teachers	Direct Instruction	Connections	Lesson Trajectory
Shawn	40	Calculator	10
Mandy	23	Minecraft	NA
Shelly	24	Code.org	12

Primary Goal

- ▶ Explore use of board games
 - ▶ Improve student's knowledge of Python
- ▶ 'Will students embrace board games in the computer science classroom to improve their knowledge of the Python programming language?'
- ▶ 'Will lecturers embrace board games in the computer science classroom as a tool to improve the student's knowledge of the Python programming language?'

Explanation of Play

- ▶ 2-10 players
 - ▶ Best played with 4-6
- ▶ Materials
 - ▶ spinner
 - ▶ Tablet 400 Python
 - ▶ Pen and paper to answer
- ▶ Two Phases
 - ▶ Player spin - read instructions
 - ▶ Collect answers - correct 'bit dollar'
 - ▶ Discussion of question and answer



Methods - Playtesting

- ▶ 16 participants - Groups of 4
 - ▶ 2 lecturer groups
 - ▶ 2 Student groups
- ▶ Semi-structured interviews
 - ▶ enjoyment, collaboration, communication, socialisation, involvement, and hands-on heads-on

Findings - Interviews

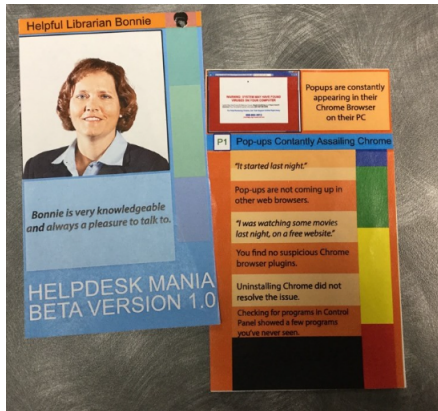
- ▶ Enjoyment
 - ▶ Enthusiastically engaged without any hesitation
- ▶ Collaboration
 - ▶ Not supported well
- ▶ Communication
 - ▶ Agreed option to discuss answers - improve retention
- ▶ Socialization
 - ▶ Group engagement and spontaneous engagement will increase
- ▶ Interactive involvement
 - ▶ Elements of the game ensure interactive involvement
- ▶ Hands-on Heads-on
 - ▶ Involves all players, questions had right amount of difficulty

Determine Goals

- ▶ Single-player videogame
- ▶ Inspired by Diner Dash
 - ▶ Time management - clients come up
 - ▶ Player - troubleshoot different problems
- ▶ Representative of a collaborative and interpersonal
- ▶ Knowledge and skills
 - ▶ Troubleshooting problems in person and remote, dealing with clients of different personality types, understanding interactions with clients affects the larger organization
 - ▶ Problem solving, communication and teamwork

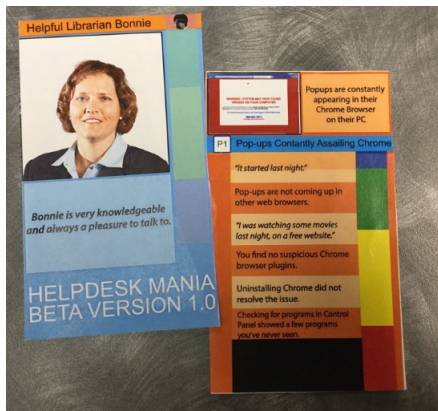
First Iteration (1/2)

- ▶ Design
 - ▶ Self-contained
 - ▶ White board - card game
- ▶ Implementation
 - ▶ Three main components
 - ▶ Client cards
 - ▶ Problem cards
 - ▶ Satisfaction gauge (blue to red)
 - ▶ Every round
 - ▶ Client card move down
 - ▶ Faster solve - more reputation
 - ▶ Couldn't solve - client card slide off



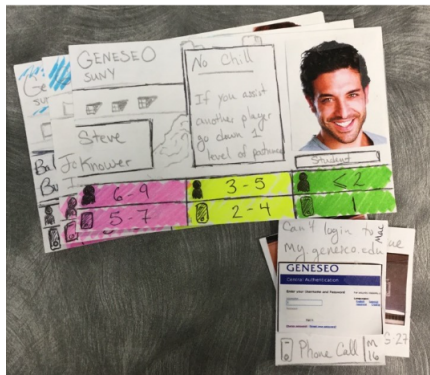
First Iteration (2/2)

- ▶ Playtest
 - ▶ Development team - two rounds with difficulty
 - ▶ Playable - not great
 - ▶ Students playtest
 - ▶ Restrictive behavior on clues on problem cards
 - ▶ Clumsy - realistic back and forth
- ▶ Evaluate
 - ▶ Structure - confusing
 - ▶ Complete → *facilitator*



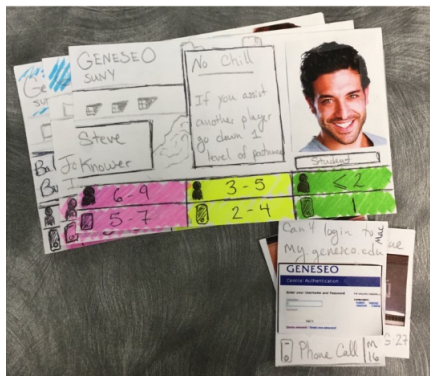
Second Iteration (1/2)

- ▶ Design
 - ▶ Guide for facilitators
 - ▶ List common problems
 - ▶ Actions - solve an issue
 - ▶ Asking the client a question or another player for help, troubleshooting task on the client's device, looking up info online
- ▶ Implementation
 - ▶ Client Cards - SUNY ID
 - ▶ Problem cards - Campus ID
 - ▶ Satisfaction gauge



Second Iteration (2/2)

- ▶ Playtest
 - ▶ Student - overview rules
 - ▶ Drew client and problem cards
 - ▶ 2 action limit - turn
 - ▶ Ran out ways troubleshoot
- ▶ Evaluate
 - ▶ Changed limit - actions
 - ▶ Asking players - help
 - ▶ Driving engagement
 - ▶ Focusing on interactions



Discussion

- ▶ Similarities
 - ▶ Engaging
 - ▶ Educate players - subject material
- ▶ Differences
 - ▶ Different age groups
 - ▶ Different papers
- ▶ Self Determination Theory
 - ▶ Autonomy, competence, relatedness

Conclusion

- ▶ Engaging students directly
- ▶ Medium of art
- ▶ Inherently educational
 - ▶ Creation educational
 - ▶ opportunities to professors
- ▶ 'The definition of a good game is therefore "one that teaches everything it has to offer before the player stops playing.' - Raph Koster A Theory of Fun

Acknowledgements

- ▶ K.K Lamberty
- ▶ Students

References

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