Bacon Brains: Video Games for Teaching the Science of Addiction

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Presentation Overview

- Substance Use in Adolescence
- Prevalence and Benefits of Gaming
- Health Games
- Substance Abuse Education Games
- Gender Differences
- Development of the Program
- Evaluation of the Program
- Future Directions
Introduction

- Adolescent Substance Use
  - 40% drink alcohol
  - 23% use marijuana

- Correlates of Use
  - future abuse
  - health issues
  - school failure
  - mental health problems
Introduction

• Substance Use Interventions
  – Popular programs sometimes ineffective
    • DARE, Take Charge of Your Life
  – Some are quite effective
    • Amazing Alternatives
    • Combination of education & life-skills
  – Long history of using technology
Prevalence of Gaming

• Children & Adolescent Media Use
  – 7 hours/day
  – multiple types of devices

• Game play
  – 85% of top 700 most popular apps are games
  – 97% play an hour a day
  – $25b in yearly revenue
Problems of Gaming

• Potential Deleterious Effects
  – pathological use
  – sexist attitudes
  – violence
  – impulsivity
Benefits of Gaming

• Potential Benefits Effects
  – cognitive enhancement
  – social connection
  – motivation
  – education
Benefits of Gaming

• Games as Education
  – “gamification”
  – “Serious Games”
Health Games

• Can lead to improved outcomes
  – Cancer
    • Improved knowledge, more adherent to treatment
  – HIV prevention
    • Increased self-efficacy
  – Dancetown
    • Coordination, Cholesterol decrease
  – RWJ Foundation
Substance Abuse Education Games

• Early examples of prevention games
  – Say No With Donny
  – Life Moves
• Structured Interventions
  – Refuse to Use
• NIDA-supported work
  – Reconstructors
Gender Differences

- Typically not evaluated when looking at Substance Abuse Education interventions
- Boys & Girls do learn differently
  - deductive vs. inductive reasoning
  - communication style
  - sensitivity to group dynamics
  - preference for collaborative vs. competitive activities
Gender Differences & Video Games

• Boys typically spend more time playing
• Boys and girls have different preferences
  – girls like social and educational games
  – boys like sports and violence
Gender Differences & Science

• Stereotype that science is a “male” endeavor
• Evident even in early years
• Impact of stereotype
  – influences classes taken
  – influences career choices
Overview

• Middle school is ideal time to intervene
• Previous approaches have had mixed results
• Our focus is solely on science education
• Tradition of using technology
Intervention

- Created a series of video games
- Designed to teach substance abuse curriculum
Hypotheses

- Knowledge scores: Intervention > Control
- Gains at Interim, Post, and Follow-up
- Girls improve more with collaborative play
- Boys improve more with competitive play
Development of the Intervention

• Funded by NIDA R-25 award
• Began by creating core curriculum
• Review by
  – Substance Abuse Researchers
  – Educators
  – Students
• Detailed design document
• Hired independent contractor
Description of the Intervention

- Series of six interactive video games
- Flash technology deployed on web
- Cross platform capable
Description of the Intervention

1. Brain Structure and Function – Racing Game
2. Neurotransmission – Racing Game
3. Brain Reward System – Arcade-Style Game
4. Addiction is a Disease – Maze Game
5. Genetics of Addiction – Arcade-Style Game
6. Treatment for Addiction – Maze Game
Bacon Brains Racing Games

• Guide robotic pig through track
• Collect brain parts
• Install correct part for a given mission
  – e.g., hippocampus to improve memory
Bacon Brains Arcade Games

- Primary action occurs in the “arena”
- Use ray to release objects from grid
- Collect objects in bucket
- Brain Reward System Module
  - collect reinforcers (e.g., veggies, sundaes, etc.)
- Genetics of Addiction Module
  - collect nucleus, chromosomes, and genes
Bacon Brains Maze Games

- Guide pigs through movie studio basement
- Collect audio / video clips
- Interspersed with matching games
- Proceed to editing room to apply audio and visual effects
- View entire animated content
Bacon Brains Teaser Video
Bacon Brains Evaluation

- After five years of development
- Secured agreement with charter school
- Restructured elective period
- All students invited to participate
- Consent gathered at beginning of year
- 12 ten-day cohorts
Participants

- Random assignment to cohort
- Approximately 25 per group
- Mixed gender and grades
Intervention Time-line

- Assigned Cohort Students
- Assent, Randomization, Pre-Test
- Collaborative Play
  - Interim Test
- Competitive Play
  - Interim Test
- Individual Play
  - Interim Test
- Post-Test
- Follow-Up Assessment
Procedures

• Conducted in a dedicated classroom
• School provided laptops for each student
Assent & Randomization

- Assigned Cohort Students
- Assent, Randomization, Pre-Test
  - Collaborative Play
    - Interim Test
  - Competitive Play
    - Interim Test
  - Individual Play
    - Interim Test
- Post-Test
- Follow-Up Assessment
Pre-Test

- Assigned Cohort Students
  - Assent, Randomization, Pre-Test
    - Collaborative Play
    - Competitive Play
    - Individual Play
    - Interim Test

- Follow-Up Assessment
  - Post-Test
Intervention & Interim Assessments

- Assigned Cohort Students
- Assent, Randomization, Pre-Test
- Collaborative Play
  - Interim Test
- Competitive Play
  - Interim Test
- Individual Play
  - Interim Test
- Post-Test
- Follow-Up Assessment
Post-Test

- Assigned Cohort Students
- Assent, Randomization, Pre-Test
- Collaborative Play
- Individual Play
- Competitive Play
- Interim Test
- Post-Test
- Follow-Up Assessment
Follow-up

- Assigned Cohort Students
- Assent, Randomization, Pre-Test
  - Collaborative Play → Interim Test
  - Competitive Play → Interim Test
  - Individual Play → Interim Test

- Post-Test
- Follow-Up Assessment
Measures

• All data collected online via Qualtrics
  – secure
  – easily exportable
  – reduces data entry errors

• Played audio recordings of each question
Knowledge Measures

• Set of 10 multiple-choice questions for each six modules
• Aligned directly to our curriculum content outlines
• Reviewed by educators and substance abuse researchers
• Pre, Interim, Post, Follow-up summations
Gender Measures

• Children’s Personal Attributes Questionnaire

• 21 five-point Likert items
  – e.g. “I almost always stand up for what I believe in” and “I am a gentle person”

• Three factor-derived sub-scales
  – masculinity, femininity, androgyny
Science Attitudes

• Project specifically geared towards science education
• Used measure from previous projects
• Nine five-point Likert items
  - e.g. “I enjoy my science course” and “Doing science often makes me feel nervous.”
Computer Experience

• Assessment of students’ experiences using computers and video games
  – Ten five-point Likert items
  – e.g. “I like playing computer or video games,” and “I would describe myself as a gamer.”
Evaluation Results

• Twelve ten-day cohorts
• First two trimesters
• All students at school eligible
Description of Participants

- Male: 132 (54.1%)
- Female: 112 (45.9%)
Description of Participants

- Sixth: 74 (30.3%)
- Seventh: 80 (32.8%)
- Eighth: 90 (36.9%)
Preliminary Analyses - Overall
Science Attitudes

The diagram shows the science attitudes of students in different grades. The attitudes are represented as follows:

- Sixth grade: 30
- Seventh grade: 29
- Eighth grade: 32

The eighth grade has the highest science attitudes among the three grades.
Computer Gaming Experience

- Sixth: 34
- Seventh: 33
- Eighth: 31
Computer Use (3 or more hours/day)

- Boys
- Girls

- Video games
- Social media
Femininity Scale

- Male: 21
- Female: 23
Primary Outcomes
Satisfaction with Intervention

![Graph showing satisfaction with intervention over three years. The red line represents Bacon Brains, and the blue line represents Control. The graph shows a decrease in satisfaction over time for both groups, with Bacon Brains starting at a slightly higher satisfaction level.](image)
Discussion

• Students enjoyed Bacon Brains
• Intervention effective in teaching our curriculum
• Significant gender effects
  – Boys learn best when competing
  – Girls learn regardless of condition
Limitations

• Full-scale evaluation at school is difficult
  – Did not complete 8-week follow-up
  – Programs treated as a stand-alone activity
    • Ideally, integrate games into science classroom
    • Games used to reinforce complex topics
Future Directions
Thanks

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References

• See notes section for complete list of references