University of Washington Campus Sustainability Challenge: Feasibility and Design Study

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PRELIMINARY RESULTS – MAY 2018

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APPENDIX - FEASIBILITY STUDY RESULTS

This document contains the preliminary results of the feasibility and design study, a three-part project that explored the potential to implement an environmental gaming challenge on the UW campus. The feasibility study consisted of three parts, which we report on separately. The first part was a review of the existing games that we found related to environmental and science education, to understand the current gaming landscape. The second part was hosting a game jam event (i.e., a hackathon) where teams developed multiple game prototypes around the theme of sustainability. The third part of the feasibility study was conducting an online survey of the UW community – students, staff, and faculty – which assessed interest and preferences related to "green games". Some of these results (Parts I and III). are currently being prepared for submission as a peer-reviewed article, and should be considered preliminary as data analysis and summary is continuing.

Part I. Literature and gaming review

Overview and Methods

We conducted a systematic review of the peer-reviewed literature related to educational and environmental gaming as well as a review of existing (digital) games focused on scientific and environmental themes. For each of these reviews, we classified and summarized the literature and games using attributes that allowed us to quantitatively assess patterns and trends over time. For the literature review, nine attributes described the publication year, topic, environment (e.g., formal vs. informal educational setting), and outcomes measured (i.e., behavior, learning). Games were classified using attributes that described the intended audience, field or discipline represented, game styles, platforms, and accessibility. The review of these two bodies of work allowed us to gain insights into the current landscape of educational and environmental gaming.

For the literature review (n=30 publications identified), we applied a multivariate approach of correspondence analysis to visualize patterns of representation across the nine attributes that described each publication. Correspondence analysis evaluates the distance between rows of related items (ie, articles) based on similarities across samples (ie, themes and topics) based on chi-square distances; distances between items with respect to research topics can be graphically rendered to assess strength of clustering across studies as well as underrepresented topics (ie, knowledge gaps).

Of the 72 environmental and educational games initially identified for consideration, only 42 were deemed to meet criteria for inclusion in the review, which was that the game should (at a minimum) capture some part of a real scientific or environmental phenomenon. These 42 games were then classified and summarized based on audience, field or discipline represented, game styles, platforms, and cost.

Results

We identified only 30 peer-reviewed publications that related to environmental and educational gaming published between 1999 and 2017, a relatively small knowledge base. However, an upward trend in publications over time was apparent, with a peak occurring in 2012 (*data not shown*). Correspondence analysis on the nine attributes that each publication could potentially be classified under revealed some dominant areas and clusters of research focus (Figure 1). Research-based publications in traditional K-12 that emphasized learning outcomes formed one cluster or dominant research space, while a second cluster appeared to emphasize engagement in informal educational settings. Publications that examined behavioral changes and explored game design were rare, as were reviews.

There were some identifiable patterns and trends across the current body of environmental and educational games. Out of 42 games deemed to meet our criteria for inclusion, representation across target age groups was relatively even (Figure 2A), although the majority were not aimed at a particular group or were appropriate for multiple groups. There was a strong bias toward games related to environment/sustainability and biology/ecology disciplines (Figure 2B), with low representation of other disciplines. Web and app-based platforms were strongly preferred (Figure 2C); interestingly, we were only able to identify one board game, although this may reflect our reliance on online searches to identify games. There does seem to be an upward trend in publication and release of environmental games (Figure 2D), although this trend was less definite than expected.

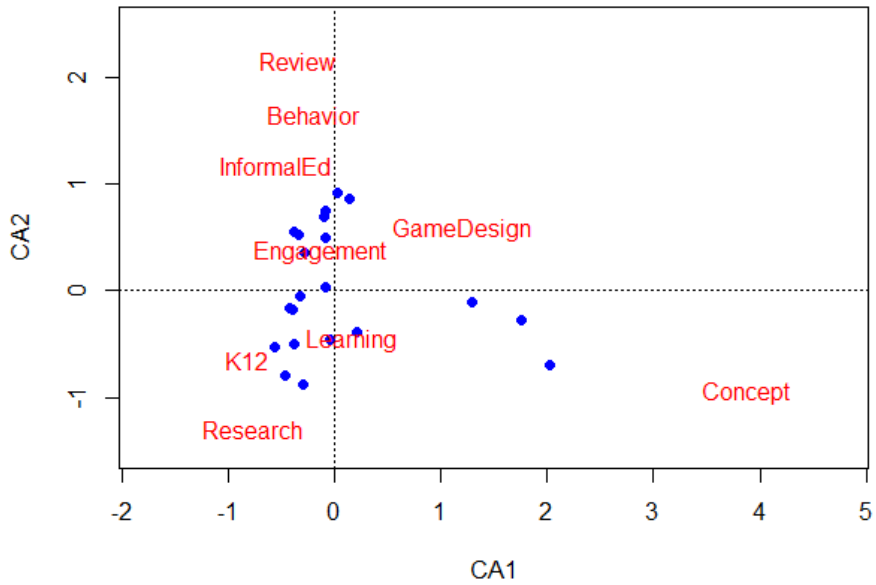


Figure 1. Correspondence analysis on attributes used to classify and describe publications that related to environmental or educational gaming, and evaluate the current gaming landscape. Points (blue) are the locations of individuals papers in multivariate space within nine attributes that relate to educational setting (K12, Informal Ed), publication themes (Research, Concept, Review, Game Design), and measured outcomes (Learning, Engagement, Behavior). CA1 and CA2 explained 60% of the total variance in the dataset.

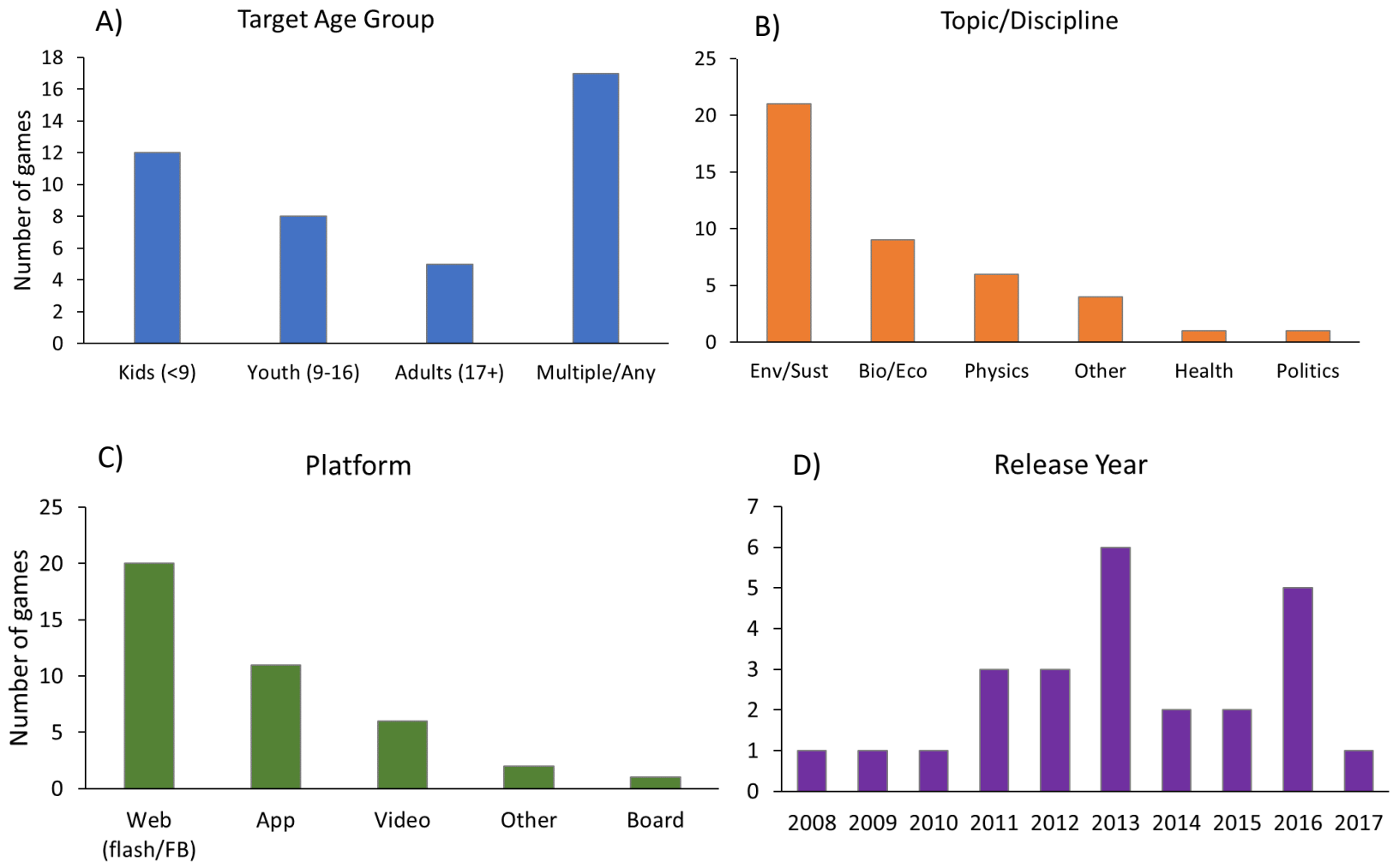


Figure 2. Overall trends and patterns in educational and science-based games based on a review of 42 current games (out of 71 reviewed) that met the criteria for inclusion. The number of games is summarized based on A) target age group, B) field or discipline represented, C) game platform, and D) year of release.

Part II. Game Jam

Overview

Our vision for the event was to host an accessible event where participants would feel welcome regardless of their skills or background, but were inspired by the potential of using and developing games that could promote a more sustainable future. Toward that end, we focused on reaching as broadly as possible across UW and the surrounding community and creating a highly supported environment for participants.

Jam design and promotion

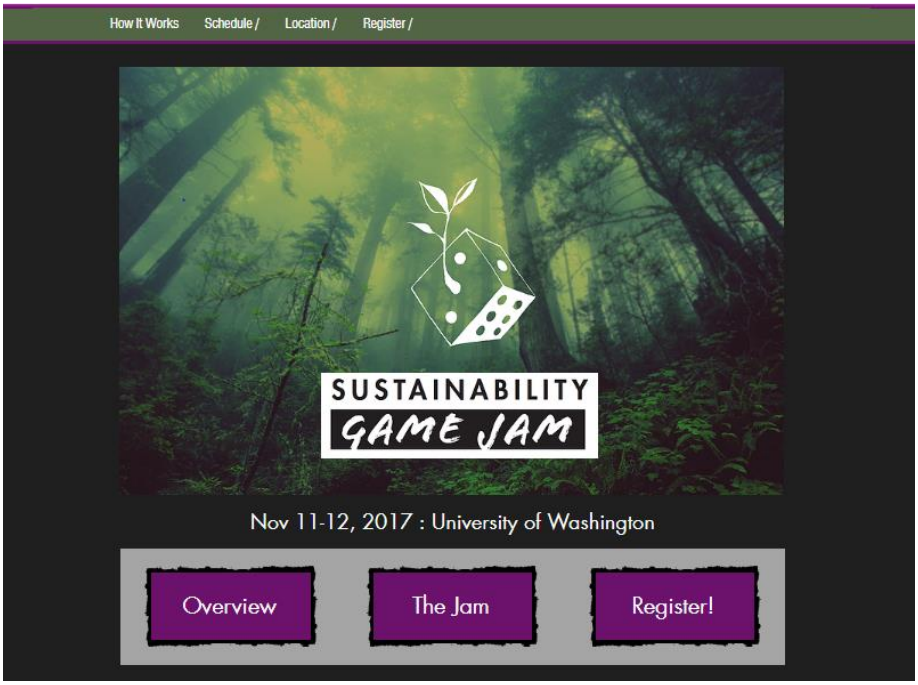
The UW Sustainability Game Jam was successfully held the weekend of November 11-12, 2017. A large effort was put in by the project team to promote the event (https://uwgames.wixsite.com/sustainabilityjam) by contacting more than 50 relevant UW departments and programs, faculty, RSOs, local non-profits, and local media. The event was selected as a featured event by *GeekWire*, appeared on the calendar for *The Stranger*, and was promoted by Seattle Indies and Seattle Serious Gamers (two popular Meetup groups related to gaming in Seattle). Across UW, the event was promoted by UW Bothell Sustainability, on the UW Tacoma campus, and broadly across the UW campus (using flyers, email, and social media). This broad reach drew a diverse group of participants with varied expertise ranging from environmental sciences to art to graphic design to game development; about 60% of registered participants were UW students and faculty (from multiple campuses), while the remainder were from the community and/or other institutions (e.g., Antioch).

The game jam followed the format of other hackathon or jam events, with some key differences that were specifically designed to improve accessibility of the event and broaden participation. Instead of a usual 48-hour event (Friday night – Sunday night), which can be somewhat prohibitive for those who had to travel (i.e., from Tacoma or Bremerton), have families, or otherwise have difficulty setting aside an entire weekend, we reduced the timeline to start on Saturday morning and finish by Sunday evening. We also obtained donations of food, snacks, and drinks to keep the event free for jammers and acknowledge their hard work. Finally, we allowed the flexibility to either register as a team or be assigned to a team (based on shared interests), which we believe participants greatly appreciated and helped make the event seem less intimidating to first-timers.

Results

More than 60 people attended or participated over the course of the weekend event, including many people that attended the introductory event and/or game showcase on Sunday evening, or helped out as volunteers. Thirty people were registered as game jam participants, with the result that eight teams were created and produced the same number of game prototypes on topics ranging from plastics pollution in the ocean to electronic waste. The results and outcomes of the

game jam were written up as a blog post for the *In Our Nature* blog (https://green.uw.edu/blog/2017-12/uw-game-jam-harnesses-games-sustainable-future), which also appeared on the AASHE Bulletin. As a result, we were contacted by instructors and sustainability offices at multiple universities, nonprofits, and government agencies who were interested in the event, the games that were developed, and learning more about green games.



A detailed event website, guided by feedback from many members of the gaming community and UW students was crucial in communicating the purpose and vision of the event, keeping registrations organized, and helping participants feel welcome and supported.

Game jammers on Sunday evening, at the Games Showcase.

Part III. Online survey

Overview

In February we conducted a survey of the UW community to evaluate interest and receptiveness to environmental or sustainability themed games. The survey was developed by building on knowledge gained from the literature review and hosting the game jam; in fact, some of the survey content was based on games developed during the jam. The survey design and content were reviewed and approved by the Human Research Subjects Review Board at UW; we are currently working to write up the results of this survey as a peer-reviewed article (target journal: *Environmental Education Research*) to share the knowledge gained with other researchers and campus groups interested in using games to promote sustainability.

Methods

We conducted an online survey of the University of Washington (UW) campus community from February 15-28, 2018, which included not only undergraduate and graduate students but also staff, post-doctoral associates, and faculty. We focused on individual departments listed at UW (n=85) as the primary means to distribute the survey. A survey announcement was initially emailed to the general advising address for each department with a request to forward to the students, staff, and faculty in the department. If this initial outreach did not elicit a response, a follow up email was sent directly to the undergraduate and (if applicable) graduate program coordinators or advisors in each department. A small number of departments directed us to alternative communication platforms (e.g., social media groups, opt-in listserves). Over the 2-week period that the survey was open we received confirmation that the survey was sent to 20 undergraduate and 25 graduate departments, as well as being shared by large organizations on campus (e.g., UW Sustainability, Center for Creative Conservation); respondents may have also encountered the survey through subsequent shares on social media or forwarding by individuals. The survey included an incentive where respondents could enter their UW-specific contact information to be entered into a drawing for a gift card.

The survey contained two sections. The first section contained demographic questions related to age, gender, broad academic discipline (5 categories), and enrollment level (undergraduate/graduate student) or position (staff, faculty, other) at UW. Respondents were then asked a series of questions that evaluated their level of concern about the environment (overall, and for seven specific issues), assessed the amount of time they spent playing games on a daily basis, preferred game platforms, and interest in different types of environmental games. At the end of the first section, respondents were asked to select from a list of six possible game features (e.g., competition with classmates, personal rewards) those that would interest them and then rank those selected features.

At that point, respondents could exit the survey or opt to enter the second section, which presented short descriptions of hypothetical environmental games. Each of the three games differed in incentives, game type, learning opportunities, and gameplay time. For each hypothetical game, respondents were asked to give the game an overall score (on a scale of 1-10) to reflect general interest, and then rank how much they liked specific game elements using a Likert-scale.

Survey data were summarized based on converted Likert-scale data. Game features that were selected and ranked as likely to interest respondents were averaged. Questions that assessed level of environmental concern and interest in the elements of the presented hypothetical games were summarized as the proportion of respondents that selected the top scale elements (i.e., "Very Concerned" for environmental issues, "Like Somewhat" + "Like a Great Deal" for game elements). The standard deviations and distributions of game element rankings were also examined to evaluate variability and patterns of response.

Results

Demographics and environmental concern

A total of 528 respondents completed the first section and 397 completed the second section of the survey. A higher proportion of survey respondents identified as female (n=354) vs. male (n=163) or non-binary (n=11) (Figure 1a). The largest number of respondents reported their major or area of academic focus was in the Natural Sciences (37% of total), with other areas ranging from 26% (Applied Sciences) to 6% (Arts) (Figure 1b). The higher proportion of female respondents (approximately 2:1) was consistent across area of academic focus and status at the UW (e.g., student, staff, etc) (*data not shown*).

Respondents indicated very high levels of environmental concern across a diverse range of environmental issues presented, although concern was more pronounced for the issues of climate change and water pollution (Figure 2). However, environmental concern about the environment was significant but not strongly correlated (*Pearson's* R^2=0.17, p<0.01) with the degree of environmental action and engagement reported by respondents (Figure 3.)

Game features and incentives

Only three game features - Environmental Benefit, Fun to Play, and Rewards - were selected as likely to interest more than 70% survey respondents; these were also given the highest rankings when they were selected (Figure 4). The other three game features – Compete, Connect, Cooperate - were selected far less frequently (<39% of survey respondents); of these, cooperation performed better than competition and connecting with new people.

Respondents asked to rank different (hypothetical) game features expressed positive interest in many different types of game incentives, learning opportunities, gameplay time, and game genre (Figure 5A-D). The primary exception to generally even patterns were an overwhelming preference for games where an environmental benefit can be realized (Figure 5A), as well as slightly greater preference for games that were linked to UW-based environmental priorities and sustainability resources (vs. general environmental knowledge) (Figure 5B).

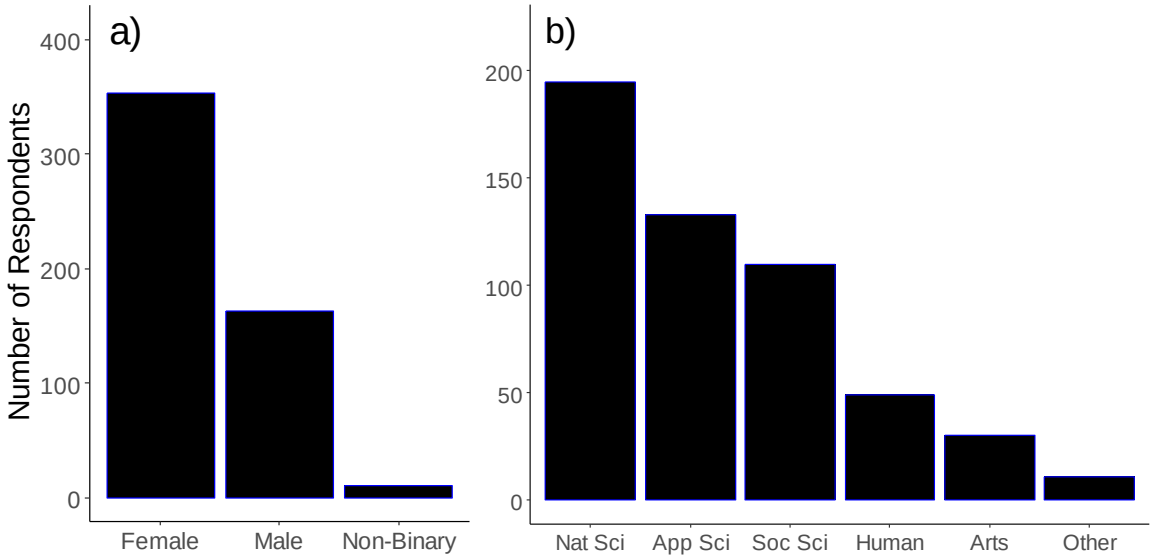


Figure 1. a) Number of survey respondents by self-identified gender and b) major or area of academic focus selected by survey respondents. Academic categories are coded as follows: Natural Sciences = “Nat Sci”, Applied Sciences = “App Sci”, Social Sciences = “Soc Sci”, Humanities = “Human”, Arts = “Arts”. A very small number of disciplines self-entered by respondents could not be classified (e.g., dual or interdisciplinary majors), and were kept as “Other”.

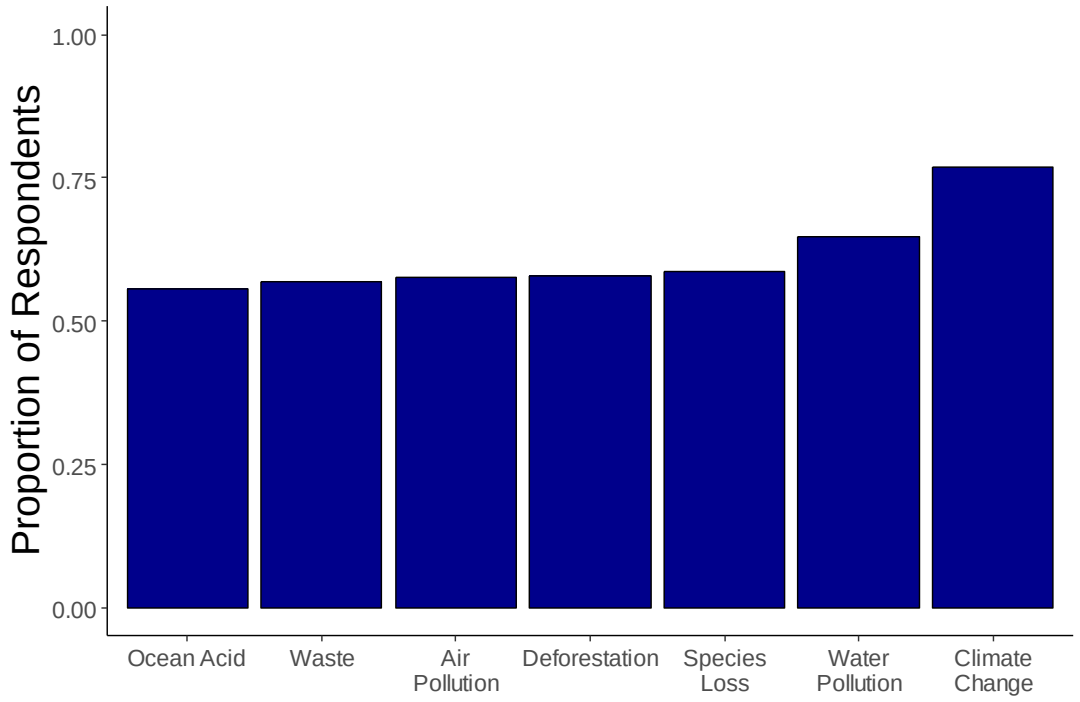


Figure 2. Proportion of survey respondents that indicated they were "Very Concerned" (on a 4-point scale ranging from "Not at all" to "Very Concerned) about seven different environmental issues presented.

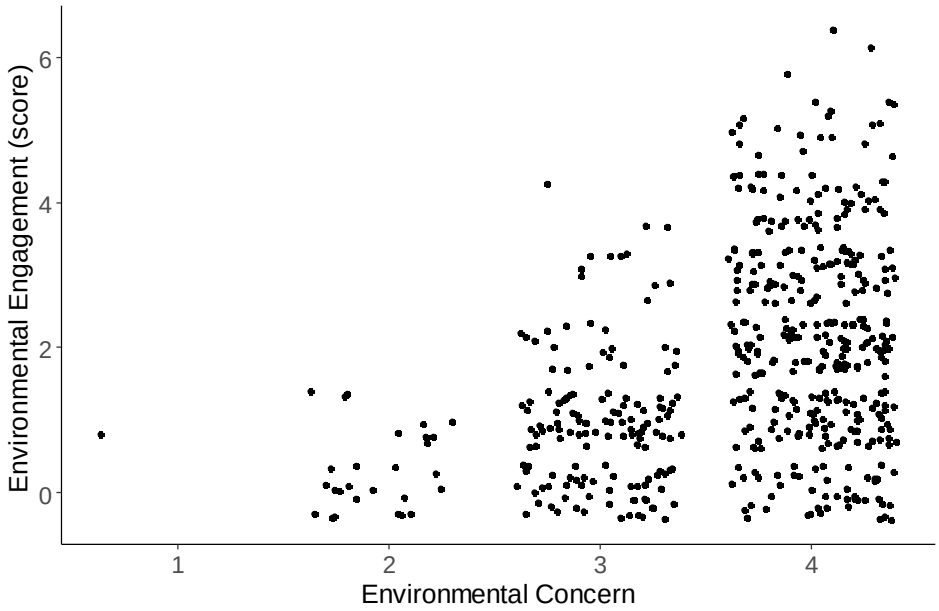


Figure 3. Overall levels of environmental concern reported by survey respondents was predominantly 3 (Moderately Concerned) and 4 (Very Concerned). Environmental concern was significantly but not strongly correlated with level of environmental engagement, as determined by a sum (i.e., score) of possible environmental actions undertaken in the past year (*Pearson's* $R^2 = 0.17$, $p < 0.01$).

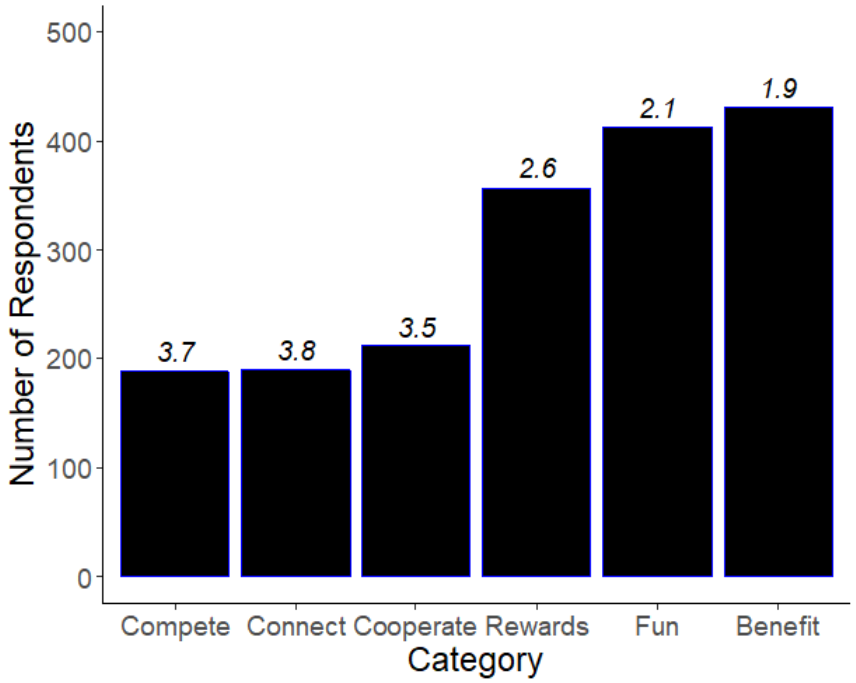


Figure 4. Number of respondents (out of a possible 528) that selected specific game features in response to the question "If there were a game about sustainability on campus, which elements would make you more interested in playing – select and rank". Categories are *Compete* = can compete with friends or classmates, *Connect* = can connect with other people, *Cooperate* = can cooperate with others, *Rewards* = has points or rewards, *Fun*=game is fun to play, *Benefit* = an environmental benefit (e.g., trees planted) is an outcome. Numbers in italics represent the average ranking [possible 1-6 scale, from most to least interesting] for that feature when it was selected.

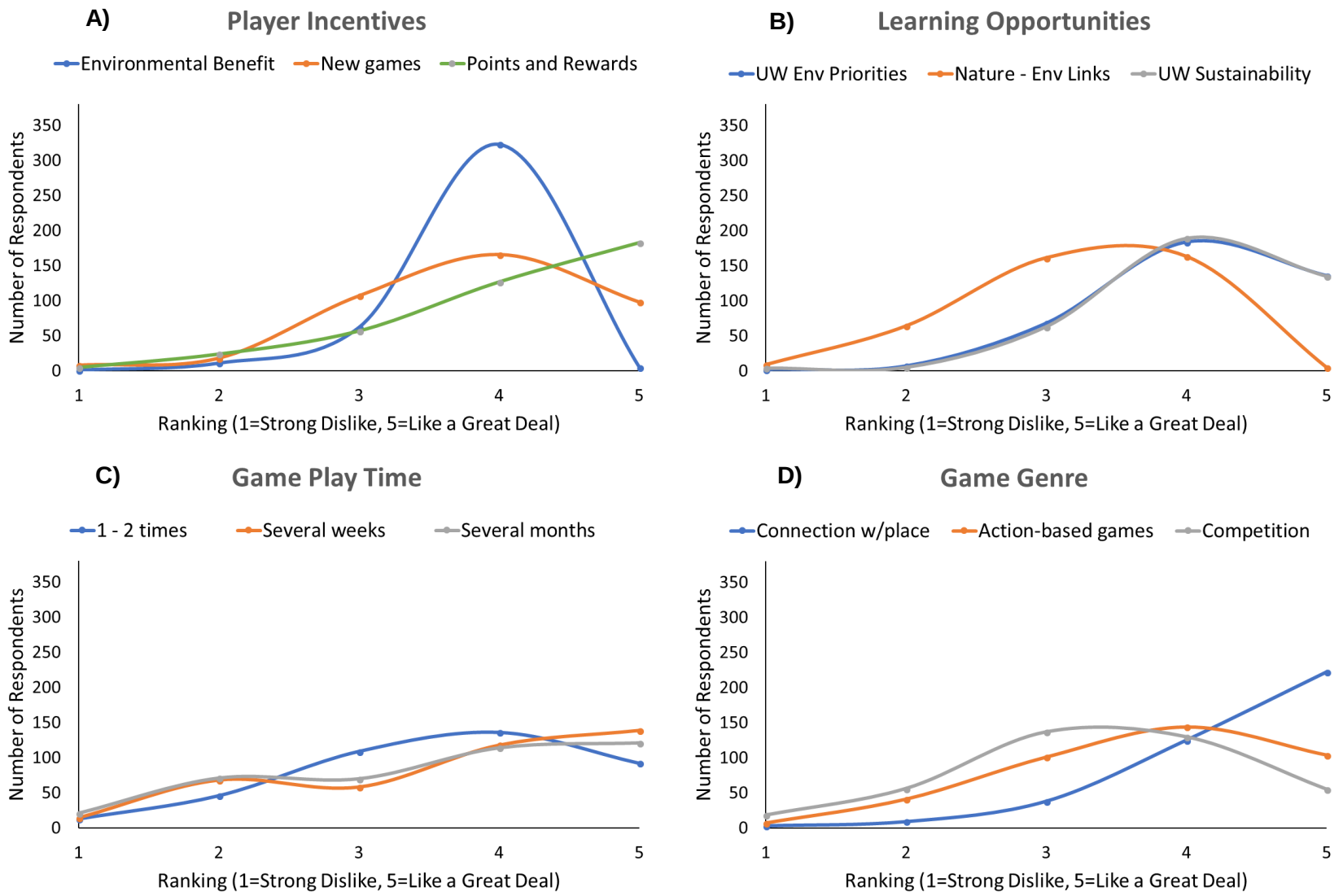


Figure 5. Rankings of survey respondents for 12 different types of possible green game characteristics, classified in one of four categories. The four categories are: A) player incentives, B) learning opportunities, C) game play time, and D) genre or focus of game. These 12 characteristics were presented to respondents as part of evaluating hypothetical game designs on campus. Respondents ranked features using a scale of 1 (Dislike a Great Deal) to 5 (Like a Great Deal).