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A Cloud-Based Scavenger Hunt: Orienting Undergraduates to ACS National Meetings

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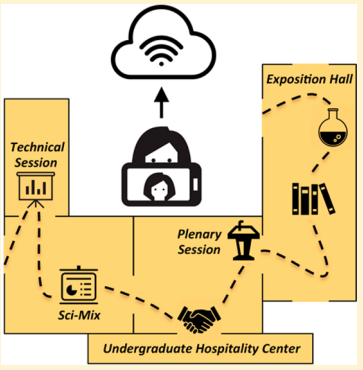
Supporting Information

ABSTRACT: American Chemical Society (ACS) National Meetings are valuable for the development of undergraduate researchers but can be overwhelming for first-time attendees. To orient and engage students with the range of offerings at an ACS meeting, we developed a cloud-based scavenger hunt. Using their mobile devices, teams of undergraduates "scavenged" items off a list by uploading "selfies" to designated folders within Google Drive, a cloud-based storage system. Time stamps offered by the cloud afforded real-time evidence of student participation. Items on the scavenger hunt were designed to integrate undergraduates into the meeting, exposing them to distinguished scientists, leading publishers, and instrument manufacturers as well as to networking opportunities. We employed this selfie-based scavenger hunt at three ACS National Meetings (Philadelphia, 2012; Boston, 2015; Philadelphia, 2016). Students reported that the scavenger hunt contributed to their learning. The cloud-based scavenger hunt is versatile and can be easily adapted for other constituencies (e.g., high school or international students) or events (e.g., regional meetings or first-year orientations).



KEYWORDS: *Upper-Division Undergraduate, Chemoinformatics, Collaborative/Cooperative Learning, Humor/Puzzles/Games, Internet/Web-Based Learning, Conferences, Undergraduate Research*

BACKGROUND

Biannual National Meetings of the American Chemical Society (ACS) offer broad opportunities for scientific engagement and professional development.[1] Between the fall and spring meetings, over 3000 undergraduates attend an ACS National Meeting each year.[2] Undergraduates who present their research report gain in confidence and communication skills as well as a greater sense of their role in the larger scientific community.[3−5] However, the large conference footprint and concurrent sessions can be overwhelming for first-time attendees. Students may not be aware of all the activities available at a meeting and their benefits.[6] The ACS supports undergraduate attendance at its meetings through travel grants[7] and offers selective programming through the Society Committee on Education, which includes symposia cosponsored by various technical divisions, graduate school information sessions, career development workshops, undergraduate poster and oral sessions, an eminent scientist lecture, and a hospitality suite.[8] While enriching and supportive, some of these events may unintentionally sequester undergraduates from the rest of the conference population. Chemical instrumentation related activities have been developed to engage undergraduates at national conferences.[9,10] However, a technology has yet to be developed that systematically integrates undergraduates into the activities of chemical practitioners including graduate students, postdocs, research scientists, and faculty at an ACS National Meeting.

SCAVENGER HUNT DESIGN AND IMPLEMENTATION

To better orient and engage undergraduates with the range of offerings at an ACS meeting, we have developed a scavenger hunt that uses students' mobile devices. Scavenger hunts have become popular for college students,[11] in instructional design,[12] and as games that can advocate for diversity[13] and teach laboratory safety.[14] As in all scavenger hunts, teams of participants were charged with collecting items on a curated list (Box 1). These items aligned with our goals for student attendance at the meeting: scientific engagement, scientific literacy, networking, and fun. Students scavenged items off the list by taking a "selfie"—a digital photograph of student(s) with the item(s)—utilizing their mobile devices. The collection of selfies constituted a digital record of each team's effort to be assessed postmeeting by faculty mentors. A unique advantage of a scavenger hunt list generated by faculty mentors is its ability to make connections between the meeting and students' curricular experiences.

We have run our ACS scavenger hunt three times with Fairfield University undergraduates. At the 244th ACS National Meeting (Philadelphia, 2012, eight students, four teams), students collated their selfies using Word or PowerPoint and submitted the final

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Box 1. List of items for the 252nd ACS National Meeting scavenger hunt. Tie-breakers are items for which a team can gain extra points. The criterion used for assessing the tie-breaker submission (i.e., creativity, distance) is given.

Provide a selfie documenting you and/or your teammate(s):

1. At a Philadelphia landmark (note: be creative, this is a tie breaker item!)
2. With a Fairfield alumnus or alumna
3. With a graduate student or faculty member from a graduate or professional school to which you might apply
4. At one of the following three events specifically for undergraduates:
   (a) Networking Basics for Students
   (b) Graduate School Reality Check, Part I: Getting In
   (c) Graduate School Reality Check, Part II: You Are In—Now What?
5. At the placard outside one of these two symposia:
   (a) "Chemistry of the People, by the People, for the People"
   (b) "C&EN Talented 12"
6. At the placard outside an oral session of any division of the ACS
7. At the Exposition booth of an instrument manufacturer or software publisher whose product **you have used** at Fairfield
8. At the Exposition booth of an instrument manufacturer or software publisher whose product **you would like to use** at Fairfield
9. At the ACS Publications booth, holding a sample copy of an *open access* journal of the American Chemical Society
10. At the SciFinder booth, having located via SciFinder a publication authored by one of the ACS meeting's Kavli Lecturers
11. At the Undergraduate Hospitality Lounge, with a quality "freebie"
12. With an undergraduate from another tri-state institution (add a photo of student's badge; the tri-state area is Connecticut, New York, and New Jersey)
13. With an undergraduate from a non-tri-state institution (add a photo of the student's badge; tie-breaker points for the student whose home institution is furthest away)

product on a memory stick. Taking into account that smartphone ownership among undergraduates is over 85% and growing[15] and that the ACS has transitioned its National Meeting programs to a cloud-based app,[16] we recognized that a cloud-based mobile system would dramatically improve our scavenger hunts at the 250th and 252nd ACS National Meetings (Boston, 2015, seven students, three teams; Philadelphia, 2016, 10 students, five teams). At our institution and perhaps others, the availability of "loaner" mobile devices ameliorates the very real issue of the "digital divide" for economically disadvantaged students. We selected Google Drive as a cloud storage system because it is bundled with the Gmail accounts our university provides to our students. Alternatively, free accounts at DropBox,[17] Box,[18] or Evernote[19] are similarly indifferent to mobile operating system and could also be used. Students were informed of the ACS's policy forbidding digital recording of speakers and presentations (see the Supporting Information).

Architecture of a Cloud-Based Scavenger Hunt

Before the start of the ACS meeting, faculty mentors created a folder in Google Drive containing an additional 13 subfolders, each named for one of the 13 items on the scavenger hunt list (see the Supporting Information). Mentors could then easily duplicate, rename, and share this folder hierarchy with as many student teams as needed. During the hunt, students accessed folders via the Google Drive app. When the desired folder was located, a single tap of a button activated the camera on the mobile device, and a second tap snapped the selfie and deposited it into the folder in the cloud (Figure 1). Multiple selfies could be uploaded with minimal effort.

Advantages of the Cloud

Taking the scavenger hunt into the cloud has several distinct advantages. First, *cloud storage lowers the barrier for successful participation by students.* Students' mobile devices connect directly to the cloud. In the Google Drive app, a short series of taps uploads a selfie. Additionally, using prenamed and preorganized folders obviates the irksome task of organizing photos postmeeting.

Second, *cloud storage allows mentors real-time assessment of student participation at the meeting.* The main motivation for the scavenger hunt is to orient students to the myriad of scientific and professional development opportunities at ACS National Meetings. Students who upload selfies are documenting their participation in real time. Changes to teams' folders are reflected on mentors' devices (see Figure S2). Therefore, mentors have an opportunity to see the level of participation of their students and to encourage their continued participation during the duration of the ACS meeting.

Third, *cloud storage offers an alternative to the "everything goes on the desktop" model of file storage.* In our increasingly digital world, it is important to develop habits of electronic hygiene. By using a series of labeled folders to organize their selfies, students did not need to rename picture files. The items with "subitems" (e.g., 4 and 5) had "subfolders." This folder hierarchy exemplified an organized set of electronic files. Notably, selfies do not contain text, making them difficult targets for text-based computer searching.

Fourth, *cloud storage offers easy assessment of results.* Immediately after the meeting, team folders were unshared with students; contributions were locked into place. Team folders could be shared with other faculty, downloaded to laptops for evaluation, or projected for group discussions. At Fairfield, four faculty mentors assessed the number and quality of team contributions by gathering before a large monitor and scanning through the submissions. The preorganization of folders in Google Drive offered uniform contributions for easy comparison and evaluation. Gift cards were awarded to winning teams.

Fifth, *cloud storage offers long-term, secure storage of results.* Going forward, student contributions are safely stored in the cloud. Future students, who may be new to large scientific meetings, can view the photos and imagine themselves in the scientifically diverse environment of an ACS National Meeting. Some photos, with permission from students, could be appropriate for the Department's social media outlets or for advertising research opportunities to underclassmen.

■ STUDENT FEEDBACK

We administered an online postmeeting survey, conforming to Institutional Review Board standards, each year a scavenger

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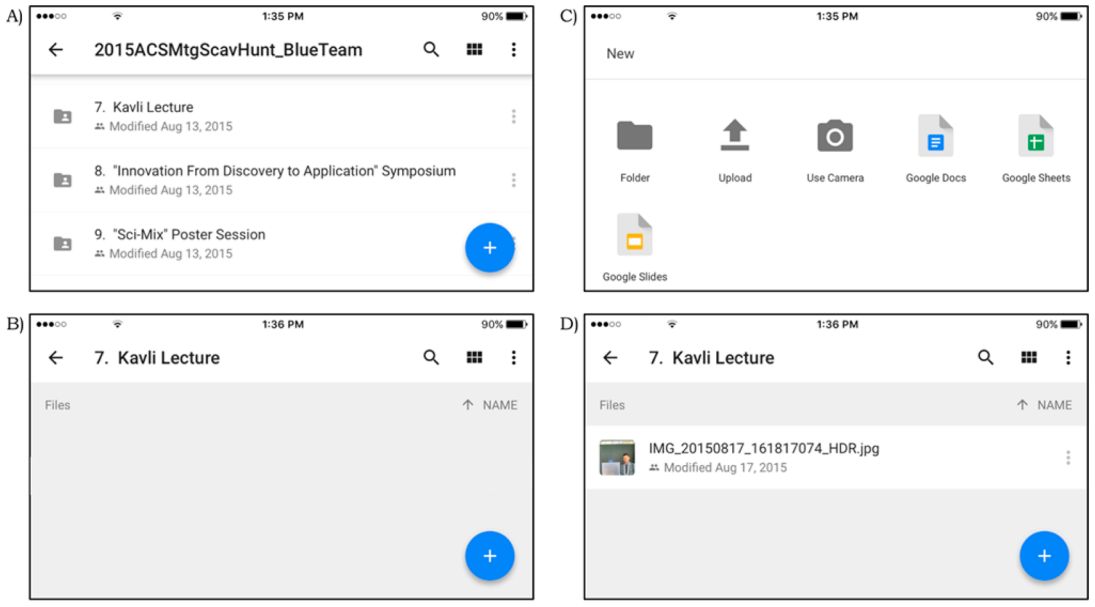

Figure 1. Smartphone touch-screen images for workflow of "scavenging" items to the cloud. (A) Student selects a folder corresponding to an item to be scavenged by touching its folder. (B) Student adds to this folder by touching the blue "plus" symbol. (C) Student adds a new or previously saved selfie by touching the "Use Camera" icon/text. The new selfie or newly selected, existing selfie is uploaded automatically. (D) Screenshot of a successfully uploaded selfie. Starting from a team's folder, four screen "touches" are necessary to upload a selfie. These four images are of an iPhone screen. The interface is subject to change. Copyright 2015 Google Inc., used with permission. Google and the Google logo are registered trademarks of Google Inc.

hunt was conducted. Given the similarity in responses and small sample size (n = 23), the results are reported as an aggregate. A plurality of students (~43%) found the scavenger hunt to be fun and a good learning experience. An additional 17% of students agreed the hunt contributed to their learning but found it to be tedious. A subpopulation of students (~26%) reported that while the activity was fun it detracted from more important aspects of the conference. Over our three hunts, we have shortened and focused the item list. Additionally, our most recent hunt was limited to the first ~36 h of the conference, concluding *prior* to a session of "Undergraduate Research Posters". Limiting the scavenger hunt to the first day of conference attendance achieves the intended orientation and allows for subsequent self-exploration.

Our goals for the scavenger hunt were twofold: to orient and to engage. Representative narrative feedback from students speaks to these goals: "the hunt was truly helpful in that it condensed the seemingly unending information into a great starting place" and "I really liked the scavenger hunt because it forced you to attend different events and mingle with other professionals/grads/undergrads" and provided an "excuse to talk/meet new people". We hoped that students who participated would uncover aspects of the meeting not formally listed on the scavenger hunt. Indeed, one Fairfield undergraduate became an ACS Chemistry Ambassador;[20] an interview describing his research is publically available on the web.[21] These outcomes suggest that we made significant progress toward both goals. Additional student responses can be found in the Supporting Information.

CONCLUSIONS

In response to the significant number of undergraduates who participate in ACS National Meetings and the need for a technology to both orient and engage undergraduates at these meetings, we have designed a scavenger hunt that utilizes mobile devices. Between our initial scavenger hunt (Philadelphia, 2012) and our more recent hunts (Boston, 2015 and Philadelphia, 2016), we evolved the hunt to a cloud-based system. The cloud offers significant advantages, including a lower barrier to student participation, developing habits of electronic hygiene, real-time assessment of student participation, and secure long-term data storage. Contemporary students are also adept at using cloud-based mobile technologies (e.g., iCloud, Google Drive, Dropbox). We have capitalized on the skillset and comfort of these digital natives. With student permission, these activities could be effortlessly integrated with social media (e.g., Facebook and Instagram), which are already widely used by the ACS at its meetings. Excitingly, the scavenger hunt platform is flexible and could be adapted for other venues. For example, the scavenger list could be modified for a regional meeting or as an orientation exercise for first-year chemistry/biochemistry majors. The technology could also be broadened to target different audiences such as high school or foreign students.

ASSOCIATED CONTENT

Supporting Information

The Supporting Information is available on the ACS Publications website at DOI: 10.1021/acs.jchemed.6b00445.

Directions for creating a scavenger hunt in Google Drive, additional student survey results, and an example scavenger hunt from an ACS National Meeting (PDF, DOCX)

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Notes

The authors declare no competing financial interest.

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