Extending and Enhancing Understanding Evolution for the Undergraduate Community: Phase II Evaluation Study

2013 Final Report

Submitted by

Rockman et al
Research & Evaluation

595 Market Street Suite 2570 • San Francisco, CA 94105-2802 • 415.544.0788 • FAX 415.544.0789
www.rockman.com

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2013 Final Report

Submitted to:
The University of California Museum of Paleontology (UCMP)
University of California, Berkeley
1101 Valley Life Sciences Bldg
Berkeley, CA 94720

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Nisaa Kirtman, M.A.

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Extending and Enhancing Understanding Evolution for the Undergraduate Community: Phase II Evaluation Study

Executive Summary

Rockman et al (REA), a San Francisco-based research and evaluation firm, conducted an evaluation of the University of California Museum of Paleontology's (UCMP) Understanding Evolution (UE) website. Working to improve evolution education, Understanding Evolution (http://evolution.berkeley.edu) is a vigorous initiative that provides a wide range of scientifically and pedagogically vetted evolution education resources through an engaging and easily accessible website.

The original UE site was constructed to serve K-12 teachers and learners, as well as the general public. Its most recent expansion focused on serving the undergraduate community, with the hopes of increasing site use among undergraduate instructors and students. This phase of the evaluation was designed to (a) capture the potential instructional use of UE resources, (b) explore the value that the web-based resources provide to users, and (c) examine who uses the site and how they use it. Evaluators conducted online surveys and virtual focus groups to capture actionable data to further the development of the site's resources.

Our analysis of the data collected leads to several main conclusions about UE's impact and expansion. First, all groups (undergraduate instructors, K-12 teachers and students) were overwhelmingly positive about UE as a general resource, and also praised the site's design, organization and navigation. In addition, all participating groups seemed to benefit from using UE, with undergraduate instructors being influenced the most. Undergraduate instructors had the highest frequency of responses in the following areas: visits to the UE site, needs being met by the site, likelihood of returning to the site, overall praise of the site, and directing their students to the site.

Finally, undergraduate and K-12 instructors were enthusiastic about learning more about the resources offered. We found a general consensus among survey respondents and focus group participants that the Teaching Materials Database was the most widely used and praised resource. In general, both groups of instructors tended to visit the site to obtain teaching materials (e.g., classroom and lab activities) and content for students. Most undergraduate instructors who were able to use some of the resources in the their classrooms felt that they were easy to incorporate. Although most resources needed to be modified prior to use, instructors praised the UE resources as invaluable teaching tools.

Recommendations are reported following the summary of findings.

Introduction and Background

Program Overview

The University of California Museum of Paleontology (UCMP) is a public institution dedicated to investigating and promoting the understanding of the history of life and the diversity of the Earth's biota. UCMP launched its Understanding Evolution (UE) website (http://evolution.berkeley.edu) in 2004 with the aim of improving evolution education. Originally intended for a K-12 audience and the general public, UE now has drawn a much broader audience and UCMP consequently developed a subsection of the UE site, the *Undergraduate Library*, which targets introductory biology instructors and students. The broad goals of the Library are to:

- Develop community interactions and an exchange of ideas and information among those engaged in evolution instruction at the undergraduate level;
- Encourage college biology instructors to integrate evolutionary concepts—especially the applications and relevance of evolution—throughout their biology teaching;
- Encourage college biology instructors to use pedagogical techniques supported by education research in their evolution instruction.

UE also aims to help instructors develop their students' understanding of:

- The many applications of evolutionary theory, both in solving real world problems and in other areas of current research within and outside of biology;
- Evolutionary theory's powerful ability to explain and frame natural phenomena across biology;
- The evidence supporting evolutionary theory and the veracity of evolution as science;
- Basic evolutionary patterns and processes.

UE provides resources for instructor professional development in pedagogy, as well as easy-to-implement guidance on integrating evolution throughout the biology curriculum. In addition, undergraduate students are expected to gain insight on the applications of evolutionary theory, its relevance, and the currency of evolution research.

Evaluation Overview

An earlier evaluation in 2012 employed a think-aloud method in which six introductory biology instructors from the San Francisco Bay Area were given a list of tasks to complete on the site, such as finding specific content that could help them teach a course on evolution, and talk aloud as they navigated the site. This approach was used to answer questions about navigation, site layout, site content, and suggestions for improvement:

- What kinds of problems, if any, were experienced with the navigation structure of the UE site?
- Were participants able to complete the tasks given to them, and were they able to find the information they were looking for?
- What features were helpful as participants navigated the site, and what could be done to improve the site?

With this method, evaluators were able to closely track the instructors while they navigated the site. All participants agreed that the site had extensive value and could help increase knowledge and provide useful resources for teaching evolution, and that they would refer to their students to it. Several participants praised the extensive content, but said that, due to the amount of information and the number of links, preparing to use the site would require much more time than many of them would be able to give. The problem area most frequently cited when navigating UE was that site users seemed to get lost among the abundance of textual density, links, and sidebars, making the resources and content difficult to find. A few instructors wanted additional classroom activities, the latest research findings, more coherent navigation, and more culturally-aligned information. The latter was particularly salient in that all of the instructors taught students from diverse backgrounds. Some participants were concerned that the site was not structured in a way that distinguished between "information for students" and "information for teachers."

The purpose of the current evaluation was to:

1. Obtain general site feedback from a broader audience (i.e., everyday site users receive a pop-up survey and invitation to complete an online survey).
2. Obtain feedback on specific resources from the site, focusing on design, usability, and impact of those resources.

Research Design and Methods

To conduct this evaluation, Rockman et al employed a mixed-methods design with both quantitative and qualitative components, and aligned all questionnaire items and protocols to the program's key indicators. Online questionnaires and virtual focus groups were the primary data collection tools used to explore outcomes related to faculty members' and students' usage of the Understanding Evolution (UE) site. Table 1 lists the key objectives guiding the evaluation, along with the activities addressing each one.

Table 1. Overview of Data Sources and Research Questions

Research Questions	**Data Source**
1) How are students using the UE site (e.g., frequency of use, reasons for use, if they are getting what they need, etc.) and what do they think of it?	Online survey
2) How are instructors using the UE site (e.g., frequency of use, reasons for use, if they are getting what they need, etc.) and what do they think of it?	
3) Who is using the UE site? (e.g., demographical information such as grade level (students), courses taught (instructors), institution type, etc.)	
4) What do instructors think of the following resources: Evo Connection Slides, Interactive Syllabus, Journal Club Toolkit, Image Library, Teaching Materials Database, and Active Learning Slides? (e.g., would they use the resource in their classes, if they think resource could improve student learning, etc.)	
5) For the instructors that incorporated a few of the above resources into their class instruction, what was their experience using them? (e.g., what worked well, how can the resources be improved, student reactions, etc.)	Virtual focus group

Participants and Recruitment

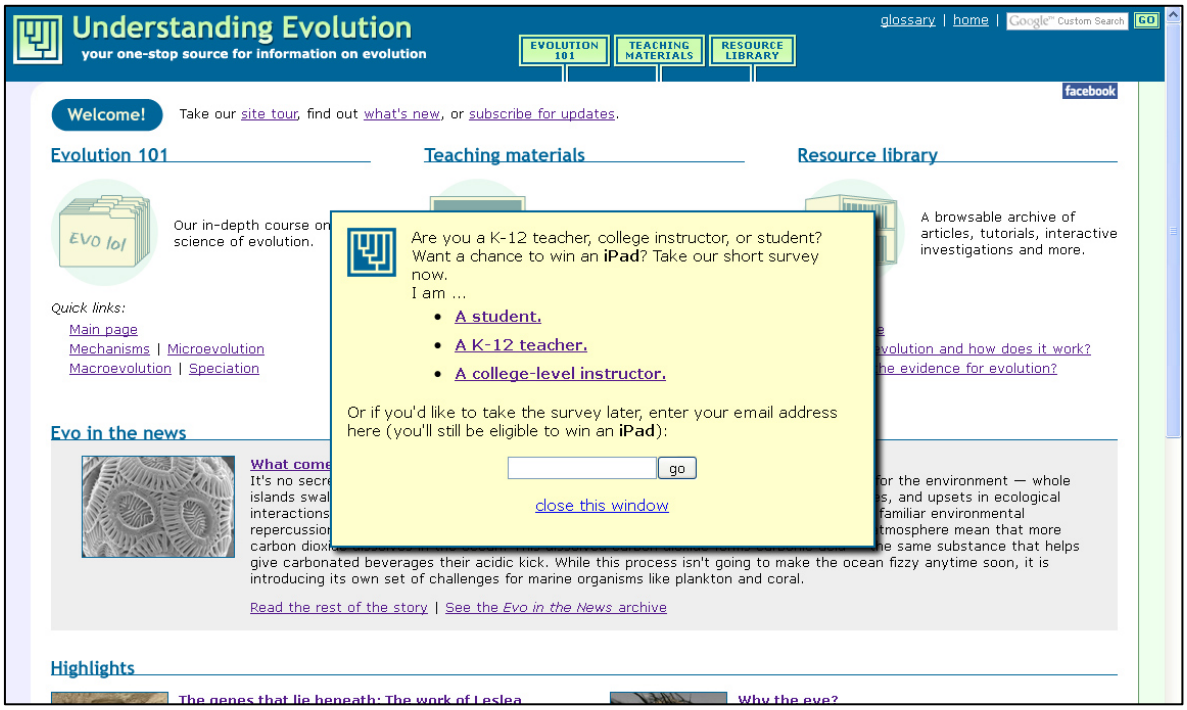
Most online survey participants were recruited using the pop-up window on the UE homepage (see Figure 1). A small percentage of instructors, and their students, were invited to participate in the online survey study and the virtual focus groups from an email sent directly from UCMP. These invited participants were identified via random internet searches seeking introductory instructors of biology from every institutional type (i.e., public universities and colleges, private universities and colleges, community colleges, etc.). Recruitment efforts also included posting information about the study on UCMP-affiliated listservs. Undergraduate instructors who completed the online survey and provided their email addresses were also asked to participate in the online focus groups.

To encourage students and instructors to complete the survey, we entered all participants in a raffle to receive an iPad; we also offered money to focus group participants.

Online Surveys

Evaluators worked with UCMP staff to develop online surveys that measure the main research questions and other related indicators to help understand and improve the impact of the UE site for students and faculty. UCMP hosted the survey on the homepage of the site (Figure 1).

Figure 1. Pop-up survey on Understanding Evolution (UE) homepage



Five versions of the online survey were created for the following participating groups: 1) undergraduate instructors recruited from the UE site via pop-up window, 2) K-12 instructors recruited from the UE site via pop-up window, 3) students recruited from the UE site, 4) students invited to complete the online survey directly from their instructors via email, and 5) undergraduate instructors invited to complete the online survey directly from UCMP. Surveys included scaled items asking instructors and students to report their reasons for visiting the site, how often they visited the site, etc. Only instructors were asked to answer questions about UE's new teaching resources. All student and instructor surveys were created in Qualtrics, which incorporated many customization features such as 'skip logic' and 'survey flow' to ensure that follow up questions were aligned with the responses given. Instructors' survey designs included 'block randomization' so that participants only responded to a random sample of two resources as opposed to all six. Sample questions from the instructor survey included:

1. What are your reasons for visiting the Understanding Evolution website study today? To get...(check all that apply)

- *Content for person information or review*
- *Content that I want my students to read or review*
- *Classroom activities, lessons, or assignments*
- *Images (e.g. to download for a slide presentation)*
- *Resources for incorporating evolution throughout the biology curriculum*
- *Tips for teaching evolution*
- *Information about student misconceptions*
- *Other, please describe*

2. Have you visited the Understanding Evolution website before today?

- *Yes*
- *No*

Sample questions from the student survey included:

1. Has your teacher or instructor ever used resources from Understanding Evolution in class?

- *Yes*
- *No*
- *Unsure*

2. Do you feel that this site is providing you with the information, resources, and features you need?

- *Yes*
- *Somewhat*
- *No*
- *Uncertain*

The pop-up survey was launched in October of 2012. The survey was made available for a period of about 2 weeks.

Focus Groups

Evaluators conducted two focus groups with a selected sample of six teachers who were asked to interweave two of six resources from UE into their biology curriculum over a period of 2 months. These resources included: Evo Connection Slides, Image Library, Active Learning Slides, Journal Club Toolkit, Teaching Materials Database, and the Intro

Bio Syllabus. Instructors participated in a virtual focus group discussion (led by evaluators) during the end of a two-month period. During this discussion, participants reflected on their experiences using two of these resources. During the focus groups, evaluators encouraged participants to talk candidly about their classroom experiences (including what they learned and what surprised them), and to recommend resource improvements. (See Appendix A for the instructor focus group protocol.)

Findings

This section synthesizes the two data sources (online surveys and virtual focus groups) to describe UE site usage and feedback from instructors and students and selected resources reviewed and used by undergraduate instructors. We first present the survey data findings to show who visited the site and completed the survey, reasons for visiting the site, frequency of use, and overall opinion of the website. These findings are then followed by a close examination of six resources available on the site, with summaries of survey and focus group results for each resource.

Online Survey Data - Who Visited UE, How Frequently, and Why?

We collected data from over 3,000 teachers and students. More than 700 records for the entire sample either contained significant amounts of missing data (e.g., respondents completed only one question) or the data were suspect (e.g., answer patterns indicated the respondents did not take the survey seriously). It is also worth noting that overwhelming numbers of first-time users who taught undergraduates or K-12 students did not take the time to learn about the UE resources before answering questions about them. The bulk of missing data came from either students or K-12 and undergraduate instructors who were first time visitors *and* asked to comment on the UE resources. We believe many of these answered questions in order to qualify for the incentive rather than providing informed reactions to the site. After deleting records with significant missing and suspect data, we had a sample of 2,342 responses: 544 undergraduate instructors, 385 K-12 instructors, and 1,413 students; out of the total number of participants, 171 identified as "other." As shown in Table 2, our sample included individuals from every institutional type and all grade levels. Of the 544 undergraduate instructors, 56.7% (N=364) taught introductory biology while 43.3% taught other biology courses and/or other subjects. As summarized in Tables 2 and 3, most of the site visitors who identified as an undergraduate instructor taught at doctorate-granting public universities (27.6%), most K-12 instructors were high school teachers (67.7%), and most student visitors were at the high school level (49.3%).

Table 2. Frequency of website visitors from each institution type

Institution type	f (%)
Undergraduate instructors	N = 544
Doctorate-granting public university	141 (26%)
Doctorate-granting private university	47 (9%)
Public college (4-year)	111 (20%)
Private college (4-year)	74 (14%)
Community, technical, or 2-year college	92 (17%)
Other	79 (15%)

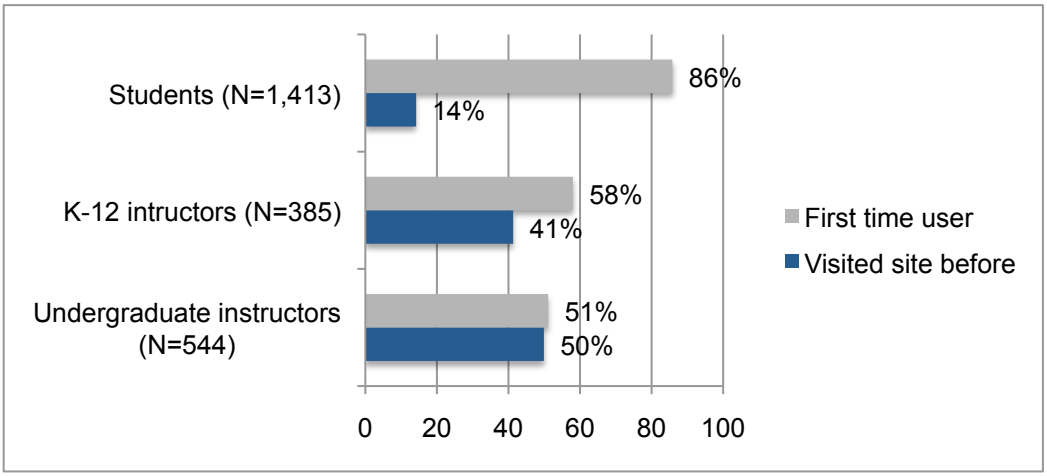
Table 3. Frequency of website visitors by grade level

Grade level	f (%)
K-12 teachers	N = 385
Grades K-2	16 (4%)
Grades 3-5	23 (5%)
Grades 6-8	80 (21%)
High School	241 (63%)
Other	25 (7%)
Students	N = 1,413
Grades K-2	17 (1%)
Grades 3-5	21 (2%)
Grades 6-8	117 (8%)
Grades 9-12	698 (49%)
College/undergraduate	472 (33%)
Graduate school	57 (4%)
Other	31 (2%)

We asked site visitors who were recruited through the pop-up survey to indicate their reasons for visiting the UE site. Among undergraduate instructors, the most common reason for visiting was to obtain classroom activities (41.7%), content for their students to review (38.8%), tips for teaching evolution (33.6%), and content for personal information or review (33.3%). Reasons for visiting were the same for K-12 instructors classroom activities (55.3%), content for students to review (47.2%), tips for teaching evolution (31.8%), and content for personal information or review. Students' main reasons for visiting the site were to find information to complete an assignment (36.3%), to find information for a research project (21.7%), for their own interest (17.6%), and because they were told to go on the site by their instructor to read something (14.1%). See Appendix B for complete list of additional reasons for visiting the UE site.

Eighty-six percent (85.8%) of student participants reported visiting the UE site for the first time when they responded to the pop-up survey. Of those students who had been to the site earlier (14.2%), the most frequent reasons for visiting were to find information to complete an assignment (41.2%), for their own interest (39.3%), and to find information for a research project (32.8%). About half of undergraduate instructor reported visiting the site before (49.9%) while less than half of K-12 instructors reported visiting previously (41.3%). Undergraduate instructors and K-12 teachers used the site for similar reasons: to obtain classroom activities, lessons or assignments, to find content they want their students to read or review, and to get tips for teaching evolution. Table 4 below provides a detailed breakdown of reasons why instructors have previously visited UE.

Figure 2. Frequency of UE Site Visitation: Have you visited the site before today?



1=Yes; 2=No

Table 4. Reasons for previously visiting UE site (Instructors)

Reasons for previous site visit	**Undergraduate Instructors N=269** **f (%)**	**K-12 Teachers N=158** **f (%)**
To get content for personal information or review	143 (53%)	85 (54%)
To get content that I want my students to read or review	162 (60%)	97 (61%)
To get classroom activities, lessons, or assignments	168 (62%)	117 (74%)
To get images (e.g. to download for a slide presentation)	137 (51%)	62 (39%)
To get resources for incorporating evolution throughout the biology curriculum	103 (38%)	86 (54%)
To get tips for teaching evolution	144 (54%)	88 (55%)
To get information about student misconceptions	117 (44%)	64 (40%)
Other reasons	13 (5%)	5 (3%)

Note: Because respondents were able to select multiple reasons, totals exceed 100%.

Most useful resources

We asked instructors who previously visited the site to list what resource was most useful. The most cited resources for both undergraduate and K12 instructors were: teaching materials, Evo 101, Images, and the Resource Library. Table 5 provides a list of the most frequently mentioned resources.

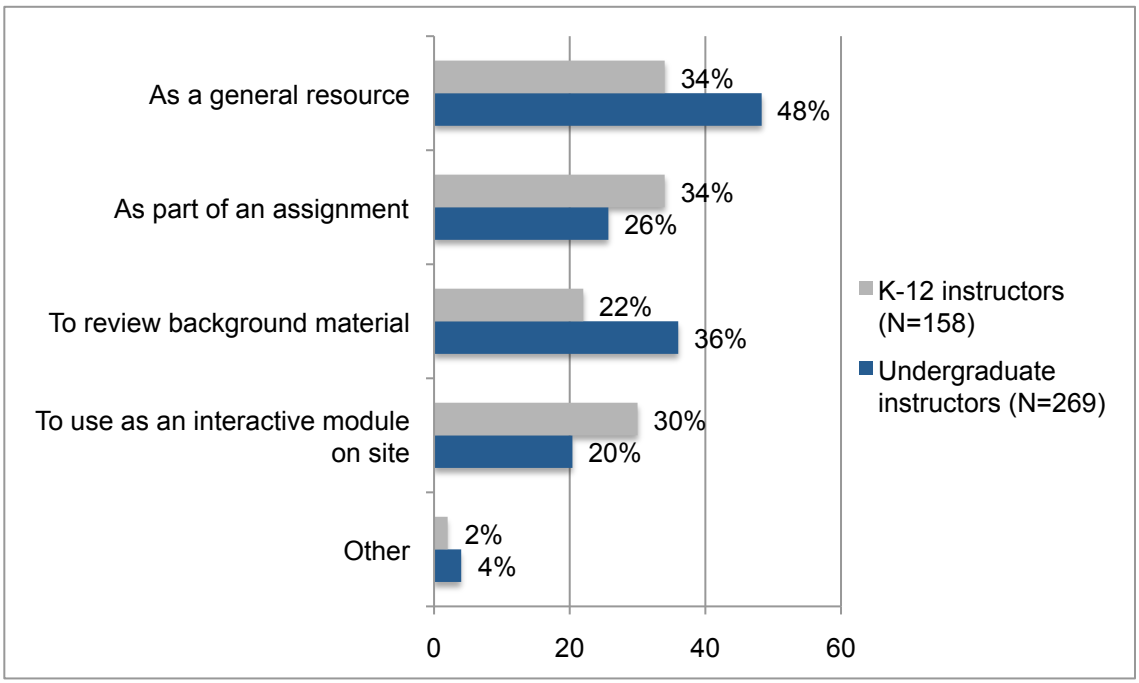
Table 5. Most useful resource for instructors (open-ended responses)

Resource	**Frequency of reference**	
	Undergraduate	**K-12**
Teaching materials	13	8
Evo 101	11	4
Images	9	6
Resource Library	9	4
Evo in the News	7	3
Class activities	6	5
Misconceptions	4	2
Lesson plans	3	3
Cladogram section	4	1
Definition of terms	3	1

Directing students to UE

Sixty-eight percent of undergraduate instructors and 60% of K-12 teachers, who had previously visited the site, reported directing students to the UE site. Most undergraduate instructors directed students to use the site as a general resource and for reviewing background material. K-12 instructors also directed to students to use the site as a resource and for a homework assignment (See Figure 3).

Figure 3. Reasons for directing students to UE site



The following comments by teachers illustrate some of the reasons for directing students to the site as well as teachers' views of the importance of having a sound resource on evolution.

K-12 Instructors:

> *This site is a superb resource for my students. After lessons on evolution I always tell my students to reference this site as a supplemental resource to what I taught.*
>
> *Even though they are Hebrew speakers, I thought the site is especially clear for students.*
>
> *Show resources in class linking to your website.*

Undergraduate Instructors:

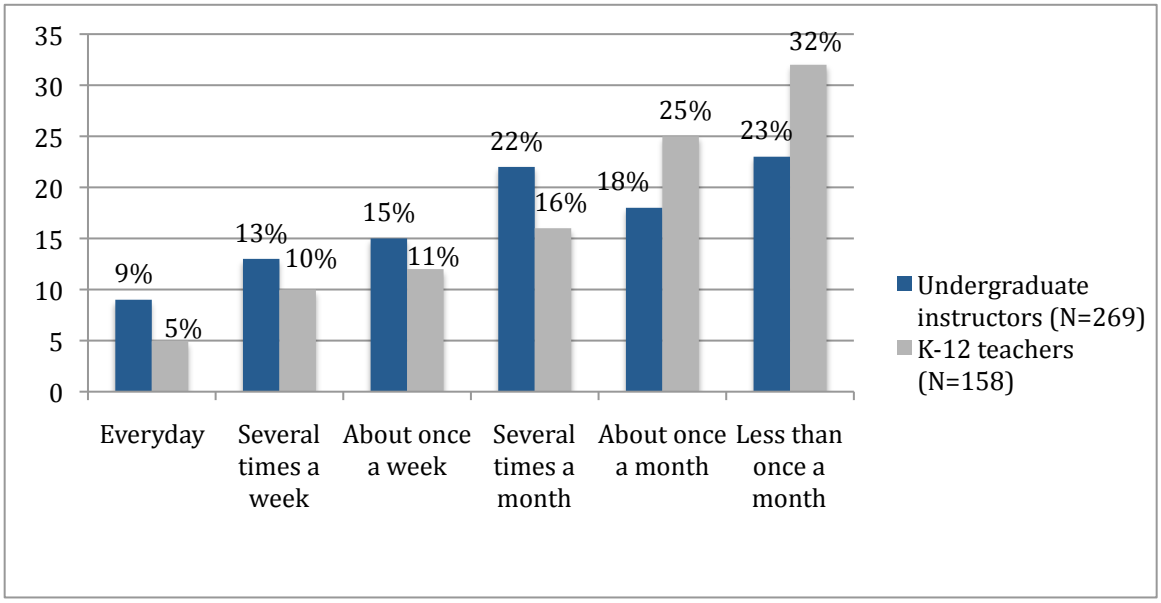
> *Students "googled" and related incorrect information on evolution from other websites. I gave this site as a reliable alternative.*
>
> *To act as an information base for discussions on evolution. Each student delivers a subject as we build a discussion.*
>
> *Pre-service teachers to assist them in developing lesson plans.*
>
> *I train future biology teachers and this is a must have resource in their evolution resource kits.*

There appeared to be an overwhelming consensus that UE is an excellent resource for not just expanding students' knowledge of evolution, but encouraging discussion and assisting in lesson-plan development for teachers.

Frequency of visiting UE

Undergraduate instructors reported visiting the website more than K-12 teachers during an academic year. Most K-12 teachers either visit the site less than once a month (32%), or about once a month (25%). Figure 4 below provides a detailed breakdown of how frequently instructors visit UE.

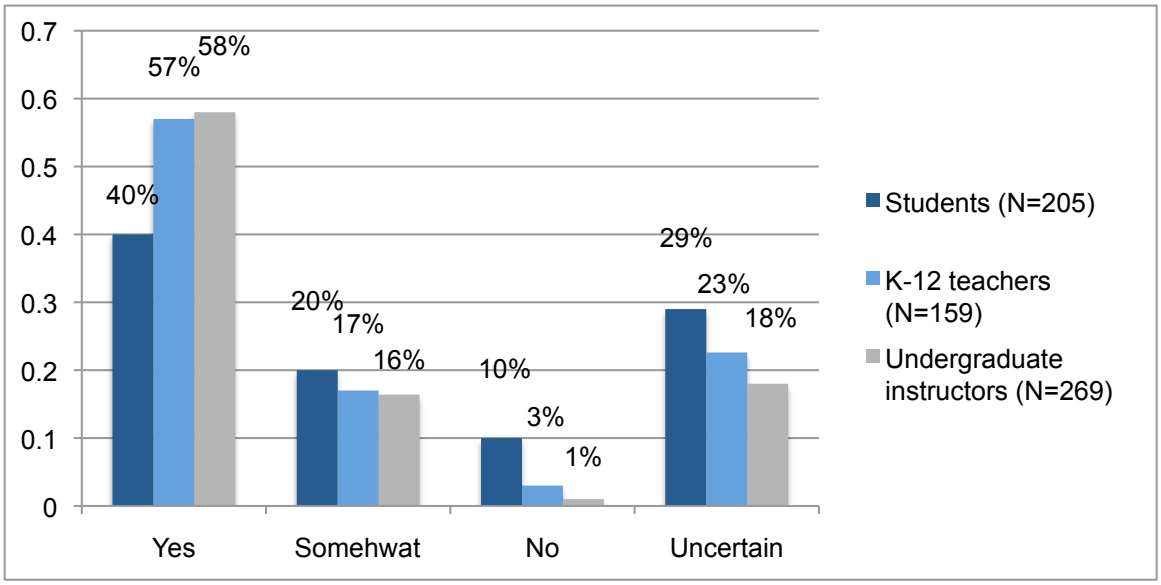
Figure 4. Frequency of visiting UE during academic year



Meeting user's needs

We examined whether the site was providing teachers and students with what they needed. This particular item analysis did not include any of the first time users. All site users who had previous UE experience, both students and instructors, overwhelmingly felt that the site was providing them with the information, resources, and features they needed (see Table 6). Very few students and instructors felt that the site did not provide what they needed.

Figure 5. Is the UE site providing you with the information, resources, and features you need? (Previous site visitors)



Participants who did not answer “Yes” to this item were prompted with a follow-up, open-ended question: What information, resources, or features would you expect to find on this site that you did not? (See Appendix C for complete list of open-ended responses.) Undergraduate instructors were expecting to find more classroom (upper-level) lab activities, more complete packages of resources organized by topic, specific content information, updated website design and features, and more interactive material to incorporate into the classroom. The following responses illustrate these points:

Two instructors hoped for a "topic-in-a-box" package as a resource, expecting to find multiple resources and materials for one specific topic to incorporate into their classrooms.

> *HHMI (Howard Hughes Medical Institute) has a complete package on Natural Selection that is IDEAL 1) a short film clip about Rock Pocket Mice current research that takes place in the field (outside!!) 2) excellent worksheets for students to use in conjunction with the short film clip 3) also, excellent background source material for instructors! The reason I find this "package" so complete and appealing is twofold. First, it is EASY to use and second, it is like a "topic-in-a-box." Ready to go and completed answer sheets and all supporting materials for an instructor.*
>
> *I would like more upper-level lab activities for undergrads, but not simulations. This is my first time teaching Evolution for majors in biology, so I'm developing labs for the course. I need detailed description about what materials are needed, how to use the programs, etc. I've been using live animals for some labs (bacteria and*

*flies). There should be links to other activities such as those published in *Bioscene* and *Journal of College Biology Teaching*. There are already a lot of simulations online. I'm looking for a good lab in which students download molecular data and reconstruct phylogenies by following directions. I'd like them to subsequently map a character on the phylogeny. Most phylogeny methods labs that I've found assume that you have materials like skulls or can do PCR. I don't have a budget for these.*

One instructor sought content-specific information:

I am looking for information/resources regarding the relationships between "environmental phenotypes" in biosystems/ecosystems and their associated phylogenetic information (if any) to gain a better grasps on how industrial processes contribute, or not, in the ongoing genetic phenomena we can see in our world. I'm hoping I can also find information regarding the kinetics of gene transfers mechanisms in the environment by bacteria/viruses/vectors/mRNA-carrying-systems.

I was especially interested in information regarding the life strategies of Prokaryote and Eukaryote in the evolutionary context, e.g. the two types of cells representing different strategies for dealing with the environment.

How about a page dedicated to "transitional fossils" - pics and info - for any taxonomic category a user selects

Other information undergraduate instructors expected to find were more videos, interactive materials, images, and a more modern layout and design.

K-12 teachers expected to find activity worksheets, alignment of lesson plan materials, images, and more visuals in general. A few K-12 teachers were also expecting more age-appropriate material, with one respondent just stating "8th grade" and another stating, "It's too high level."

Students' responses on what they expected to find on the site were mixed. Some wanted simpler presentations and explanations of topics:

Blunt answers

Clearer explanations, better site navigation

Information easy to comprehend

More straightforward definitions

Some topics are too hard to understand the way they are explained

Something more suited to my level

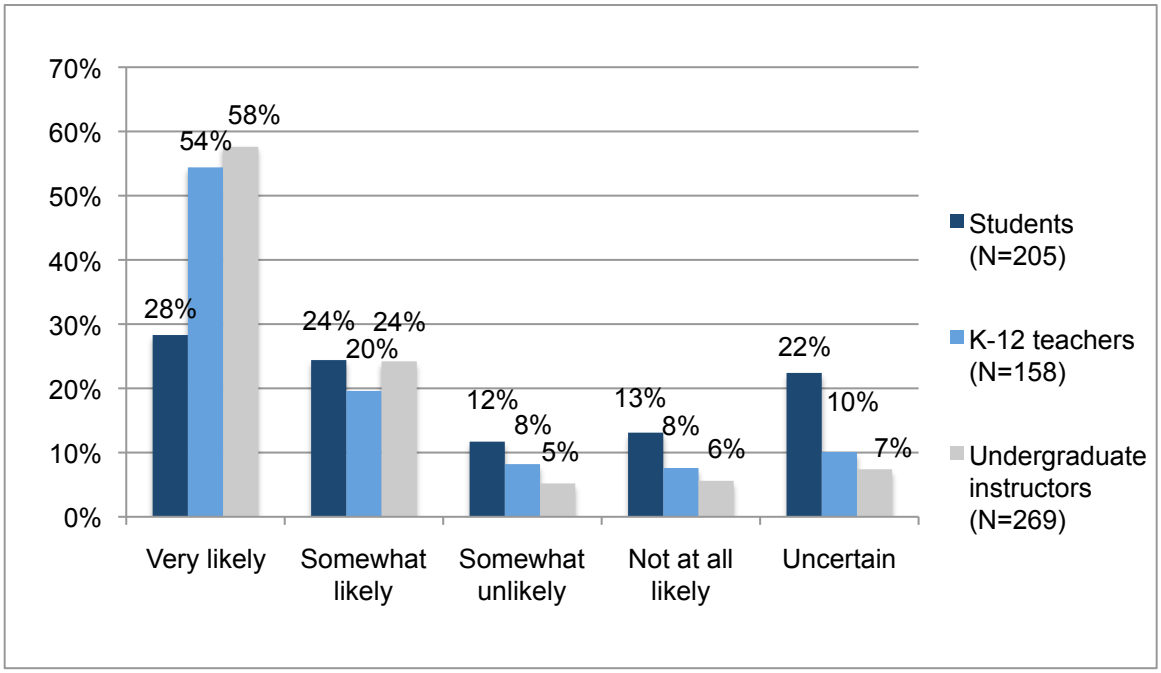
Others expressed a need for more detailed and elaborate explanations of topics:

> *I needed more in depth details than what were provided*
>
> *It's informative, but I need a website that has more hardcore facts as opposed to basic/introductory evolution ideas.*
>
> *I'd like more advanced information. It may just be that I haven't had a lot of time to look around but most seems pretty basic.*
>
> *More detailed information.*

Likelihood of Returning

More than half of undergraduate instructors (58%) and K-12 instructors (54%) who had previously visited the site say they are very likely to return to it (Figure 6). More than half of student visitors reported that they are either very likely (28%) or somewhat likely (24%) to visit the site again. Students who were "somewhat unlikely" or "not at all likely" to return indicated that they did not have a reason to do so. "Unless my teacher tells me to revisit it, mostly likely not," wrote one student; another student responded, "Not unless I have another essay on the theory of evolution." A few students mentioned not believing in evolution as a reason to not return to the site.

Figure 6. How likely are you to return to this website?



For educators who were either “very likely” or “somewhat likely” to return to the site, the most frequently reported features that influenced their decision to use the site in the future are summarized in Table 6. Classroom activities, content for students, and images were the top features would influence instructors' decisions to return to the UE site in the future (Table 6).

Table 6. What features influenced your decision to use this site in the future? (Previous users - Instructors)

Features	Undergraduate Instructors N=257 f (%)	K-12 Teachers N=149 f (%)
Classroom activities, lessons, or assignments	109 (41%)	61 (39%)
Content that I want my students to read or review	106 (39%)	56 (36%)
Images (e.g. to download for a slide presentation)	88 (33%)	41 (26%)
Tips for teaching evolution	86 (32%)	40 (25%)
Content for personal information or review	81 (30%)	43 (27%)
Resources for incorporating evolution throughout the biology curriculum	70 (26%)	41 (26%)
Information about student misconceptions	63 (23%)	29 (18%)
Other reasons	8 (3%)	3 (2%)

Note: Because respondents were able to select multiple features, totals exceed 100%.

For students, useful information on the site (32%) and information to help with future projects and assignments (30.6%) were the top reasons to use the site in the future (Table 7). Appendix E reports a complete list of other reasons influencing students and instructors decision to return to the UE site).

Table 7. What features influenced your decision to use this site in the future? (Previous users - Students)

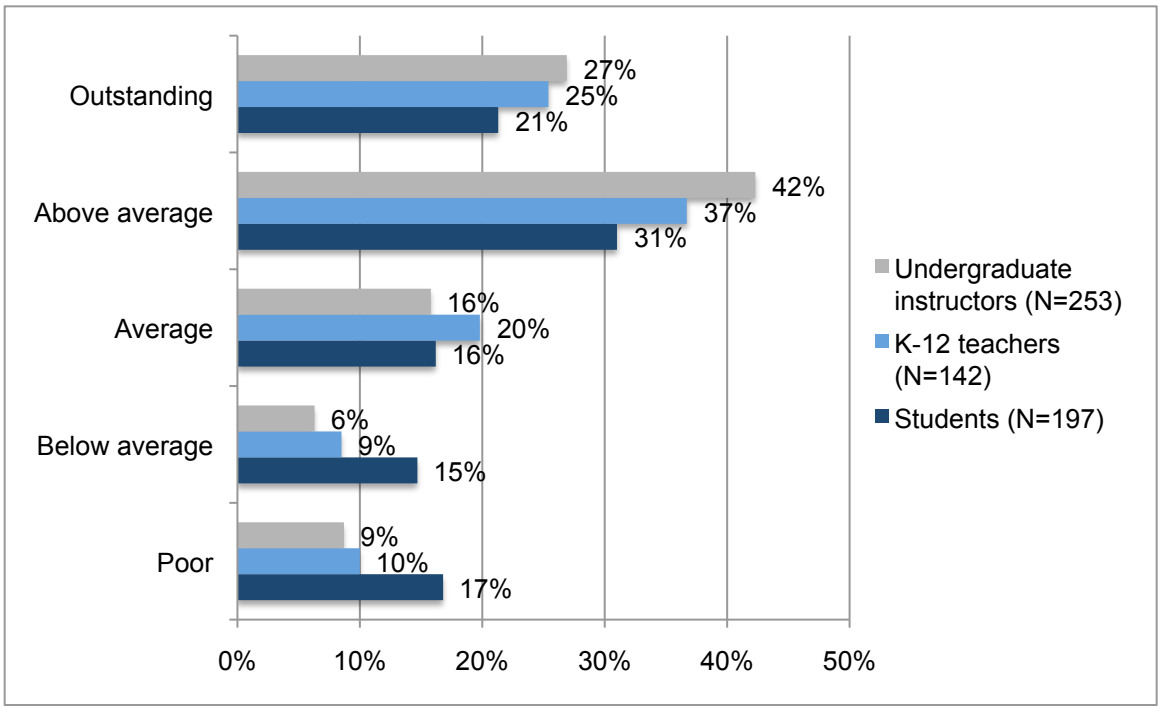
Features	Students (N=134) f (%)
The site has useful information	43 (32%)
I will need the site for future research projects and assignments	41 (31%)
The site has easy-to-understand explanations	30 (22%)
The site is fun and interesting	25 (19%)
My teacher/instructor is likely to send me to the site again	23 (17%)
Other	13 (10%)

Note: Because respondents were able to select multiple features, totals exceed 100%.

As Figure 7 illustrates, participants expressed an overall positive response to the design, organization and navigation of the site, with the majority of ratings from all groups being "outstanding" or "above average." Respondents who rated the site as average, below average, or poor were asked to explain why they rated the UE site in that way, and to include any problems they had with the site. Instructors and students collectively had problems in the following areas:

- Difficult to navigate, hard to find content or information site visitors were looking for (e.g. too many clicks, inconsistent links and sidebars that do not feel connected, feeling lost)
- Outdated layout
- Size of font is too small, and dissimilar fonts and formats throughout the site
- Web pages contain too much information and text
- Website is not student friendly, not that user friendly
- Does not contain culturally diverse images (i.e., "too white")
- Not enough media, graphics, and images
- Bland color scheme

Figure 7. How would you rate the design, organization, and navigation of the site?



Understanding Evolution (UE) Resources

This section synthesizes focus group findings and survey findings in an effort to examine instructors' experiences with six UE resources: Evo Connection Slides, the Intro Bio Syllabus, the Image Library, Active Learning Slides, the Teaching Materials Database, and the Journal Club Toolkit. We asked undergraduate instructors to respond to the six resources, with each assessing two of them. Using the block randomization feature in Qualtrics, participants were randomly assigned two of the six. K-12 instructors were prompted to only respond to the Teaching Materials Database and the Image Library. Faculty members were assigned resources to incorporate into their teaching. Some faculty had to be re-assigned specific resources because a few of them required significant planning and more time to use than the faculty were willing to give (e.g., Journal Club Toolkit).

Two, one-hour long, online focus groups were led from the Rockman office in San Francisco, with three participants per group. Participants included undergraduate instructors of introductory biology from a community college in New York City, a public university in Las Vegas, Nevada, a public university in North Carolina, a private college in Worcester, Massachusetts, a community college in Aptos, California, and a university in India. Participants consisted of four men and two women; five were Caucasian while one was of Indian decent. Each group was digitally recorded via YouTube, and hosted by Google Plus Hangout. Five questions were used as guides for focus group discussions (See Appendix A for the complete protocol).

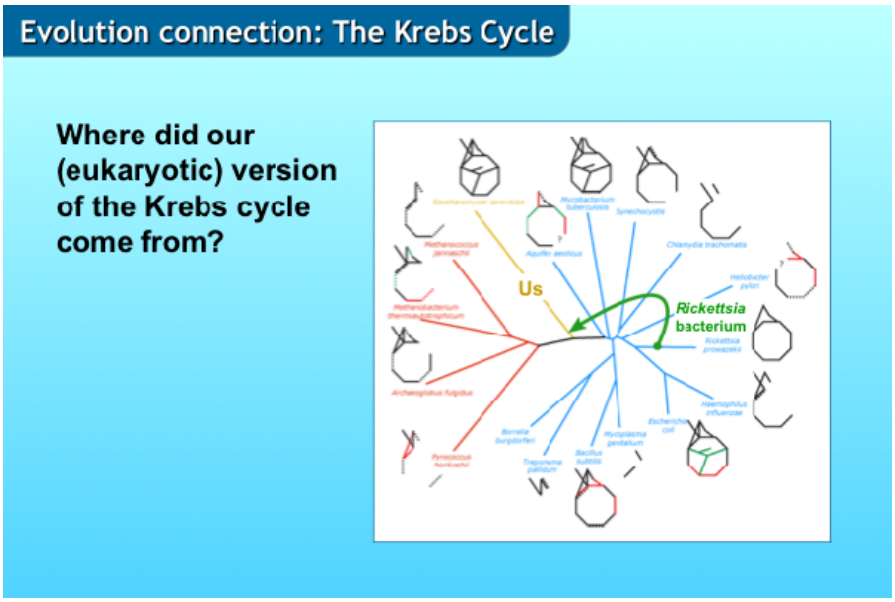
- Did anything strike you right away (either positively or negatively)?
- What are some of the things that you liked about this resource? Why?
- What are some of the things that you would change? Why would you change them?
- For those of you who incorporated this resource into your class, how did it go? Reactions from students? Challenges using this resource?
- Would you use this resource with your classes in the future? If not, what would encourage you to use this resource?

Each participant was originally assigned two resources to incorporate into their class lessons. However due to the difficulty many instructors had with making changes to an already-exiting curriculum scope and sequence, many ended up using whatever resources aligned best with their lesson.

The following sections are organized by resource.

Evo Connection Slides

Figure 8. Image from Online Survey - Evo Connection Slides



Very few undergraduate instructors surveyed reported using the Evo Connection Slides, but were enthusiastic about learning more about them nonetheless (See Appendix D; Table 1). Participants overwhelmingly believed that making connections to evolution is an important teaching goal. Most instructors who used the slides agreed that this resource would help improve instruction and student learning, and reported being satisfied with the format and content of this resource (See Appendix D; Table 2). Overall, undergraduate instructors praised the slides, and the ease of modifying them to suit their teaching needs, but expressed concerns with the content (e.g., too advanced for their students; too general for their students). Instructors who would not use this resource were reluctant to use pre-made slides, and felt that they needed more time to review the slides before deciding to use them. Some also felt that using the slides would be too time consuming, and that it would not help them accomplish their teaching goals. Survey respondents who used the slides found them appealing because they are easy to incorporate into lectures and are an effective teaching tool.

Similar to survey respondents, focus group participants reported satisfaction and ease with incorporating the Evo Connection Slides into their classrooms. Specifically, using the slides helped participants generate new discussion topics to present to their students. Furthermore, instructors expressed the need to modify and customize all resources that they use so that it aligned with what topic they are teaching and their students learning level; the need to modify was not mentioned as a downside to using the slides however. As noted by a respondent:

Positives for me are ideas and questions and discussions. I don't use the slides per se though because I always have to modify everything that I use. In fact, I'm astounded that I'm not adding that much to the website per se in the Darwinism medicine course. But usually when I use a teaching resource like a slide or an animation I usually modify it to suit my audience or the objectives I want. So for me they were mostly suggestions and ways to get the images that it would take me a long time to draw to get students talking about the topics or use as a study guide.

I used the actual slides and then I've taken points from them and them I've also just taken screenshots from the website and assigned the students to read the material.

Similarly, another respondent used this resource and modified the slides to suit her classroom:

I used some of them but I used them in a variety of different ways. I didn't use the exact slides. I actually take points from the slides or images from the slides for discussion points in both courses. The slides I could actually use to review as a study guide or even part of their quizzes.

One participant did not have to make any adjustments to the slides, but felt that the topic of the slides could have been more focused and less general. This participant also mentioned the need to make additions to the Evo slides, or customize them to fit the particular topic he was teaching.

The slides for the non-major's biology course are perfect. They are perfect for my audience there and the topic and the presentation of the information is just right for that audience. For microbiology I would like to see more microbiology-based topics. Speciation in microbiology is not well defined. It's kind of messy. Most of the examples in the tree section on the website deal with plants and animals that everyone knows about. That's appropriate for a general audience but for microbiology, since I don't have examples with micro-organisms I just have to create those for myself.

Some of the negatives about using Evo Connection Slides were related to the definitions of topics being too limited, and the information on the slides reading too much like a textbook. One respondent reported that her students compared the slides and website in general to a textbook, and that UE should consider making it more interactive and less like a resource similar to what students already use:

I would say the only negative is that students would say, "Why did you have us buy a textbook? Now you're having us look at this (slides) and the website..." But maybe that's not your issue. This resource and the site in general is very text heavy.

Even the images are similar to those from a textbook. Maybe you can make it more interactive and make use of new technology.

When asked how students reacted to this resource, the two participants that used the resource reported that they responded well to the slides and to the website in general.

I think my students rated it really positively. They also really loved the website. These are website kids. That's what they want to do. They felt it was really great.

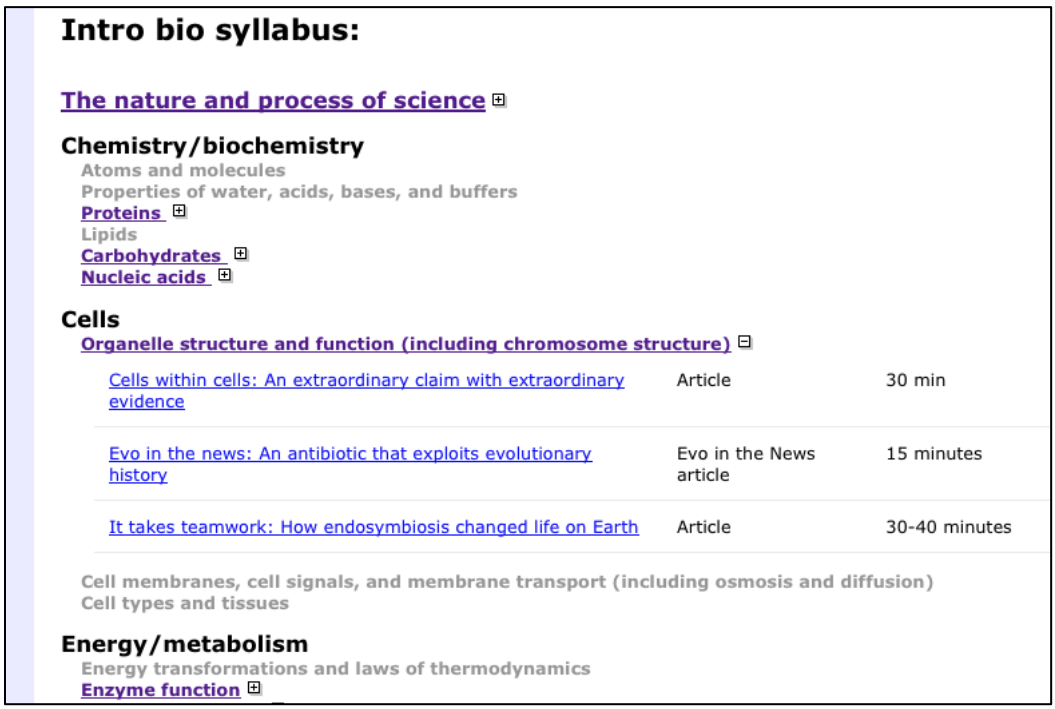
They reacted very positively and I refer them to the website as well to go back and review material. They, again, so much of the other comments was why do we need a textbook for this topic? Because the topic was so well covered on the website and it was covered at a depth that was easy for them to understand.

This resource may also be better suited for upper division biology courses. One undergraduate instructor responded to an open-ended survey item on how to improve the Evo Slides: "You need more slides that align with the topic of an intro bio class. They aren't general enough."

Intro Bio Syllabus

Reactions to the Intro Bio Syllabus were mixed. Survey data showed that most undergraduate instructors did not use this resource, nor were they familiar with it, but were interested in learning more about it (See Appendix D; Table 3). Just half of respondents reported being satisfied with this resource, while slightly more than half felt that the Syllabus would improve student learning and instruction (Appendix D; Table 4). Discovering new teaching tools and the desire to make connections to evolution were the top most appealing aspects of this resource, with students' abilities' to find the evolution connections interesting being the least appealing (see Appendix D; Figure 1).

Figure 9. Image from online survey - Intro Bio Syllabus



Focus group participants praised the Intro Bio Syllabus for its images and vast selection of topics. When asked about their experience using this resource, one participant stated:

> *That was the resource I used the most in my class. I used it in my introductory course for diagrams, pictures and all those things. My students' comments about the Syllabus were that it was better than their textbooks.*

Another participant appreciated the subject matter and sequences the Syllabus offered:

> *I used the papers; I liked that. It's a good standard syllabus. It has a good range of topics for what I teach, similar to what we see. I will also use it more next fall. What I really like about it is that we have here two sequences. One is the cell biology sequence and one is evolution and diversity. I'm actually trying to talk to people that teach the second semester or cell biology because I think you have so many good links for them to go back and review what they've learned in that first semester and relate it to the material they're learning now. It's just fantastic that way.*

Two participants noted that if they had more time to plan their lessons more they would have incorporated this resource into their classes. One instructor commented:

I looked at it a great deal and thought it was awesome. It's something I would probably use in the future if I had planned it at the very beginning.

The same instructor noted his experience incorporating the syllabus into his class and the difficulties with making drastic changes to his existing curriculum.

Most of the topics I had already covered so I didn't change my own syllabus at all. I would use this syllabus more. It seems like a valuable resource to use for a longer period of time. You know when you're teaching four classes it can be difficult to take on a full revamp in the middle of the semester. So this was actually very easy for me to slot into my teaching. I think next time I use this it will be for my plant biology class. For example there was the work of Chelsea Specht, which looked really interesting to me. I did find the resource interesting and I think it would be useful to incorporate into my plant biology course where I can set the pace myself.

Another instructor offered ways to improve the UE site by providing links from the Syllabus (and other resources) to the main UE site (i.e., intra-site links to areas of the site with parallel content), and making the site more interactive so that instructors could share what they modified in the Syllabus. The following responses illustrate these suggestions:

- Providing links from resources to parallel content on entire UE site

I'm just thinking back and looking back at my notes on when I was taking the crickets case and trying to make it into something that I was going to use in class. I ended up writing a series of follow up clicker questions that didn't, I think, match or parallel very well to the discussion questions that were given in the case. I glanced at those, realized they weren't the direction I was going to take the material and went someplace else with it. So it might be nice to get some instructor feedback about where these cases can really take us in specific directions. So in that particular case I was really trying to get feed back about sexual selection and animal behavior because that's where I plugged in this particular content. So it might be nice to have, I could provide that resource back to Understanding Evolution and it can be a parallel to slides that someone can download if they wanted that extra resource.

- Sharing ways to modify resources

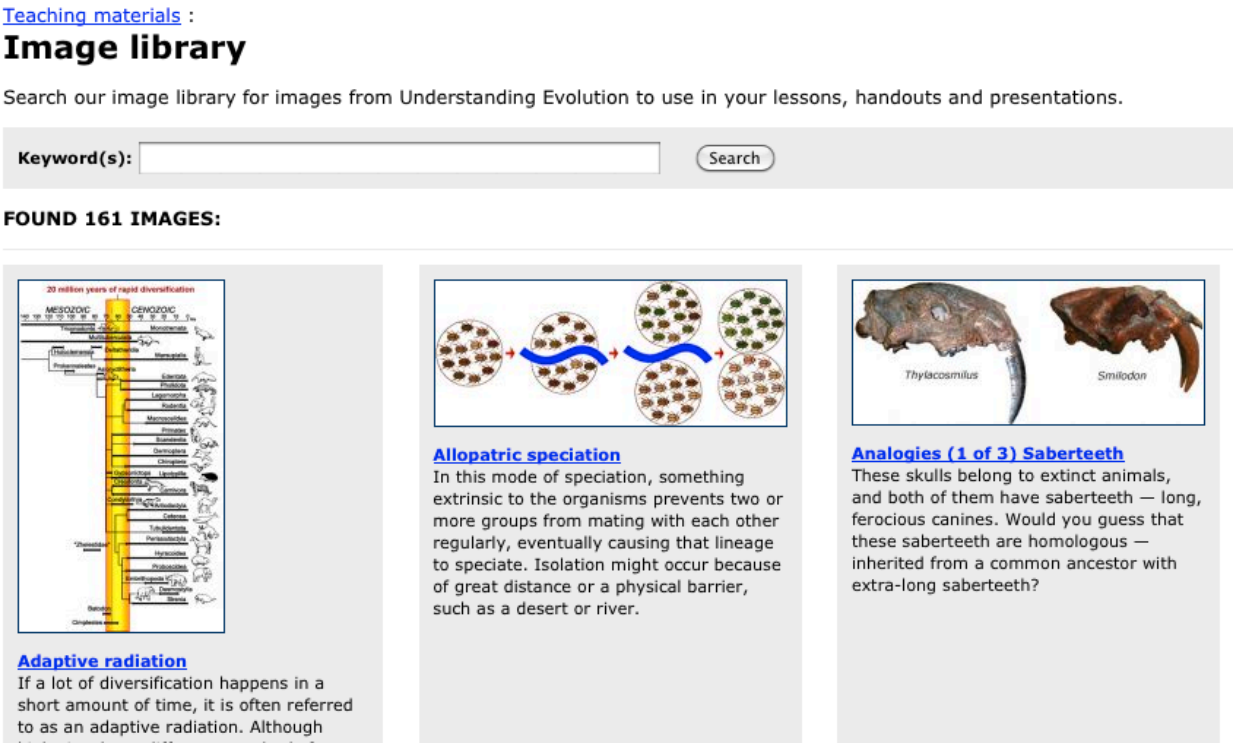
The fantastic thing about the archive is we can access resources that can be modified. I agree, my students are really disconcerted if the storyline of the slides or the material is different than the angle that the book material, the chapter takes. I think we have to modify the material in order to make it comfortable and relevant to our students. It would be useful to have the option to share those modifications too and maybe keep track of who did the modifications. Then faculty who use the

material can get to know each other and figure out, oh yes, I teach a class like her class. So if she modifies it that's useful to me. That would be really useful.

Focus group participants indicated that the resource was useful, receiving a positive response from students, but they did not have enough time to incorporate it. They felt that using this resource would require drastic changes to pre-existing syllabi, but were interested in the various ways that other instructors have modified this it successfully.

Image Library

Figure 10. Image from online survey - Image Library



K-12 and undergraduate instructors were overwhelmingly positive, and enthusiastic about the Image Library and its influence on instruction and student learning. Close to a quarter of both groups reported using this resource in the past, with most participants being familiar with it or interested in learning more about it (Appendix D; Table 5).

Undergraduate instructors tended to use the Image Library slightly more than K-12 teachers, while K-12 instructors were slightly more satisfied with it. K-12 teachers and faculty both agreed that it would improve instruction and student learning. While both groups reported being satisfied with the format and content of this resource, K-12 teachers were slightly more satisfied (see Appendix D; Table 6). Visually appealing graphics is what both K-12 and undergraduate instructors appreciated most about the Image Library, and the fact that it is easy to use. They also valued that students will find the

graphics interesting and they will, in turn, help them understand difficult concepts (see Appendix D; Figure 2).

Few K-12 teachers and undergraduate instructors were reluctant to use the Image Library. When asked what would prevent them from using it, some of the reasons listed as "other" were that they already had effective ways to make connections to evolution from different topics in biology. Hence, it is possible the limitations of the Image Library had less to do with the resource itself, but more with instructors already having images and graphics they needed. In addition, some K-12 and undergraduate instructors felt that the graphics would not help students understand difficult concepts.

Focus group participants were overwhelmingly positive about the Image Library. Many instructors praised the amount of images available, the ease of downloading them, and their relevancy to so many areas of evolution:

> *There was such a wide range of images, across so many topics both general and not so general. They were also easy to download. I would have used more images if I had more time to look through them all. My students love seeing images. It in all honesty livens up the topic that I'm covering a bit.*

Two participants noted that this was the only resource that they did not have to modify:

> *I have to modify almost everything I use. Even if I'm using a textbook I'll say read this part and focus on that part. I think that's just part of being a teacher. The fact that I didn't have to do anything with these images was nice. Teachers in general like having alternatives and options and flexibility. Most of these resources, how we all use them will vary from teacher to teacher. But these images, in my opinion, didn't require any modifying.*
>
> *Just downloaded them and fit them in as is. I didn't need to do anything else...and I typically make changes to all outside resources I try and incorporate into a lesson. Even if teachers choose not to use them or if they don't fit just knowing that this library exists is great.*

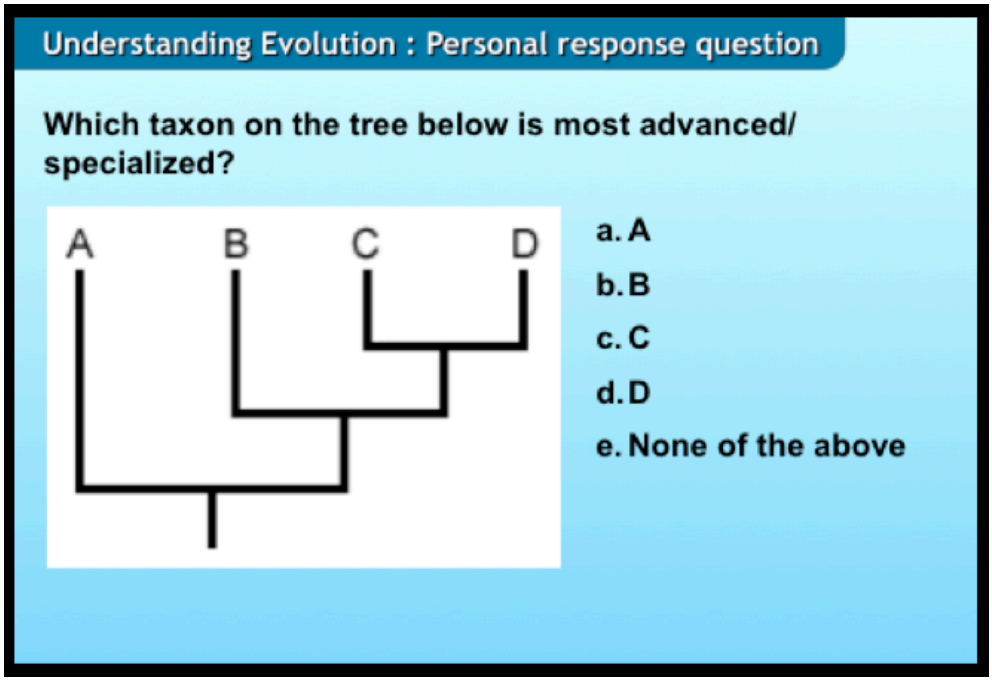
When asked how this resource could be improved, participants had very few suggestions, indicating their overall satisfaction with this resource. The few ideas given were related to the quality of the images, and the number of images available. The participants stated:

> *A few images I downloaded were not high-resolution images. They could be a bit clearer. I use a large projection screen and they looked a bit blurry.*
>
> *The images look somewhat low quality...like images I could produce myself. Not that they weren't great and useful, I just think they could be improved.*

I would like to see more images, maybe separated into two categories: more general topics for an intro class and more advanced for upper division courses

Active Learning Slides

Figure 11. Image from online survey - Active Learning Slides



Undergraduate instructors found the Active Learning Slides appealing because they are easy to incorporate into lectures (See Appendix D; Figure 3). On the other hand, participants were not very satisfied with their content and organization and unclear as to how the slides would benefit students (Appendix D; Table 8). Fewer than half undergraduate instructors who responded to this resource reported using the Active Learning Slides, while most expressed interest in learning about them (Appendix D; Table 7).

The majority of undergraduate instructors who used this resource would use it again in the future. Open-ended responses on how to improve this resource referred to the font size, limited number of examples, and questions on how it can be used.

Participants who have not used the Active Learning Slides but were interested in them reported that they probably would use this resource in their classroom. Those who stated that they would *not* use this resource in their classroom were asked what about this resource makes it unappealing; the main two reason reported by undergraduate instructors was that “the slides are not on topics that (they) teach” and reasons listed as "other," such as:

The content seems questionable

I'm limited to just one week of online materials in general biology

They would all need to be translated (My students and I speak Italian)

I'm not sure they are appropriate for my intro class

Two focus group participants were able to incorporate the active learning slides into their lessons. One described his experience using the slides by customizing them to fit his own teaching style; he began by first describing the process of locating the slides and his overall opinion of the UE site:

> *I was able to incorporate the active learning slides. I must say though, my first initial experience with the website was utter confusion. I went through it and I couldn't anything. I know you gave me the link but I thought that I could just find them. I thought Evolution 101 was a good introduction to the instructor as far as where the slides were, before actually looking at the slides.*

This comment illustrates a problem that many UE site users (who do not receive the direct link to this resource) may face when attempting to search for slides. He then elaborates on his experience using the slides, including a unique strategy he developed to encourage discussion and active learning. His experience also illustrates the uncertainty that many had of how to use them:

> *I used the active learning activities during their three-hour class and that includes their lecture manual, which has similar questions in it based on what's your topic. We don't typically talk about evolution in the beginning, so I've tried to squeeze in the slides. I gave them some examples that I might normally use and then I went through questions with them. I did them three at a time. So I would do the first slide, give them a minute and a half to answer and then go to the second slide and give them a minute and a half to answer, and then go to the third slide. Then we would gather the class and discuss their answers as a class. The reason I did it that way is that's just how I normally implement any activity in the class, where they do a lot of group discussion after answering questions. I did notice further on, even though I didn't get to the end of the active learning slides, that a lot of that covered content that we just don't cover in this non-majors class. I had to get creative too because I just wasn't clear on how to use them. ...there weren't instructions or any explanations about their usefulness or effectiveness.*

The same instructor praised how easy it was add them to a lesson.

> *I liked the slides. I thought they were done well. I mean I just inserted them into my PowerPoint presentation so there was a clear division of what the lecture was and what the actual questions were. I don't normally do that. I just normally use a*

lecture manual that has the questions in it, but I liked the idea of having the questions incorporated into the PowerPoint presentation.

Similar to the previous comment, another instructor also liked the slides being in PowerPoint format, making them easy to modify.

I liked that they were in a PowerPoint format so I could edit them to match the format of the way I ask clicker questions. I'm using a concept called Retrieval Practice right now in my class where students come in at the beginning and I ask them a series of questions just to get them thinking again about the concepts because presumably they just came in from chemistry or somewhere else and they're not in biology mode. So I was able to re-label the slides and make them match really nicely into this format I was already using but keep the format that you guys had in terms of having the logo and all of that branding on there as well.

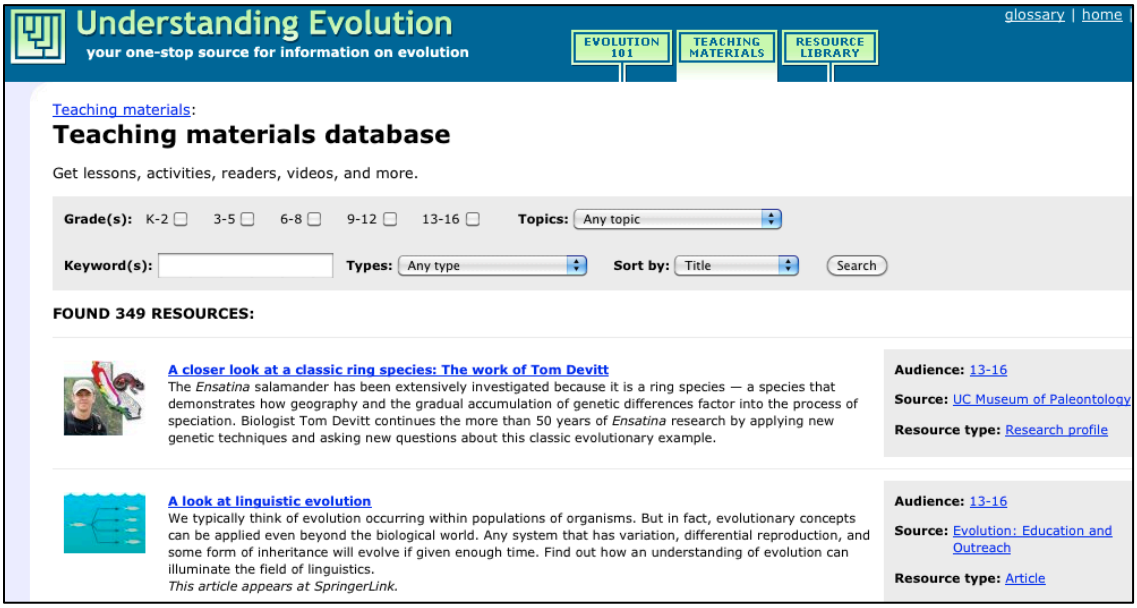
This same participant commented on how students responded to the slides.

I don't think my students perceived them as different than the usual slides that I ask. I didn't ask them afterwards what did you think about this question versus another one. They didn't do as well on these questions as they do on questions where I've really focused on material in the class. I kind of asked them out of the blue. I didn't set it up so that we would really be focusing in on this particular idea. I to see how were they getting this general concept without me coaching it in any way. So they didn't do as well as I wanted but it was nice because I like those questions where you have three answers and they all kind of got about the same proportion of right answers and then we could really talk about why are some of these the right way to think and the wrong way to think about this problem.

Teaching Materials Database

The Teaching Materials Database was the most used, and most praised, resource for both undergraduate and K-12 instructors. Both groups reported being very interested in finding new teaching tools and found it easy to search for materials that matched their needs; the least appealing feature among survey respondents was that students may not find the resources on the database interesting (see Appendix D; Figure 4). Most K-12 teachers and undergraduate instructors who answered items about the TMD had not used this particular resource but were interested in learning more about it (See Appendix D; Table 9).

Figure 12. Image from online survey - Teaching Materials Database



K-12 teachers tended to use the Teaching Materials Database slightly more than undergraduate instructors. Both groups agreed that this resource would improve instruction; more K-12 teachers felt that the Teaching Materials Database would improve student learning compared to undergraduate instructors. While both groups reported being satisfied with the format of this resource, K-12 teachers were slightly more satisfied (Appendix D; Table 10).

The majority of K-12 and undergraduate instructors who had used this resource would use it again. A few faculty commented on the level of difficulty of the lessons on the Database; others suggested how to expand the database by adding more content:

> *I need additional activities for upper-level (junior, senior) college courses*
>
> *Last time I used this resource, much of the material was simpler than my students needed, but it looks like you have some higher-level material now. Maybe too high for my students*
>
> *More modules on more than natural selection*
>
> *More "clicker" activities and a wider variety in general*

Comments made by K-12 teachers focused on the layout, organization, and navigation of the Database and site overall, as well as the limited number of lessons available.

> *I would like to see clearer linkages between the organization of the Teaching Material Database and the conceptual framework offered by the website.*

Nonetheless, the way it is currently organized is already very user-friendly (e.g., the title, audience, source and resource type into points.

I'd like to see more upper level lab or phylogeny-building activities for biology majors taking evolution.

More aligned and topic specific

More categories and better organization. Sometimes it's difficult to navigate, classify by lab, like microevolution versus macroevolution.

There are so many options out there. The internet is a rich source of teaching materials. Your supply of lessons is very limited and some are disorganized.

Participants who stated that they would not use this resource in their classroom indicated that the resource is not on topics that (they) teach. Participants who have not used this resource, and were not interested in using the TMD, felt that they did not need additional teaching tools or pedagogical strategies.

During one focus group, in response to a question that asked what they liked most about the TMD, two instructors who used this resource noted the ability to read examples of actual classroom activities and the opportunity to give feedback. They also wanted an option to read comments from other instructors.

I really like how it gave actual classroom activities and lab activities, not just theoretical ones but a step-by-step guide on what to do and what materials to use.

Sharing feedback among instructors would be great. I like the option to be able to comment. I would also like to read about instructors' experiences. Maybe if it were more interactive in that way.

I'd like to hear about the positives and negatives from other teachers who've used some of these materials and lessons in their classes.

Both respondents praised the organization of the Teaching Materials Database and its ease of use, as explained by an instructor who developed a successful strategy for using the Database and found that the sidebars were its most effective component.

The sidebars and the way the database is organized and labeled is extremely useful for pulling up or weeding out information that would benefit me and my class. I really like how the material is organized by grade level and resource type. It's all easy to find.

Additional evidence of the potential value and usefulness of the TMD is provided in comments made about the Database being a new type of resource.

What I liked about the database was that I had no idea it was out there. What I found was just wanting to go back and read everything, for my enjoyment and to see how these resources might fit.

This is a resource I would definitely share with my colleagues.

The desire to quickly apply information from the database to a specific or upcoming lesson was also mentioned. Although the Teaching Materials Database provided a variety of searching indexes, one instructor mentioned wanted to search by topic:

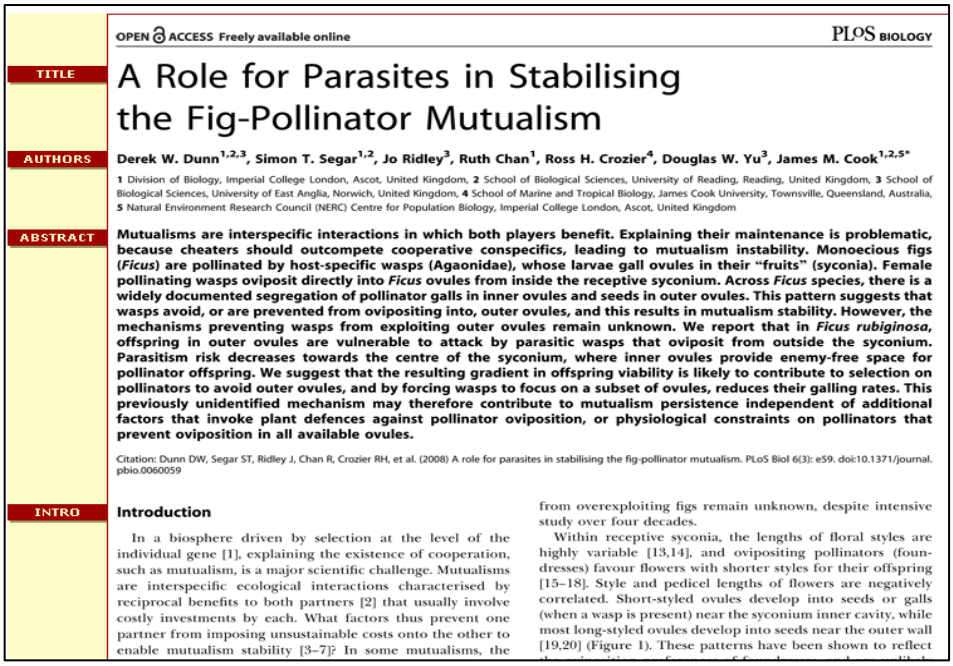
I would've liked to see an outline or list of topics, rather than have to scroll down and read each one. I guess I could have used the search engine, but I would have liked to see a breakdown of each topic or subject area. I really wanted to see if I could use something for a lesson I was giving the next day.

Lastly, an additional perceived weakness of the TMD was lack of order (similar to the comment about indexing):

I was scrolling for a long time. There is so much information I'm wondering if it can just be organized a bit better. Like on the right side of the screen you can have a link for topic or subject. I would've liked to see just the range of topics in front of me. The more ways of organizing it the better. As a teacher I just don't have a ton of time to spend seeking new material.

Journal Club Toolkit

Figure 13. Image from online survey - Journal Club Toolkit



This resource seemed most valuable for instructors who took the time to review it in detail and actually use it in their class. For survey respondents the Journal Club Toolkit was the least used resource; out of 135 instructors who responded to questions about this resource only five reported using it. Most still reported being interested in learning more about it. While very few undergraduate instructors felt that this resource would improve instruction or improve student learning, most indicated that they would use it in the future and were satisfied with the format and content of this resource. Engaging students with the primary literature as well as perceiving the Toolkit as an effective tool were the most appealing for the instructors. Participants, on the other hand, did not think that students would find this resource interesting (see Appendix D; Figure 5).

For undergraduate instructors who would use the Journal Club Toolkit in their classrooms, the two most appealing aspects of it were that it seems like an effective teaching tool, and that engaging students with literature is an important teaching goal. Participants also provided several open-ended concerns with using this resource:

- I tend to use this type of resource as an additional tool to be used on their own
- Language limitations of my students
- Many of my students have never even taken a high school biology course
- Not sure if the content aligns with my needs
- Would like a paleontological or geological aspect

For participants who have not used this resource and were not interested in using it, the most unappealing aspects of this resource was that the level is too difficult (Appendix D; Figure 6).

Two undergraduate instructors were able to use the Journal Club Toolkit with their students and noted that this resource generally worked well, and both planned on using it again. One instructor described how even though her students were already familiar with reviewing journal articles, she still felt it was a valuable resource and activity for her class:

> *I used it in my Darwinian medicine class and I'm going to use it in the regular evo course but they don't do their presentations until the end of the semester. So I won't be using it to introduce them to how to look at a journal article until later in the semester. In Darwinian medicine, again, we did all the methods, everything that they would need in the first half, which they are now completing. So they did that fairly early. The comments that I got from students were all positive. They thought it was a valuable tool. The only negative comment, and I don't know if it's a negative comment, some of my students are seniors and so they said they did some of this before in different classes. But they all liked it. I gave them the example that you gave and they went through that but then I picked a paper that was more relevant to Darwinian medicine to actually analyze. I didn't use any of your three choices.*

The need to modify the Journal Club Toolkit to better align it with the topic being taught was also mentioned. While the Toolkit was perceived as an invaluable exercise for students, one participant initially felt that only certain aspects of it were relevant.

> *I did teach my students to read through articles previously, but we're very focused on experimental design right now. For that reason the evolution papers didn't quite fit into what we're doing. They have workshops each week where they meet in peer led groups and they discuss experimental research by the cases. The focus is on defining variables and things like that. But I did find that the guiding questions were useful. So I modified some of them and put them into the guidelines for the peer leaders. It worked very well.*

The same instructor soon thought of ways that the articles could be used to teach what he originally intended, and expressed interest in looking into its use further:

> *I actually thought that those papers looked pretty accessible with experimental design. So may be worth kind of reconsidering whether or not those would work for an experimental design approach. I did actually find a good approach for experimental design in each of the two papers that they focused on. I think obviously breaking down how experimental design works in the scientific literature to choosing a paper of your choice and bringing that in but using this resource to kind of take it apart is great. I need to really look at it in terms of that. That would be worth checking.*

The desire to use this resource, due to its appeal and relevance, was also noted. Finding the time to incorporate it appeared to be a hurdle, but using parts of it was an option.

> *So the Journal Club Toolkit, the one where I pick the paper, I'm hoping, we'll see this afternoon if this happens, to put together a guide to work through a paper. I'm thinking of actually using some of these papers in my class so that half of the groups are doing one and half do the other and then they'll turn to the group next to them and see what they covered. I'm not sure that we'll have time in the class period to get through the whole scope of the way that that guides students through the papers. So I might use what I think is important and if I do that I'll pick the abstract and one figure as my way to do that. But I think even that will still work pretty well for the way the tool kit is set up.*

During the focus group the same instructor looked over the Toolkit and realized that it would be more helpful for her students, based on their grade level, to divide the papers into three categories: experimental papers, modeling papers, and reading papers. She explained:

> *I'm looking at the dissection the paper because they want to focus on those experimental work and modeling work. So the materials in that section that says*

does this involve an experiment, modeling or some other sort of testing and I think because of that it's generalized which makes it, it might be a good idea to create an experiment version of this resource and a model version. My guess is, given my own experience, that most intro bio groups are not going to approach modeling papers although they may talk about math and models in their courses. That's my approach. But we also have a course that is all about modeling and I would love a better way to guide students through how to make models in a paper. So that might be my additional resource like to split this out and have experimental papers, modeling papers and reading papers.

The weaknesses of the Journal Club Toolkit were related to time constraints and the large number of students in some classes. There were also problems with the "guiding questions" that served as follow-up or for discussion, which were reported as not being engaging enough for students.

Although this resource was the least used among the six resources, there seemed to be a general consensus that this was a valuable teaching tool and an important teaching goal amongst undergraduate instructors. Focus group participants made an effort to incorporate the Toolkit, even if it meant using part of it or modifying it ways that suited their lessons and teaching goals. Participants seemed to want clearer organization of the content, and divisions between grade levels to better suit their students.

Summary

Participants who used (or just reviewed) some of the six resources reported that they would use them in the future. Survey respondents, who had not used these resources, were very interested in learning more about them and perceived to be valuable teaching tools. The focus group participants and online survey respondents in this study were very positive about the use of image-related resources in the classroom (Evo Connection Slides, Image Library, Active Learning Slides), and were generally positive about the potential of these resources to improve teaching and learning. Respondents were interested in new teaching tools and found the resources appealing; they also saw that making connections to evolution was an important teaching goal. Participants explained benefits they perceived from using curriculum-planning resources such as the Intro Bio Syllabus, Teaching Materials Database, and the Journal Club Toolkit. What they identified were the availability of great resources, especially those that fit their particular needs. Undergraduate instructors liked having access to resources where they don't have to "reinvent the wheel," and many of them liked the option of borrowing and tailoring the resources to suit their needs. Time, as might be expected, was a barrier for instructors; adapting resources to suit classroom needs takes time, as well as preparing for lectures, activities, discovering different ways to present a lesson, and finding the time to decide how to best utilize resources in general.

Conclusions and Recommendations

Our analysis of the data leads to several main conclusions about UE's impact and expansion. First, all groups (undergraduate instructors, K-12 teachers and students) were overwhelmingly positive about UE as a general resource, and also praised the site's design, organization and navigation. In addition, all participating groups seemed to benefit from using UE, with undergraduate instructors being influenced the most. Data showed that undergraduate instructors had the highest frequency of visits to the UE site, of needs being met by the site, of the likelihood of returning to the site, of overall praise of the site, and of directing their students to the site.

Both undergraduate and K-12 instructors were enthusiastic about learning more about the resources offered. We found a general consensus among survey respondents and focus group participants that the Teaching Materials Database was the most widely used and praised resource. In general, both groups of instructors tended to visit the site to obtain teaching materials (e.g., classroom and lab activities) and content for students. Most undergraduate instructors who were able to use the resources in the their classrooms felt that they were easy to incorporate, although most needed to be modified prior to use.

Our evidence strongly suggests that Understanding Evolution has met its objectives for reaching the undergraduate community (instructors and students), while maintaining interest from the K-12 community. It is an established initiative with considerable momentum. Its key strength is that it enables teachers and students to experience a reliable, multi-faceted and accessible resource in the field of evolution. The website has also developed efficient and effective teaching resources, including tools to encourage student learning. Through the joint efforts of UCMP, and the teachers and faculty who utilize the site's resources, the UE has the potential to improve students' understanding of and appreciation for evolution.

Based on a synthesis of the range of information collected, we offer the following recommendations for website improvements.

General Recommendations

(1) Continue to provide resources for instructors that can be customized, but add interactive components that encourage sharing of modification strategies, feedback on resources and modification strategies, and general communication within the undergraduate and K-12 community of instructors using UE's resources. UE's resources offer a wide range of options for instructors. Focus group participants and survey respondents appreciated having access to resources that are customizable, or used in a way that best suits their classroom. Tools that allow instructors to customize, add to existing resources, and share content was seen as useful, and was a repeated theme from respondents. UCMP may want to consider providing a customizable user interface that

allows instructors to add or omit any elements, and an option to comment on individual experiences.

(2) Consider the quality of website design and usability for instructors and students. Many previous UE users reported there is not a consistent navigation strategy. When students and instructors accessed the site they were presented with a list of links and an abundance of content and experienced difficulties navigating between the connection of links and windows. Also, the content and teaching resources were displayed such that users had to scroll through pages of information to locate what they needed. The usability issues that arose in our study stemmed from two sources: (1) functionality and usability of the website itself and (2) how the instructors used the resources in their classrooms. An important element in ensuring accessibility is the existence of support for site visitors using UE's learning tools.

(3) Carefully consider the diversity of UE users by providing custom search options. Site users (students and instructors) come from diverse backgrounds, have a variety of content-knowledge in evolution; they are all searching for something different. The success of UE hinges on its ability to understand the needs of many users. Attention to diversity must be built into the way UE thinks about the structure of the site, as well as how the content is delivered. It may be useful to include categories, or web interfaces, that organize the website by a selection of search options, including language preference, grade level, learning level (e.g., basic, intermediate, advanced or novice, expert), and guiding questions (e.g., what are you looking for on the site?) that lead the user to where they want to go. Guiding questions on the UE homepage can serve as a way to customize search options for users. Some examples are as follows:

1. I am... (options: a student, a K-12 teacher, an undergraduate instructor, Other)
2. I need a specific type of media or image... (options: slides for a class I am teaching, etc.)
3. I want to browse current research on a specific topic...
4. I am looking for class or lab activities...

Resource-specific Recommendations

(1) Evo Connection Slides: organize slides by learning level (e.g., basic, intermediate, advanced and/or grade level) and topic, and offer customizable features that help control the appearance of the slides (e.g., amount of text, font, etc.). Participants either felt that the topics of the slides were too general, too advanced, too time consuming, or too text heavy (resembling a text book). One way to encourage a wider range of slide use would be to organize the slide library by selected categories, giving instructors more flexibility and control of what slides are presented and how they are presented.

(2) Intro Bio Syllabus: offer a "syllabus builder" as an option that includes customizable features, links to the main UE site, and the option to share strategies for modifying syllabus. Participants felt that using the existing resource may require too much time, mean drastic change to an already-existing syllabus, or wanted to learn more from other instructors about how they modified this resource to better suit their individual needs. A "syllabus builder" may not only get instructors to adapt this resource as is, but also to create, share, and archive a custom syllabi. Instructors can also utilize all of the content on UE for the elements of their syllabus. Not only can UE be used for content access, but the site can provide syllabus templates, options to drag, drop or replace topics, and ways to re-use data from semester to semester.

(3) Image Library: add high resolution images. The most frequently cited suggestion for improving this resource was to add high-resolution, higher quality images. UE may want to consider updating their image library by using higher pixel graphics.

(4) Active Learning Slides: provide examples of how these slides/activities can be incorporated into a lesson and highlight the value and effectiveness of each slide/activity. Some participants seemed unclear as to how to best incorporate these slides into their teaching, and whether or not they were effective tools to use in their classroom. UE may want to consider providing clear, step-by-step examples on how to utilize these slides in a classroom activity or lab. Along with example on how to best use them, UE may want to offer detailed analysis or insight as to how effective these strategies are. Strategies for examining the effectiveness of the slides could include an interactive component that consists of the following: a) the option for instructors to share successful ways of incorporating the slides, b) the option for instructors to rate the various slides or instruction modules, c) the option for students to offer their feedback on the slides and what they found most useful.

(5) Teaching Materials Database: organize material by content area, grade level, and/or learning level while offering links between resources on the database to other related resources on the UE site. K-12 and undergraduate instructors both sought further organization of the database: K-12 instructors expressed the need for content-specific organization; undergraduate instructors voiced the need for more grade-level/learning level organization (e.g., either the material was too general or too advanced). Offering a way for instructors to find material that is aligned with their students' learning level is to categorize the content by grade and/or level of difficulty. Organizing the database by topic may be away to appease instructors who may not have the time to sift through all of the teaching materials.

(6) Journal Club Toolkit: offer step-by-step guide on how to incorporate the journal articles into teaching and categorize articles by content, type, and learning/grade level. Similar to some of the previous recommendations, undergraduate instructors sought more specific instruction on how to best incorporate this resource. They also wanted the journal articles

organized by topic or subject to enhance search ability and navigation. UE may want to not only consider offering step-by-step instructions on how to best use these journal articles, but provide a table of contents so that instructors can easily select topics of their choice. Furthermore, giving instructors the opportunity to share their feedback on using the materials, and/or rating strategies for the articles themselves may benefit the larger pool of instructors interested in using the Toolkit.

Web-based learning tools such as UE must be constantly re-designed to improve their effectiveness. As the results of this study have illustrated, the usefulness and effectiveness of UE and its resources is contextual, depending on many different factors including the design of the sites, its users, and the delivery of content. Feedback from "real" users of the site and its resources is important to provide input into further site development.

Pragmatically, it is important to recognize that there are many obstacles to conducting such studies. For example, it is difficult to ask first-time site users to spend time, study, and give feedback on resources they have never used. In addition, using a pop-up window to collect data, and the timing of the survey, excludes much information that can be collected about what is offered on the site. It is also difficult to request instructors to incorporate UE resources into their curriculum within a limited window of time.

Nonetheless, the findings of this study suggest that UE resources, content offered, and tools available, are widely accepted as an integral part of evolution education in the undergraduate and K-12 communities. The successful implementation of these recommendations requires a strong partnerships between UCMP, website developers and site-users—whether they are K-12 teachers, undergraduate instructors or students.

Appendices

Appendix A - Instructor Online Focus Group Protocol

Program for focus group: Google+ Hangouts

Date of focus groups: February 19, 2013

I. Introduction

Hello my name is Nisaa Kirtman. I work with Rockman et al, the external evaluators of the University of Paleontology's Understanding Evolution website. We are having this focus group today to gather your reactions to four of our new resources from the website, including what resources you incorporated into your teaching, what your experience was like using these resources with your students, your overall thoughts on the resources, and how the resources can be better developed.

Before we begin, I would like to go over a couple of guidelines for our discussion. It is important that everyone have a chance to speak, although I'd ask that only one person speak at a time. We'd like you to share both positive and negative comments; both are useful. I am also recording this discussion so that we can have a reminder of what you said when we prepare our final evaluation report.

First, I'm going to ask each of you to introduce yourself, what you teach and where you teach. I'd also like to know how long you've been teaching and how familiar you are with the UE website.

Now we're going to talk about four resources from the site: the Journal club toolkit, Evo Connection Slides, the Intro Bio Syllabus, and the Active Learning Slides.

What was your initial reaction to the Evo Connection slides? (Ask the same questions for the Evo Connection Slides, Intro Bio Syllabus, Journal Club Toolkit, and Active Learning Slides).

1. Did anything strike you right away (either positively or negatively)?
2. What are some of the things that you liked about this resource? Why?
3. What are some of the things that you would change? Why would you change them?
4. For those of you who incorporated this resource into your class, how did it go? Reactions from students? Challenges using this resource?
5. Would you use this resource with your classes in the future? If not, what would encourage you to use this resource?

Is there anything else that we didn't discuss that you'd like to give feedback about?

Appendix B - Additional Reasons for Visiting UE Site

Undergraduate Instructors

- AP History report on Vesalius
- Background to be used to write a review paper
- Common ancestry of tetra pods
- Concepts in historical geology and paleontology
- Content for my anthropology lectures
- Developing an epistemological survey instrument measuring student beliefs about scientific arguments
- Distribution to state science teachers with the impending adoption of the NGSS
- Doing something for my 8th grade science class
- For an assignment
- For college credits in early childhood
- General knowledge
- Homework Research
- I like biology, and wanted to do PhD. Also like to teach if offered a Job.
- I teach Environmental Science and spend a significant portion of the semester linking Evo with Biodiversity
- I want to debacle evolution, because it is against my religion.
- I wanted to look at what evolutionary biologists think about viral evolution
- I was looking for... videos, but I clicked the wrong website.
- Ideas while writing a book about evolution
- Incorporate evolution into a biochemistry lab course
- It's a high school project
- Just curious
- Learning about recent research
- Link on another website
- List of books on evolution for undergraduates
- Material to help teaching arthropod ancestry and evolution to first year biological sciences undergraduates at Oxford University
- My teacher put an assignment based from this website.
- My teaching (in Burundi, central Africa) is introductory anthropology which also includes perspectives on evolution. A topic not well understood by students here.
- Nature of Science ideas and resources
- Other work, personal interest
- Personal well-being

- Projects
- Question from student
- Researching
- Searching for a duckweed stoma image
- Sharing the facts of evolution
- Short (5 minutes in length) dvd or you-tube style presentations on REAL world evolution in ACTION
- Specimen for studio work
- Stumbling to find information about evolution
- The one about santosh
- They told me that if I teach at a college u should learn this stuff
- To disapprove creationism
- To have some notes for my exam, which is Today
- To learn a lot
- To see what's here...
- To share my thoughts on the subject, of how life works, from the insight out
- To work on my project.
- Whenever I see reference to evolution examples (in this case Jerry Coyne's blog WEIT), I archive them for spring semester evol/ecol/diversity.
- Working on a paper for a biology credit, increasing personal knowledge and then applying it to morphing or evolving ideas in art

K-12 Teachers

- Aid for my research work
- Assigned as part of a graduate course
- College class reading assignment
- Course work Montana State
- I love learning about evolution
- In addition to teaching, I am also a student. It is for a class assignment.
- Information for applying for grant funding for a field trip for ESOL students
- Interested in research on evolution education
- Kids cladistics
- Looking for resources for students
- Relationship between science & religion
- Resource for graduate course - Teaching Evolution
- Taking a Graduate Class that requires reading
- Taking online class titled Teaching Evolution
- Evolution versus Creationism

Students

- As an online tutor I try to cover the possible resources I will send students to use.
- Background refresh to prepare for current assignment
- Biology Packet
- Brush up for work
- College Application
- Complement my lecture notes
- Exam
- Exam preparation
- Exam Revision
- Exam study
- Examples of parapatric speciation
- Exams
- Extra information to help with exams
- Find articles to write reviews/reports on
- Followed a link from an evolutionary biology website
- Fun
- Gain extra knowledge
- Games
- I am looking for a complete description of Lynn Margulis' Endosymbiosis Theory
- I asked for science resources websites and someone sent me the link
- I have a friend who tried to use the "it's only a theory, not a fact." argument and I want to show her what she is missing.
- I would like to teach my family about evolution
- I'm studying for an exam
- Interested finding evidence for the "tree-down" theory of avian evolution.
- Link from other website
- Look for examples to use
- Looking for info
- Mid term test
- My biology professor recommended the site and I find it interesting
- My teacher doesn't believe in textbooks and I have a final
- Online lab
- Preparation for an examination
- Prepare for teaching10-12
- Recommended by my teacher to help study
- Reviewing for a test
- Revision
- Science study for an exam

- Science vocabulary
- Seeing if bias
- Study for a test
- Study for test
- Study guide
- STUDY!
- Studying
- To confirm facts in a short story - Andrea Barrett "The Behavior of the Hawkweeds"
- To be able to explain concepts to other students
- To better understand and broaden my knowledge in Evolution
- To better understand exam material
- To find information for a seminar topic
- To find definitions on scientific words
- To find information for Chapter test
- To find information to clarify something my book doesn't explain well.
- To find information while studying
- To find the flaws in evolution
- To freshen my memory for Graduate School Exit Interview for Master's Degree in Science Education defense.
- To gain additional knowledge on school work
- To help me understand what I've learned in lectures.
- To help prepare me for my exam.
- To help with my lab assignment in biology 101
- To prepare for an honors science test
- To show my little brother what whales looked like millions of years.
- To study
- To study for a test
- To study for an exam on evolutionary mechanisms
- To win an iPad
- To write note for my exam
- Trying to get a better understanding
- Want to further understand for schooling
- Watching a movie in class on evolution

Appendix C - Information, resources, or features *expected* to find on UE site but did not

Undergraduate Instructors

- Continental drift and types of natural selection
- Earths development and analysis of biology evolution
- Examples, exercises, tests, quizzes - all with the goal of giving my students teaching strategies.
- Estimated dates as to how many years ago eukaryotic cells developed
- Exam questions
- HHMI (Howard Hughes Medical Institute) has a complete package on Natural Selection that is IDEAL 1) a short film clip about Rock Pocket Mice current research that takes place in the field (outside!!) 2) excellent worksheets for students to use in conjunction with the short film clip 3) also, excellent background source material for instructors! The reason I find this "package" so complete and appealing is twofold. First, it is EASY to use and second, it is like a "topic-in-a-box." Ready to go and completed answer sheets and all supporting materials for an instructor.
- HIV evolution
- Hoping to find background data for a series of online labs for a biological anthropology course for community college students.
- How about a page dedicated to "transitional fossils" - pics and info - for any taxonomic category a user selects
- I am looking for information on the finches that were studied on Galopagos. Facts, descriptions how the beaks changed, range to time etc.
- I am looking for information/resources regarding the relationships between "environmental phenotypes" in biosystems/ecosystems and their associated phylogenetic information (if any) to gain a better grasps on how industrial processes contribute, or not, in the ongoing genetic phenomena we can see in our world. I'm hoping I can also find information regarding the kinetics of gene transfers mechanisms in the environment by bacteria/viruses/vectors/mRNA-carrying-systems.
- I could use some more detailed examples relating to higher level classes and related courses (e.g., using evolution in conservation).
- I expected to find truth. I did not.
- I was especially interested in information regarding the life strategies of Prokaryote and Eukaryote in the evolutionary context, e.g. the two types of cells representing different strategies for dealing with the environment.
- I would like a photo generator that allows me to upload photos and generate left and right symmetrical morphs

- I would like to download the animated flashes. It is not always that I have internet connection in the classroom, I would like to be able to show them offline. The rest is wonderful.
- I would like more upper-level lab activities for undergrads, but not simulations. This is my first time teaching Evolution for majors in biology, so I'm developing labs for the course. I need detailed description about what materials are needed, how to use the programs, etc. I've been using live animals for some labs (bacteria and flies). There should be links to other activities such as those published in *Bioscene* and *Journal of College Biology Teaching*. There are already a lot of simulations online. I'm looking for a good lab in which students download molecular data and reconstruct phylogenies by following directions. I'd like them to subsequently map a character on the phylogeny. Most phylogeny methods labs that I've found assume that you have materials like skulls or can do PCR. I don't have a budget for these.
- Info on SARS
- it does not matter, I just wish share, my take on life. you look at the big picture first, then fit in all the pieces. we are evolution in progress, with every thought which comes to mind via the cosmic b-line, the universe is planting seeds in our mind, for our enlightenment
- It was very insightful /
- It would nice to be able to choose a level and then have content adjusted up or down to the level for that student population. Other sites (citable--by Nature) does this.
- It's all rather superficial / few classic references
- Links to other resources, more cladograms
- Looking for info for an insect toxicology class
- Major steps in evolution
- Maybe links to scientific resources
- Maybe some high level may bee for post-graduate students
- More active learning resources for teaching evolution
- More advanced lesson plans/activities
- More citations / Links to TED talks, etc. / More sophisticated student activities
- More details regarding the intended subjects.
- More examples
- More extensive references
- More images
- More in depth information about each topic
- More specific examples generics
- More specific examples such as examples of evolution in humans. Students listen more closely when we are talking about us.
- More updates, modernized (usability!) layout, design, incorporated social media gadgets, simpler navigation and again design, design, design! (the current design is outdated by far, one might say, a fossil!!) otherwise great content, keep up the good work!

- More video material e.g. evidence for evolution
- More videos of mechanisms of evolution. More evolution as observed through: genomics, molecular biology, proteomics, and metabolic pathways.
- Mutation
- More VIDEOS!
- Need more classroom activities
- Need more time with the site, sorry!
- None
- None
- Not much
- Not much really
- Picture files
- References to the most significant scientific papers in the field
- Reg evolution, how, what, why
- Religion
- Scholarly Articles
- Short video clips
- Simulations. It would be useful to have more interactive stuff. We use EvoBeaker, but it would be good to have some of those types of simulations on the website. Also more articles from the popular and primary literature (or links) (for example, the original Ensatina paper).
- Since I am teaching genetics to a continuing education class I am looking for material to present to a general audience / I am finding your site quite useful
- The links to Evo in the News articles don't seem to work. / Ideally, it would be great to have more examples for integrating evolution throughout the Intro Biology syllabus. The UE website provides many examples and resources, but there are many other good examples as well.
- Who discovered genetic mutations
- Zone classification

K-12 Teachers

- Evolutionary biology from Futoyama
- I would expect to find criteria sheets/ grading sheets for assessment
- 8th grade level
- Activities
- Activity worksheet
- Animations, images and activities
- Even more examples. I love the real examples/scenarios but want more.
- Evolution comics

- Evolution of prokaryotes to eukaryotes
- How to address clades and cladistics with young children. Hands-on ideas. VISUALS!!!!
- Information of animals and their habitats
- Inquiry activities, videos, interactive, short readings
- It's too high level
- Looking for more cladograms and evograms
- Looking for more in depth information on taxonomy and evolution
- More aligned lesson plans. For example, if I'm teaching about Speciation, embed a lesson plan about this specifically in that section. Also, more inquiry based lessons.
- More detailed real life examples from around the world /
- More explanations and more diagrams
- More material on lesson plans, more variety maybe
- Needs a better layout so resources are easier to find
- Not sure. I remember looking for specific resources about a week or two ago but now I can't remember the details. Missing/broken links?
- Powerpoint presentations of various evolution topics /
- To be honest, this is the first year that I am teaching evolution in a long time. I am a California Middle School science teacher who had been teaching 8th grade Physical Science and this year moved to 7th grade Life Science. I am like a student again developing curriculum to enhance the textbooks and my own understanding.
- what is the theory of evolution

Students

- Enzymes
- A sample of how to create a phylogenetic tree. So far I have not been able to get information on how to create the phylogenetic tree.
- A better genetic conservation perspective on mutation causing genetic variation
- Actual articles
- Additional vocabulary and greater depth on topics
- Answers to the researcher questions
- Answers to my biology assignment would be great
- Any and all that are applicable to evolution and biology, or any hard science
- Articles
- Basic geology
- Better descriptions.
- BLUNT ANSWERS
- Clearer explanations, better site navigation.
- Comprehensive research and evidence databases, articles, and reports.
- Definitions

- Detailed and research based information of all the topics
- Details on evolution
- Development of agricultural processes from the past to present time
- Early man
- Ecological niche of locust
- Elaborate explanations
- Endosymbiosis /
- Evidence of evolution
- Evidence that proves something
- Exact knowledge about gene mutation in humans
- Examples
- Exercises and basic readings
- Explain things we need to learn in biology
- Extra evolution stuff. Pretty good so far.
- Flash animations
- How evolution began and how Darwin created the theory and interesting facts for my project
- How to read the phylogenic tree
- How to tell if which species are more related
- I didn't find articles in a comprehensive manner.....
- I didn't really have any expectations, just checking it out.
- I didn’t find the beginning of evolution /
- I do not require the information on phylogenetic tree. I require to know the basics of molecular phylogeny. What molecular phylogeny really is.
- I found everything I needed for the project. A lot of types of mutations
- I found everything I expected to find on an educational website but not what I was actually looking for.
- I have found everything I needed
- It s informative, but I need a website that has more hardcore facts as opposed to basic/introductory evolution ideas.
- I need more of how Wright, Fisher, and Haldane contributed to evolution theory
- I needed more in depth details than what were provided
- I thought there was going to be more info on the characteristics
- I would find similar information to the one I have visited
- I'd like more advanced information. It may just be that I haven't had a lot of time to look around but most seems pretty basic.
- If there was a plasmid transfer from one species of bacteria to S. aureus (ala VRSA)
- Images of female ovulation
- In depth understanding of the genetic and physical factors that determine analogous structures. "Do ancestral genes determine predilection habits or preferences?"

- Information about microbiology
- Information easy to comprehend
- Information on evolution, which is perfect for my biological evolution course
- Issues related to small scale farming
- It would help if you guys went over the same things as the AP or IB handbooks do that way it would be easier to help me find relevant information. I believe the outline for the handbooks can be found on their websites.
- Links to academic journal articles
- Live videos
- Mental/psychological evolution
- More clarity
- More description & IMAGES of monocot stoma searched at google but neither they didn't have any:-(
- More detailed information on marsupial evolution!! There is plenty on mammals and others but not enough on marsupials!!!
- More detailed information.
- More evidence
- More examples on natural selection theory.
- More facts.
- More information that student need,
- More specifics about the climate of the various geological periods
- More straight forward definitions
- Not sure
- Patterns
- Phylogenetic tree
- Pictures
- Pictures of different stages of evolution of Homo sapiens
- Probably more of the same general theme that I've seen. It's good.
- Q and A feature
- Reading tree
- Reliable information
- Resources for students
- Science research
- Science stuff like the answers to these questions that I need to answer /
- Some topics are too hard to understand the way they are explained /
- Something more suited to my level
- Statistics about the decrease of Irish population
- Stomata
- Stomata history
- Stuff on Evolution

- Summary of Each area
- Talks with and names of scientists who can teach me more about the subject
- Teaching games and the like
- The definition of natural selection
- The endosymbiotic theory by Lynn Margulis
- The fountain of youth
- The information is just a bit too basic.
- The meaning of life.
- THE ORIGIN OF ANTRHOPODS NOT TOLD BY THE LECTURER
- The process of evolution
- The work that Jean Baptiste Lamarck did for evolution
- Videos.
- Was good for finding the topics that I should research more but didn't go into much detail on this actual site.
- What an arthropod is
- What did Kwang Jeon discover when researching Amoeba infected by bacteria?
- What evolution is
- What happened in the Irish potato famine?
- Work sheets

Appendix D - Resource Tables and Figures

Index of Resource Tables

Index of Resource Figures

Table 1. Have you used the Evo Connection Slides? (N=138)

Responses	f (%)
Yes	13 (5%)
No, but I am familiar with them	40 (29%)
No, but I'd be interested in learning more about them	81 (59%)
No, and I'm not interested in it	15 (5.7%)

Table 2. Satisfaction with Evo Connection Slides (frequency of responses)

Survey item	**N**	**Yes**	**Somewhat**	**No**	**Uncertain**
Do you feel that this resource helped you improve instruction? (N=8)	Undergraduate instructors (N=8)	5 (62%)	3 (37.5%)	0	0
Do you think that this resource would improve student learning? (N=9)	Undergraduate instructors (N=9)	7 (77.8%)	2 (22%)	0	4 (44%)
Are you satisfied with the format and content of this resource? (N=12)	Undergraduate instructors (N=12)	7 (58.3%)	3 (25%)	1 (8%)	1 (8%)

1 = Yes, 2 = Somewhat, 3=No, 4=Uncertain

Table 3. Have you used the Intro Bio Syllabus?

Response options	Undergraduate instructors (N=132) f (%)
Yes	8 (6%)
No, but I am familiar with it	16 (12%)
No, but I'd be interested in learning more about it	78 (59%)
No, and I'm not interested in it	30 (22.7%)

Table 4. Satisfaction with Intro Bio Syllabus (frequency of responses)

Item	N	Yes	Somewhat	No	Uncertain
Do you feel that this resource helped you improve instruction?	Undergraduate instructors (N=7)	4 (57%)	2 (28.6%)	0	1 (14.3%)
Do you think that this resource would improve student learning?	Undergraduate instructors (N=7)	4 (57%)	2 (28.6%)	0	1 (14.3%)
Are you satisfied with the format and content of this resource?	Undergraduate instructors (N=8)	4 (50%)	2 (25%)	1 (12.5%)	1 (12.5%)

1 = Yes, 2 = Somewhat, 3=No, 4=Uncertain

Figure 1. What about the Intro Bio Syllabus appeals to you?

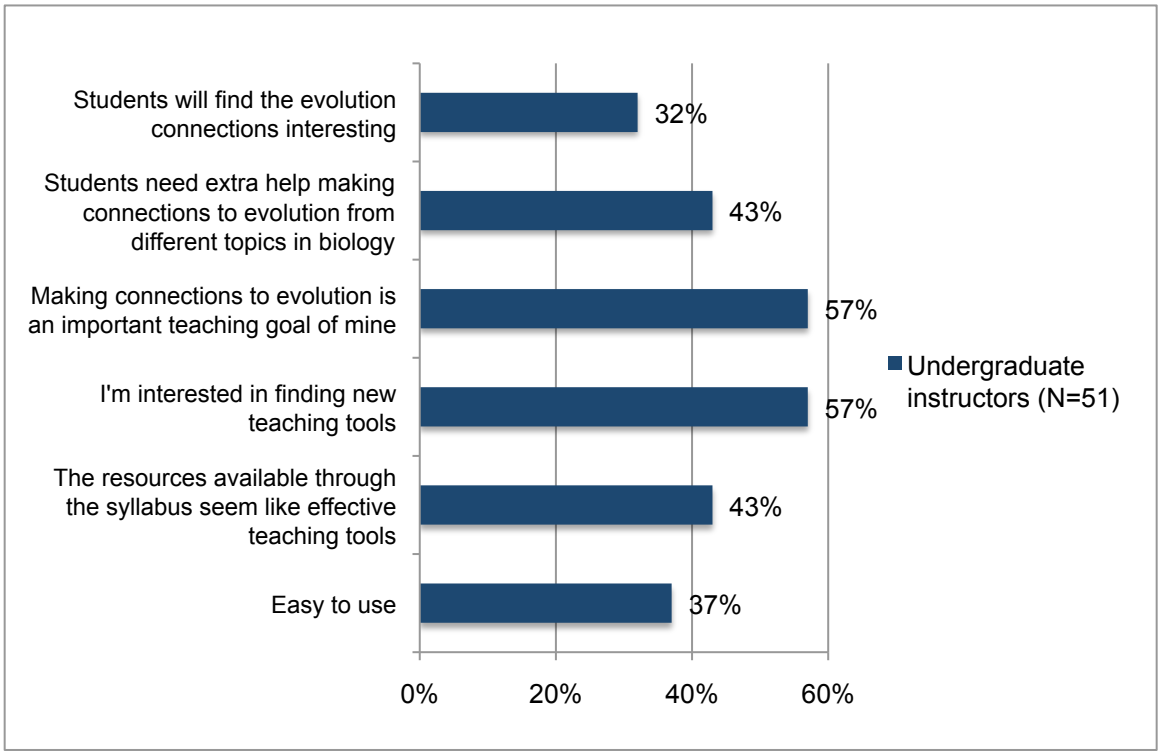


Table 5. Have you used the Image Library?

Response options	Undergraduate instructors (N=136) f (%)	K-12 teachers (N=118) f (%)
Yes	32 (23.5%)	21 (18%)
No, but I am familiar with it	31 (22.8%)	26 (22%)
No, but I'd be interested in learning more about it	64 (47%)	58 (49%)
No, and I'm not interested in it	9 (6.7%)	12 (10%)

Table 6. Satisfaction with the Image Library (frequency of responses)

Item	N	Yes	Somewhat	No	Uncertain
Do you feel that this resource haled you improve instruction?	Undergraduate instructors (N=32)	27 (84%)	4 (12.5%)	0	1 (3%)
	K-12 teachers (N=21)	18 (85.7%)	3 (14.3%)	0	0
Do you think that this resource would improve student learning?	Undergraduate instructors (N=32)	24 (75%)	7 (22%)	0	1 (3%)
	K-12 teachers (N=21)	19 (90%)	2 (9.5%)	0	0
Are you satisfied with the format and content of this resource?	Undergraduate instructors (N=32)	24 (75%)	7 (22%)	0	1 (3%)
	K-12 teachers (N=21)	17 (81%)	4 (19%)	0	0

1 = Yes, 2 = Somewhat, 3=No, 4=Uncertain

Figure 2. What about the Image Library appeals to you?

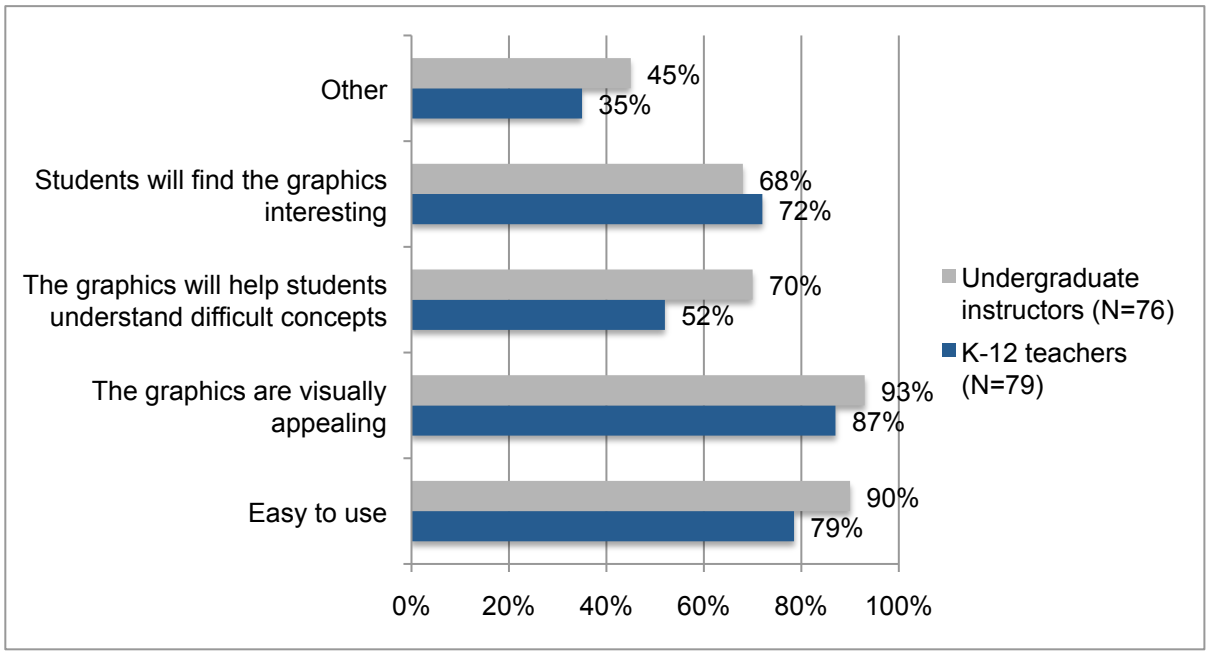


Table 7. Have you used the Active Learning Slides?

Response options	Undergraduate instructors (N=131) f (%)
Yes	28 (22%)
No, but I am familiar with it	25 (20%)
No, but I'd be interested in learning more about it	62 (47%)
No, and I'm not interested in it	16 (12%)

Table 8. Satisfaction with the Active Learning Slides (frequency of responses)

Item	N	Yes	Somewhat	No	Uncertain
Do you feel that this resource helped you improve instruction?	Undergraduate instructors (N=76)	27 (35.5%)	23 (30%)	7 (9%)	19 (25%)
Do you think that this resource would improve student learning?	Undergraduate instructors (N=81)	21 (26%)	19 (23%)	16 (20%)	25 (35%)
Are you satisfied with the format and content of this resource?	Undergraduate instructors (N=80)	23 (29%)	16 (20%)	17 (21%)	24 (30%)

1 = Yes, 2 = Somewhat, 3=No, 4=Uncertain

Figure 3. What about the Active Learning Slides appeals to you?

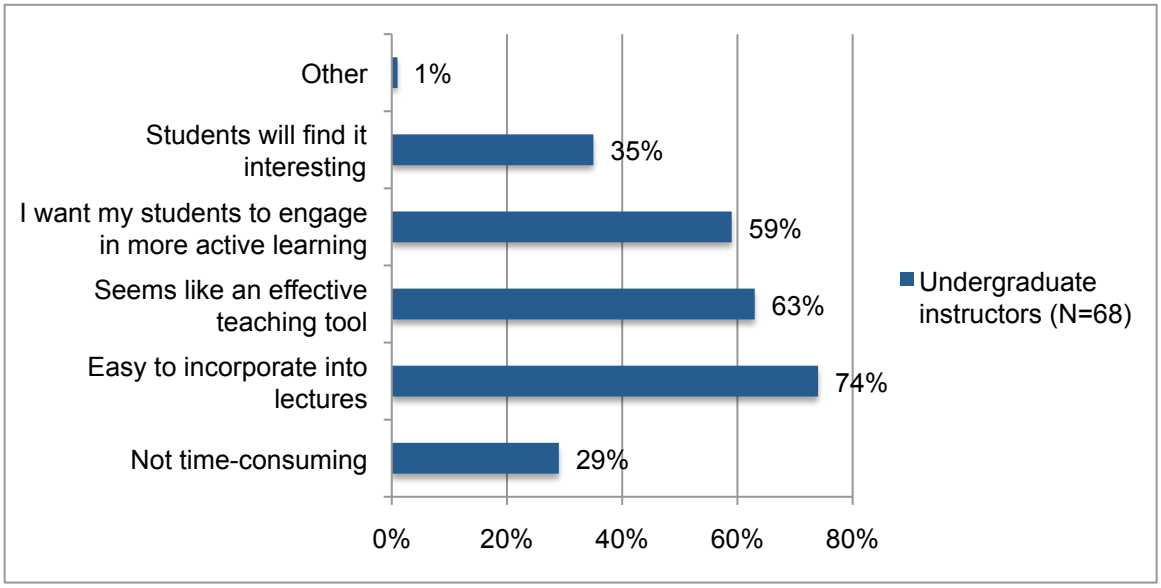


Table 9. Have you used the Teaching Materials Database?

Responses	Undergraduate instructors (N=131) f (%)	K-12 teachers (N=121) f (%)
Yes	41 (31%)	46 (38%)
No, but I am familiar with it	20 (15%)	13 (11%)
No, but I'd be interested in learning more about it	54 (41%)	58 (48%)
No, and I'm not interested in it	16 (12%)	4 (3.3%)

Table 10. Satisfaction with the Teaching Materials Database (frequency of responses)

	N	Yes	Somewhat	No	Uncertain
Do you feel that this resource haled you improve instruction?	Undergraduate instructors (N=41)	25 (61%)	7 (17.1%)	1 (2.4%)	0
	K-12 teachers (N=46)	39 (85%)	3 (6.5%)	0	0
Do you think that this resource would improve student learning?	Undergraduate instructors (N=41)	26 (63.4%)	5 (12.2%)	0	0
	K-12 teachers (N=46)	37 (80.4%)	3 (6.5%)	0	0
Are you satisfied with the format and content of this resource?	Undergraduate instructors (N=41)	29 (71%)	4 (9.8%)	1 (2.4%)	1 (2.4%)
	K-12 teachers (N=46)	35 (76%)	8 (17.4%)	0	0

1 = Yes, 2 = Somewhat, 3=No, 4=Uncertain

Figure 4. What about the Teaching Materials Database appeals to you?

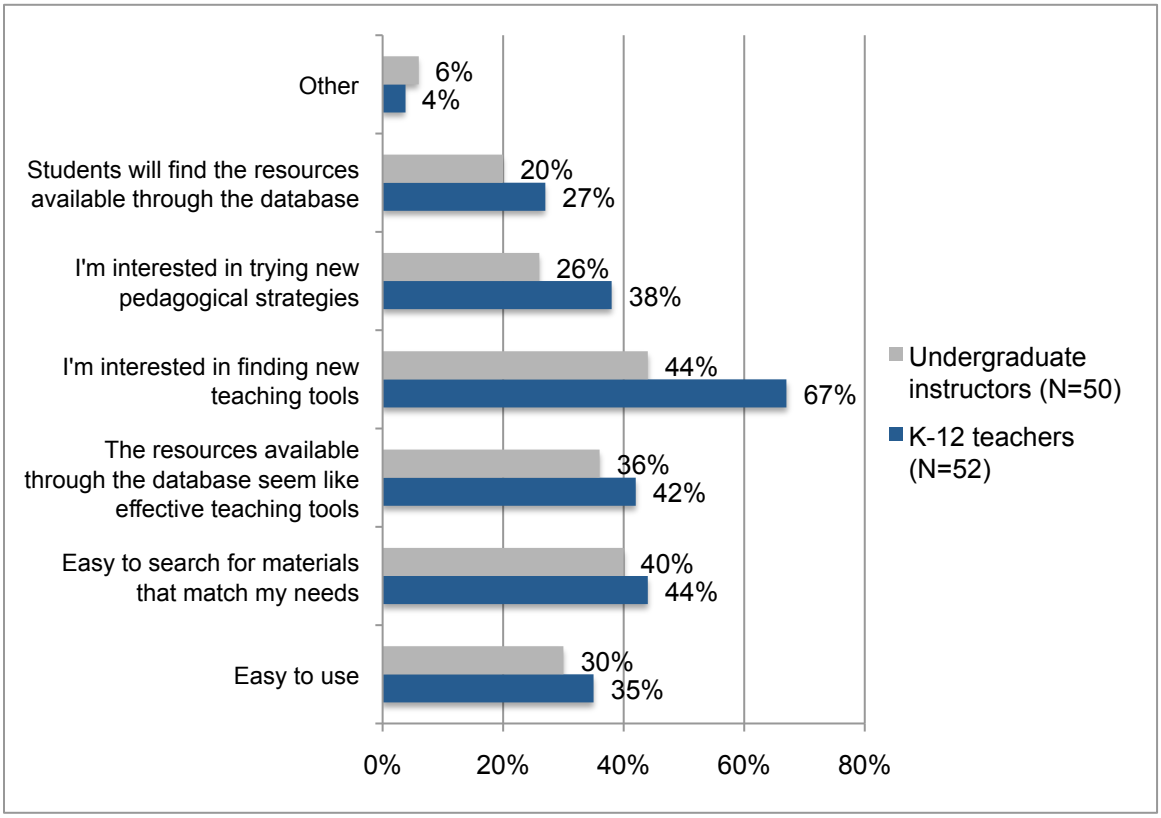


Figure 5. What about the Journal Club Toolkit appeals to you?
(Participants who would use this resource)

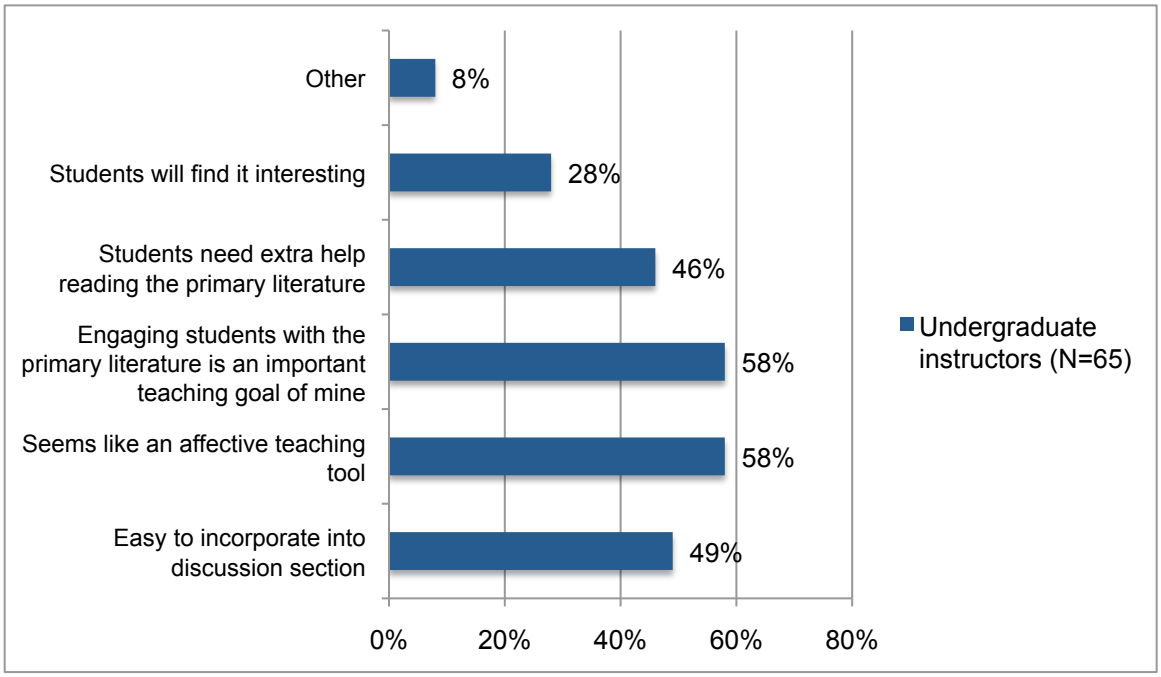


Figure 6. What about this Journal Club Toolkit is unappealing?
(Participants not interested in resource)