

Project 2A

Final Report

**Website for Questions on
Fundamental Physics and Cosmology
Informatics 132
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1. Introduction

The client, Dr. Kevork Abazajian, requested a re-design of a website that displayed information about Cosmology and Particle Physics through a question-and-answer format. Underlying problems in the original design, as explained by the client, was that it was neither dynamic nor intuitive, unlike many modern information-based websites like NASA or The Planetary Society's website. Additionally, due to the question-and-answer nature of the website, the original design also made it difficult for visitors to both search for answers and submit new questions.

Through our implementation for the website to look more modern and to act more responsive, this will allow Dr. Abazajian to push the website to become the public face of UCI's Center for Cosmology. Because of this, the information architecture and the usability of the website will be tested with high school teachers and undergraduate students, users that are expected to use the website more often. Furthermore, the website will then be revised through the results of usability tests conducted on these user subgroups.

Our objectives for this project were as follows:

1. To create a modern-looking website to fit the current market of Cosmology websites
2. To improve the website's core functionalities, including a more dominant search bar and an easier more visible question submission feature
3. To provide the client with flexible options to customize and manage the website

2. Initial Analysis

The audience for the website were high school teachers and undergraduate students who have a basic understanding in cosmology and fundamental physics. We will consider this category of users as the *visitor* role. Likewise, our project sponsor is also a user of the website who operates on an administrative capacity. We will consider this role as the *admin* role. Both the user and the admin roles of the current website experienced HCI problems, and these were revealed through our evaluation of the features exposed to each role.

Our group reviewed the existing website within the context of the two, clearly established roles: *admin* and *visitor*, and identified the common tasks for each role. The visitor role had more blatant HCI defects than the admin role, and the admin role had less functionality in general throughout the website due to the lack of features available for this role. The functionality made available to the visitor role includes finding existing articles on the website that answer questions related to the topics of the website. This can be done in 2 ways; by manually browsing the website via a category drop-down widget, or by utilizing the search feature of the website. There are several issues with both ways.



Figure 2.1: Original website's category dropdown menu

The dropdown widget pictured in Figure 2.1 was problematic in nature for several reasons. It failed to give feedback to the visitor. Upon selection of a category from this widget, the web browser starts to navigate to the web page for that category, however there was no clear indication of this fact. The widget itself does not convey the idea of navigation, in terms of a browser changing what page it was on, because visitors do not normally correlate a drop-down widget with navigation. Typically, a drop-down is used to select from a number of options prior to submitting a form.

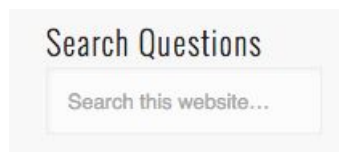


Figure 2.2: Original website's search bar

Additionally, the search widget pictured in Figure 2.2 was problematic for a number of reasons as well. Firstly, the location was inadequate. It was located at the bottom of the page in smaller widths and the right side of the screen in larger widths. A typical visitor would have left the page by the time they located the search bar. Secondly, in more recent times, there are a few expectations that visitors have with dynamic features such as search bars that the website fails to address. These expectations include a large, prominent search bar and instant feedback when performing each search. We attribute these expectations in part because website users nowadays are used to popular search engines like Google, Bing, and Yahoo.

Furthermore, a feature that allows visitors to ask questions from the admin through asynchronous submission of questions exists within the website but was difficult to find. Not only was it difficult to find that this feature even existed, but once found and used, it linked to an entirely new domain. Some visitors could be confused by this transition and would think there was a mistake. The link for question submission was hidden deeply at the end of a large blob of text on the home page. Unless the visitor was diligently reading the introduction, they would be unaware that this feature even existed.

The admin role had less HCI issues primarily because it relied on Wordpress, a piece of software that many independent developers contribute to and use to allow other users to tap into its high quality potential. That said, the fact that the form that visitors used to ask questions was off-site poses HCI problems that fall out of scope of what Wordpress can solve. This lack of integration in the question-answer process was the primary HCI defect of the admin role.

3. Designing Mockups

Since the original website was not worth testing in the first place, one of our first priorities for this project was to create mockups that would help us focus on the implementation phase. Taking inspiration from the UCI Strategic Communications style guide, Google, and various other Science, Cosmology, and Physics websites, we were able to come up with a rough idea of how we wanted the site to look.

Several members of the team, including Catherine, Daniel, and Ney contributed to the first round of mockups. Each mockup had valuable components that we worked on as a team to combine into one cohesive mockup that we presented to the client.

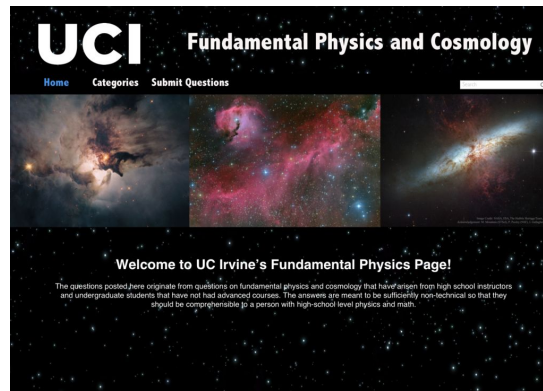


Figure 3.1: Catherine's mock-up of the homepage

From Catherine's mockups as seen in Figure 3.1, we were able to get a better grasp of how the user would work through the website to find the information they'd be looking for through mockups of the different pages of the website. From Ney's mockup seen in Figure 3.3, we utilized the way the information was presented and combined it with Daniel's use of colors and images for the design as seen on Figure 3.2.

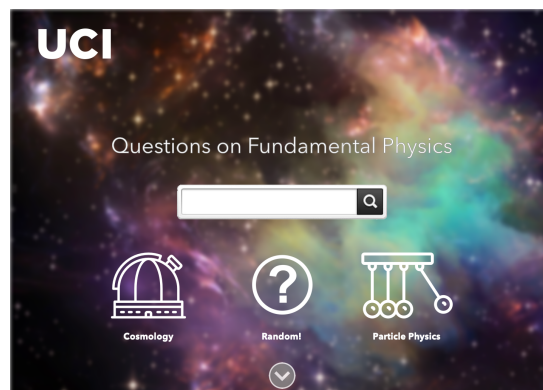


Figure 3.2: Daniel's mock-up of the homepage

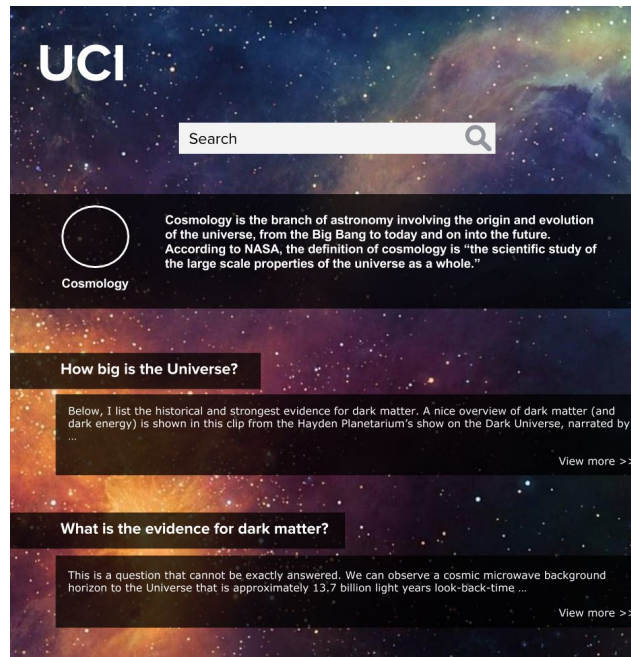


Figure 3.3: Ney's mock-up of the Categories page

For all of the mockups, we focused on making the information on the website as easy to access as possible. Based on the project description and our initial meetings with the client, we wanted to focus on 2 primary features that the website was intended to have; searching for specific questions about Cosmology and Particle Physics, and browsing for answers on the website as a way to learn more about those topics. With those features in mind, we focused on making it easy for the user to discover the information they were looking for if they were very intentional in their search, and making it easy for users to simply browse around.

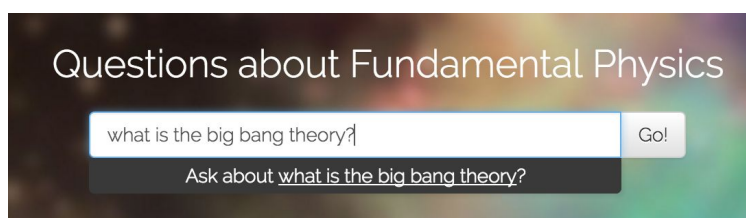


Figure 3.4: "Ask a question" implementation on the search bar

One other primary function that the website needed to include was the ability to ask new questions for our client through the website, who also happened to be the primary source of information for the answers. In order to keep repeat questions to a minimum, we wanted to make sure the user would actually take some time to search for their question before trying to submit a new one. The only way a user would be able to submit a question, based on our new mockup pictured on Figure 3.4, would be to attempt to find a question in the search bar, realize that there were no results that matched the question,

and then discovering the link to the "submit a question" page that will then be found at the bottom of the search bar's suggestion box.

Once we had our initial mockups flushed out by discussing these possibilities with our client, we proceeded to create a functioning prototype of the website that would then be used for user testing. While working on the actual implementation of the website, there were a few design related changes that were made. For example, we were able to come up with a smooth way of incorporating "Center for Cosmology" into the website's logo shown below in Figure 3.5.



Figure 3.5: UCI Center for Cosmology logo

Since there was not an enormous amount of time to do both the mockups and the implementation, it was helpful to be able to combine some aspects of both into the development process. Instead of sticking strictly to our original mockups, we would change the site as we saw fit. As both developers and designers, using WordPress made it reasonably straight-forward in completing the implementation of the freshly designed site.

4. Prototype Implementation (Daniel, Keyvan, Lorenia)

Working with a team of developers can be difficult when each of those developers has a different skillset with varying levels of mastery. Add in busy schedules with both work and classes made it difficult to find time to physically build the website together. Luckily, we used a combination of tools (WordPress and a shared server) along with agreements (checking to see if anyone else was working on the same file) to facilitate productive collaboration to achieve a final product we could be proud of.

4.1 Tools

A variety of tools were used in developing the website. The main component was the WordPress blog software. We decided to pay for a DigitalOcean.com virtual private server in order to avoid setup-time on individual machines to maintain a single state of the website, which was an advantage to collaboration and sharing. We also purchased a domain from Name.com in order to further ease sharing by keeping the domain name short and memorable.

The virtual private server ran Linux, and so we deployed WordPress there. By using WordPress, we were able to leverage existing WordPress plugins in addition to the theming capabilities within WordPress. Our group used different tools on their own machines to edit the files of the custom WordPress theme that we created. Editor software ranged from Sublime Text, Vim, and others. SSH was used in order to remotely

connect to the live server to edit files. Aside from deploying WordPress plugins, web development languages like HTML, CSS, PHP, and JavaScript were used in order to edit the website through plugin customization and custom theme creation.

4.2 Difficulties

Overall, some of the largest difficulties we encountered dealt with time management. Working in a team with both developers and user testers meant that we needed to focus on maintaining strong lines of communication to all be on the same page. Adding in communication with our client, and things became even more tricky. During the early stages of our implementation phase, there were some challenges with regards to making the instant search results work with our planned user experience. In order to allow users to submit a question through the search bar, some additional tweaking had to be done to the search bar WordPress plugin. Additionally, there were some misunderstandings between the development team and the client in that we were unsure about some features and whether or not to implement them. One such feature was the creation of a tag cloud that would allow users to more easily browse through the website's content through specific keywords. Though the tag cloud was not implemented, it will be possible for our client to request this feature once the back-end data exists to support it. One final difficulty that we had to deal with was our client wanting a moving slideshow or video as the background for the site. A background with animation can certainly work, but we agreed as both developers and designers that the user experience would be more streamlined to simply stick with a static image as the background. If our client comes across a suitable video in the future, it would not be terribly difficult to implement, but it would be up to him to do so. Development projects are sure to encounter difficulties along the way, and with strong communication and open minds it becomes much easier to work through them to create a satisfactory project on completion.

5. User Testing

User testing was conducted by 3 members of the team. The goal of the test was to identify possible usability problems with regards to the search bar's functionality, as well as the user-friendliness of the design in terms of the use of color, images, and how the elements were positioned. The search bar had 3 different functionalities; to find an answer to a question, to provide suggestions for similar questions, and to include a link to ask a new question if the question did not exist in the database. Additionally, the group aimed for a more minimalist design and wanted to test if that was applicable to a website with a question-and-answer format. Lastly, we also wanted to see what features of the website the users utilized the most and which features were ignored.

5.1 Recruiting Participants

The process of recruiting participants involved effort from both the client and the team in terms of communication. However, the participant turnout was relatively low considering the amount of people we reached out to. High school teachers were one of the main types of users that the website was intended for, so our client attempted to recruit several science teachers from the local high schools around Irvine, California. The client sent

e-mails to high school teachers before the quarter began, but decided to visit the high schools in person after receiving no response. Throughout the course of the quarter, the client visited 6 local high schools: Corona Del Mar, Irvine High School, Northwood, Sage Hill, University High, and Woodbridge. The client gave 10 flyers to each of the high schools' receptionists and provided the incentive of free movie tickets for participation, however, only 2 of the 6 receptionists seemed enthusiastic about the opportunity. Despite reaching out to several high schools, we were unable to recruit any high school teachers to participate in our user testing, so we decided to instead target undergraduate students.

We e-mailed a Cosmology professor to make a recruitment announcement during his lecture and he was accommodating enough to let us make the announcement. We also contacted 2 more Physics professors through email and asked them to forward the e-mail to their students. We didn't receive any responses so that may be why we didn't gather as many participants as we wanted.

Whenever we attempted to recruit users, we would mention the \$5 Amazon gift card incentive for participating. Our first attempt to recruit participants was the announcement we gave in the Cosmology class, but the students may have been hesitant to sign up because they had a midterm coming up for that class. Also, another issue that arose was passing the sign-up sheet around the lecture hall. The sheet did not completely circulate around the class because it was stuck somewhere towards the back of the lecture hall, so not many people had the chance to sign it. Since we only received 6 signatures on the sheet and only 2 of those 6 actually responded to schedule a testing session, we reached out to different clubs on campus.

We did not have much success after contacting the *Astronomy Club at UCI* and *FUSION at UCI*, an engineering club, through Facebook. There was one person from the Astronomy Club who was interested in participating, but he was not a UCI student so there were scheduling conflicts that ended up with us being unable to book him for a testing session. After speaking to several members of FUSION in-person, we were able to recruit 3 of them. Our team had much more success with recruiting users when we contacted people directly, which was why a majority of our users were people who at least one person in our team personally knows.

5.2 Scheduling participants

The user test team originally scheduled to allocate one week to user testing. However, because the client needed more time to contact high schools for possible user participants, and the development team needed more time to finish the initial re-design of the website, user testing was extended to another week. Contact with users were primarily done through e-mail during April 18 - May 3, 2016 while the development team were working on finishing the initial prototype of the website. But even during user testing, we were still communicating back and forth with the users to confirm appointment dates.

Scheduling was divided into 3 phases; the initial e-mail, signing up through the google forms, and confirming appointment dates. The initial e-mail provided the users with a

brief description of what the usability test was about, as well as a Google forms link that we asked them to complete by Sunday, May 1st. The Google forms were primarily used to allow the users to choose which of the provided dates and times they would be available. Additionally, the forms were also used to inform the users about audio and screen recording, and we asked them to consent to those terms prior to the actual usability test. Based on their responses to the forms, we sent them a plausible date and time for their test appointment. Should they have any conflicts with the suggested appointment, they could respond to that e-mail to negotiate a better time. Otherwise, we required them to confirm the date and time by simply responding to the email as soon as they could.

5.3 Pre-testing responsibilities

Before conducting user testing, there were numerous responsibilities we had to complete before meeting with users. To begin, we had to scout for locations to conduct the user testing. In the event that high school teachers agreed to participate in our usability testing, we planned to go to their schools to accommodate them and their busy schedules. We hoped that by offering to go to their schools, they would be more inclined to participate because they would not have to drive to UCI and pay for parking. As for undergraduate students, we decided to conduct testing at the Courtyard Study Lounge (CSL) located on campus at UCI. We chose this location to conduct testing because we were allowed to reserve private study rooms for 3-4 hours and undergraduates would not have to leave campus in order to participate.

In addition to finding locations for testing, we had to prepare and print forms for our participants to read and fill out. We found samples of a consent and recording release form on the usability.gov website and edited it to fit the needs of our usability testing. By signing the consent and recording release form, the user agreed to 4 things; that they would be screen and audio recorded for research purposes and to provide honest feedback, that they understood that their names and information will not be used, that they will only receive the \$5 Amazon gift card if they completed the entire user test, and that the usability study was completely voluntary. Additionally, we also prepared a receipt for the users to sign to indicate that they received the \$5 Amazon gift card we promised after the study concluded. Lastly, for testing purposes, we created and printed out System Usability Scale(SUS) questionnaires for users to fill out after completing a series of tasks.

The user testing team created a guidebook and set-up/tested audio and screen recording equipment to ensure testing ran smoothly and efficiently. The “Experimenter’s Guidebook” contained 5 things that was crucial to each test --- the schedule of appointments for user testing, 3 checklists (before user testing, during user testing, and after user testing), a list of the questions and tasks, a copy of the post-test system usability scale questionnaire, and a troubleshooting section at the end of the document in the event that a problem arose during the duration of the appointment. This guidebook helped with organization and consistency during user testing. The equipment we used for testing was a Macbook Pro and an external wireless mouse. The Macbook Pro has an application

called Quicktime Player that allowed us to screen and audio record users with no problems.

5.4 User Testing Feedback

We began testing by asking the users a set of pre-test questions. These questions were made to give us a better understanding about the users' views on the design of the website. We asked questions such as "Please give me your initial impressions about the layout of the page and what you think of the colors, graphics, photos, etc." and "Without clicking on anything yet, please describe the options you see on the home page and what you think they do." 3 users mentioned the blurry background and of those 3 users, 1 user suggested that we use a sharper image for the background. As for the overall layout of the website, 4 users said that the website was "simple" and 6 users mentioned how the website resembled the popular search engine, Google. When we asked the users to tell us what they thought the purpose of the website was, 3 users said they did not know what the website was about and suggested a small description that would inform them about who and what the website was intended for.

After the pre-test questions, we gave the users 3 tasks to complete. Each task was designed to learn how users went about looking for answers to questions while also making sure that the search bar was running properly. Out of the 9 users, all 9 used the search bar to ask a question. None of the users utilized the categories as a way to find answers to question. One reason for why the categories were not utilized was because the categories did not seem clickable. 2 users did not notice that the icons could be clicked on. Another reason why users did not gravitate toward the category icons was because the search bar was the main focal point of the website and it gave users an instant answer to their question with minimal effort required. After User 2's testing, we decided to change one of our tasks. The original question for task one was "What is dark matter?" We changed that question to "How big is the Universe?" because we felt that the question for task one was too similar to the question for the second task. For the third task, 4 users were surprised that they could submit a question using the website. They could have been surprised because the only way they could be directed to the submit a question page was if they typed in a question or a keyword that was not found in the database. There was no visible icon or link on the home page that the user can press that indicates that they can submit a question.

Lastly, we gave the users a System Usability Scale questionnaire to fill out. Because of the abundance of positive responses, we would like to differentiate between both levels of appreciation --- *strongly agree* as a response that the user was likely confident with and had little to no second-thoughts making, and *agree* as an answer that although the user was confident about making, our team fell short on fully satisfying the user. When asked if the website was well-integrated, the responses were split with 4 strongly agreeing and another 4 simply agreeing. We attribute this to the fact that although we did make a presentable website that most of the users liked, we still received a fair amount of critique regarding functionality where we fell short on. Additionally, with regards to if the users would like to frequent the website more, only 2 strongly agreed while 5 agreed. This

might be because we were given limited content to work with in terms of information that we could display on the website. With only 6 questions, there was only so much we could show on a website that revolves around presenting information. Lastly, we would like to point out that there were 3 outlier responses that we wanted to analyze, 2 of which are explained below. When it came to if the website was complex, one user agreed to it. We trace this back to one feedback that there wasn't enough information to explain what the website was about or where a button icon led to. Another outlier response strongly agreed to the fact that they would need technical help to navigate through the website. But because during our tests, the users didn't need our help to navigate through the website, we believe it's safe to assume that this answer was most likely mistakenly filled out. Our analysis, however, was that this was an issue on how we designed the form itself. To avoid this mistake, it might have been better to label the column titles for the scale "Strongly Agree" to "Strongly Disagree" instead of numbers that corresponded to the scale.

5.5 Difficulties Encountered

Primary difficulties during user testing involved reaching out to possible user test participants and communication between unconfirmed participants during user testing.

As mentioned before, the client requested more time so he can reach out to high school teachers in 6 different high schools around Irvine, however none of them responded. According to the client, a majority of the high schools were not very responsive to both the e-mails and the incentives offered. We did, however, acquire users on our undergraduate subgroup to meet our quota of 10 users for the test. But because of the lack of high school teacher participants, it's difficult to feel confident that the website we implemented would also be useful for that specific subgroup.

When user testing started, we were still communicating both with the client and with the unconfirmed user test participants. To secure the right amount of Amazon gift cards, 10 to be exact, we needed confirmation from all our participants before our client could procure the cards. In retrospect, it would have been easier to have directly asked for 10 gift cards, but because we weren't confident that we could get 10 participants, we were hesitant to ask more than we bargained for from the client. Some of the users were late to respond with the confirmations, and securing the gift cards became a last-minute endeavor. The client managed to provide us with up to 9 gift cards but by the end of the first week of the usability study, we were still lacking one more gift card. Luckily, however, one user couldn't make it to one test appointment, which resulted in us giving that user's gift card to the last user.

There weren't any major setbacks during user testing and we attributed that to how well we prepared for it. Each appointment was 15 minutes longer than our expected test duration to make room for unexpected events --- like laptops and devices malfunctioning, forgotten forms, late participants, and last-minute rescheduling from our participants. One example was when the fire alarm went off right before one of our test appointments

had to begin, but because we allotted that 15 minute extra time on each test appointment, we successfully avoided any appointment delays.

6. Redesign based on results

The redesign of the website guided by the feedback from our user testing was overall a smooth process. In general, the users liked the look of the website so in terms of appearance we did not have to change much. We did, however, learned from users that we needed a better description on what the website itself was about and how it was meant to be used. The issue of how to explain the purpose and functionality of the website poised a very unique challenge where the team had to come together to make decisions on how to preserve our minimalist design yet at the same time communicate the purpose of the website.

There were a total of 5 changes that we made based on the feedback from user testing; the About section, the Particle Physics icon, clickable Category icons, and 2 changes regarding question submission. First, an About section was added to the homepage containing information about the purpose of the website and information about the author of the page, our client, as shown in Figure 6.1. This came about because 3 users said they didn't know what the website was about and suggested to add some kind of description on the homepage.

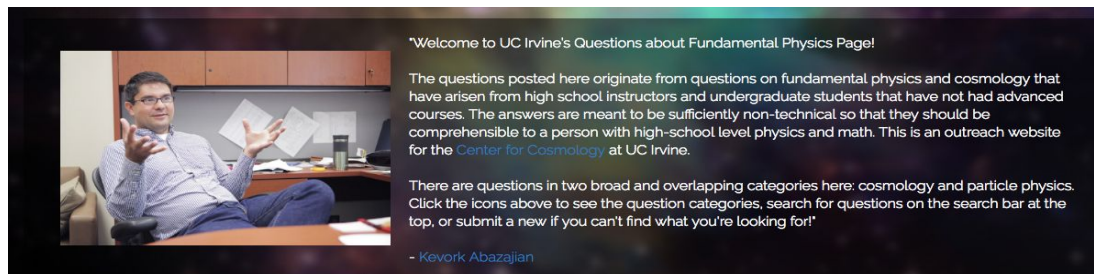


Figure 6.1: About Section on Homepage

The second change we made was to replace the old Particle Physics icon with a more relevant icon. This was due to the fact that one user mentioned that the old icon we used was related to Mechanics and suggested that we change it. Then during another user test, user 7 suggested to use an atom icon which we thought was the perfect replacement shown in Figure 6.2.

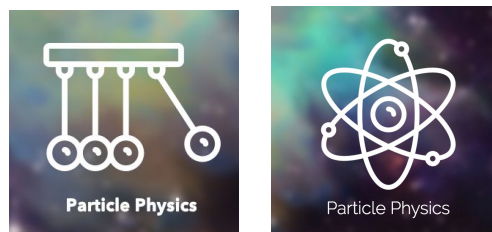


Figure 6.2: Old Particle Physics icon (left). New Particle Physics icon (right)

The third change on the homepage based on user feedback was to make the icons look more clickable. During user testing, 3 users felt that it did not appear obvious that the categories icons were a link to each category and all users gave wrong guesses of what they thought the icons were for. Another 2 users also didn't know that the icons were clickable and both thought that they were part of the design. We decided to add a hover feature that made it more obvious the the category icons on the homepage could be clicked on, as shown below in Figure 6.3.

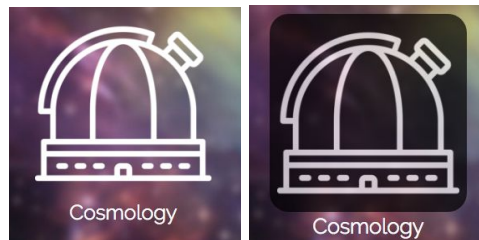


Figure 6.3: Icon with no hover effect(Left), Icon with hover effect(right)

The fourth and fifth change we made were 2 changes regarding question submission. The first change to the question submission process was with regards to remembering what question was asked. When a user searches a topic or asks a question, finds no answer and proceeds to submit a question, the text he initially entered was then copied to the question form. This way the user knows exactly what they entered and can proceed to fill out the question form for submission. This change came about during our pre-final presentation, when Dr. Kobsa suggested it during class to emphasize recognition rather than recall. This change is shown below in Figure 6.4.

Figure 6.4: User enters in a question with no answer on website(Top), Question is copied into the submission box(Bottom)

The second change to the question submission was providing a link to the home page after submitting a question. One user mentioned how it would've been better to either auto-redirect the users to the homepage, or provide a link that took them to the homepage to make navigation after question submission more user-friendly.

7. Conclusion

As a result of team collaboration and user testing results, we were able to build a modern-looking website that was responsive and much more intuitive. We also provided the client with a customizable site that was also easy to manage. Overall, the initial design process was about coming to an understanding of what the website should be about and what purpose it would serve. After several meetings with our client, we gradually visualized our concept and made sure it fit his vision. The client wanted this website to be a resource for teachers and students with questions on fundamental Physics and Cosmology that also served as the face of UCI's Center for Cosmology. The final product was a result of carefully conducted user testing and our initial concept. User testing was undoubtedly one of the most critical phases of the project --- a product is no good if the intended user does not understand the motivation for the product or is unable to successfully utilize it. User testing allowed us to identify what our initial design was lacking and to demonstrate if our concept was successful in projecting the goal of the website and who the target audience was.

Overall, during the creation of this project, we learned that constant communication between the client and the team was an important aspect of development. The client's needs changed slightly after every meeting, and it was our responsibility to get to the core of what the client wanted for the product during these meetings. In terms of user testing, although the user testing itself was important, what was more important was how we analyzed and compiled the results of the tests. Based on the right feedback, we learned to use that information to further improve the product while still keeping in mind the client's needs.