

Project 1 Usability Study
Information Retrieval
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Math Stack Exchange Usability Study

Abstract:

The write-up does not ask for an abstract.

~~The purpose of this project is to focus on evaluating the design of the search interface, propose a new feature for the search interface and carry out an informal user study. For this assignment, Math Stack Exchange was chosen to be the search interface for evaluation and modification. Math Stack Exchange is a medium that is primarily used for Mathematics. The users post questions and answers for various questions pertaining to Math. This search interface was chosen because, as robust as it is, it was observed that the true search wasn't being used efficiently enough.~~ The advanced search feature didn't have an "easy to use interface". This allowed room for improvement and thus gave the opportunity to easily get upgraded for a greater and promising search experience.

Search Interface Overview

put figures close to where they are discussed in the main text.

The UI for normal search was very intuitive. The search bar is situated at the top of the page, appearing distinctly on the page. Once the user clicks on the search field, a callout appears right underneath the search bar, indicating some of the advanced search attributes that users can use. This can be seen in Slide 2 in the Appendix. This is useful for letting users know that there is an advanced search feature at their disposal. There is no search button anywhere in the UI, the user will have to submit their query by pressing the enter button once they are done entering their search query.

Once the query is submitted the user will be taken to the results page. The results page shows one more search bar right above the results which is redundant but is added to maintain consistency. Each record in the result page has informative document surrogates which are separated using different font styles and colors appealing to the user. This is observed in Slide 3 in the Appendix. The different parts of the record include the title which has 'Q:' in front, below the title a part of the question is added and all the words in the questions that match the keywords in the query are shown in bold font face, below this the tags attached to the question are shown in separate boxes which are hyperlinks to a page that shows all the questions that are tagged with it (essentially a search for the selected tag). To the left end of the record the user can find the number of votes and the number of answers that the question got, and on the right bottom end the user can find the date that the question was asked. The result page also includes four different ways to sort the results, Relevance, Newest, Votes, and Active(sorts by the datetime of last edit).

Guideline-Based Evaluation

1. Offer Efficient and Informative feedback:

The result page UI shows an informative document surrogate(slide 3) for each record which includes the title linking to that document, a summary of the question, the date the question was asked, the number of votes and answers. The UI also highlights the terms from the query in the summary by making them bold. It also allows sorting of the results by four criterias (Relevance, Newest, Votes, Active). However, unlike few advanced search engines, the UI doesn't provide any feedback in the form of auto-generated query term suggestions or refinements.

2. Balance User Control with automated actions:

The search engine doesn't show any kind of query transformation. elaborate

What other trade-offs are there between user control/automation in the system?

3. Reduce short term memory load:

The UI suggests search action in the top search bar by placing the text “Search on Mathematics...” in the text box(slide 1). The text within the text box disappears when the user clicks on it. This helps the user to easily recognize the search bar.

The UI also integrates navigation and search so that users can search for questions, tags, users, or unanswered questions directly from the left navigation pane(slide 3). Is there a search history within MSE?

4. Provide shortcuts:

The UI also provides a vast range of keyboard shortcuts that could be used to navigate it. But to use them users will have to enable the keyboard shortcuts from the Settings page. such as?

5. Reduce Errors:

The result page UI shows an empty result page if the query didn't return any result. It recommends that users should try different or less specific words, this could help users to update their query to find them some results for the query.

6. Small details:

Each question in the result page has tags attached(slide 3) to it, these help users to get an idea what the question is about and is that what they are looking for. The answer number on the left of the record is color coded, the background color is green when the question has at least one accepted answer and is white if there are none accepted answers. This greatly helps users to find the answers that would help them.

When clicked on the search bar at the top a callout appears which gives users some of the advanced search options that they can use while searching. This is a very good way to let users know that there is an advanced search feature available for their use. Also reduces short-term memory load.

7. Importance of aesthetics in design:

The design of the UI is aesthetically pleasing and user friendly. It's designed in such a way that the user can find links on the webpage very easily. The result page is how? designed in such a manner that it allows the user to absorb a great amount of information very quickly, for example for accepted answers, the block with the number of answers is filled green indicating that there is at least one accepted answer, so with a quick glance the user would be able to decide if this record would be useful or not.

New Feature Design

elaboration, and more explanation and discussion of examples would be helpful.

~~To design the new feature we analyzed the search UI extensively.~~ We found that the advanced search feature in the UI could be improved ~~greatly by making it interactive and user-friendly.~~

The current advanced search used specific keywords in the search box to filter the search results. So, the users will have to type the keywords for the advanced option in the search box. An example of a query would be ‘quadratic isaccepted:yes’. This will return all the questions that have the keyword ‘quadratic’ in them and have accepted solutions. The advanced search is a very powerful tool, but it requires much more effort for the users, ~~which is knowing the specific attributes, as a result not making use of this feature to its maximum potential.~~

For the new feature the contents of the callout under the search bar were replaced with actual buttons and text boxes for the filters that could be used for advanced search. Whenever a user clicks anywhere on the callout, a popup will be opened which will show all available advanced search options. The boolean filter options like ‘isaccepted’ where added as a slider with three values ‘Off’, ‘Yes’, and ‘No’. In the off setting the filter would not be used while searching the query, and on Yes and No, the filter will get the respective value. This drastically reduces the amount of effort that the user will have to put in to performing the advanced searches. The user can change these filters by less than two clicks which is very easy and fast as compared to typing the filter keyword and its value.

Informal Usability Study Design

The Usability study was conducted to find out whether the new feature could be useful and intuitive to the user. The study was designed in such a way that the user understood the purpose of the new feature and use cases. The study followed the ~~talk loud~~ protocol. Where the think-aloud

participants would be as vocal as they could be regarding their feedback and thoughts about the new features. The mock-up used for the study included three information retrieval tasks.

Once the study started, the participants were shown a screenshot of the Math Stack Exchange homepage. They were told what the website is for and who uses it. The participants were asked if they ever used this website to search for math related questions, if they did, they were asked about their experience. If not, our goal was to further explain in detail the working of Math Stack Exchange. We had also made sure to ask them explicitly whether they belong to the user base that primarily searches for answers or the user base that goes about answering questions. This was very important for the study as it would allow us to get a skewed type of result and make it blatant. Next, the participants were shown an example of searching on the web page using a simple query, seen in slide 3 from the Appendix. Once clicked on the search bar, the callout message appeared. They were asked how they felt about this graphic view of the attributes. They were also questioned whether the attributes were self-explanatory. After gathering data from them based on this UI approach, we moved to the results page. This is where they were asked to look at the results ordering, color schemes, positioning of the relevant information and whether it was pleasing to their eye. We asked them to tell us if anything was confusing with what they saw, regarding the information they were viewing and the diction used on the page, was it comprehensive and not too wordy or straining. They were also asked what they understood from the page, in order for us to be certain that the correct details are being displayed for the user and that the UI is making sense of the information being displayed.

This isn't focused
on your added
feature.

Next, the participants were shown the current UI for advanced search as seen from slide 4 in the Appendix. Here, they were shown all the keywords that could be used in advanced search. Again, they were asked if they understood what these keywords meant and that they could make sense of it. They were asked to guess the functions of these keywords. Next, they were shown two examples of advanced search using ‘isaccepted’ keyword with value ‘yes’ and then with value ‘no’. This working can be seen from the slides 5 and 6 from the Appendix. They were asked if they understood how to use the advance search options, and if they were confused about anything. Then, the participants were asked if they would use the advance search option and asked them to justify their reasons.

After showing the participant the current search UI, they were shown the new advance search UI. This is the new feature that we decided to implement. First, they were shown the updated callout below the main search bar. Next, the participants were asked if they understood the purpose of the callout and how it can be used for advanced searches, they were asked if they were confused about anything shown on the webpage. The participants were asked which callout box would they prefer, the new or the old and why. They were also asked if they had any recommendations or issues with anything in the new design.

You should let the users do not tasks, not watch a presentation
of the tasks being executed. Interaction with the prototype is important;
this is often how unexpected issues are identified.

Next, the participants were shown the popup dialog which is opened by clicking on the callout. Questions similar to the previous callout were asked again. Furthermore, they were asked if they would change the keywords used to describe the filter option or the order of the filter keywords in the dialog box. Then, they were asked how likely they were to use this feature. As a final note, we asked them again if they had any other feedback they wanted to give. We stressed upon the differences between the two UIs while asking this to ensure that the subject of discussion is maintained correctly.

This concluded the study.

Study Results and Discussion

The primary reason for this study was to check on the usability of the new feature implementation and compare it with the previous UI. The result of this study was that the new search feature could be very useful to users and that they would prefer to use it with some changes to the UI. We also found that the participants would prefer using search engines like Google and add 'Math Stack Exchange' as a keyword to their search query rather than using Math Stack Exchange search.

Initially, we found out that one of the participants has already made use of Math Stack Exchange, but not extensively. This allowed us to change the flow of the study to explaining the website in brief and then we asked about their experience. They mentioned that if not most, all of their searches had been conducted from Google and then they were directed to this website. The search feature of this website was rarely used by them. One of them mentioned that they were able to have a promising experience that they were able to get the required results from the questions they had asked. They both also mentioned that they were part of the user base that would search for answers. This narrowed our focus to that kind of user base, in order to get greater accuracy in data.

After showing them the original callout, they told us that they were especially fascinated by the possible filter attributes that they could go about using. One was able to guess the 'isanswered' attribute correctly, however, in majority, they weren't sure about what they were seeing, as in they were not confident what the attributes would pertain to or after using them, what kind of results they would get. From here, we were able to see that this UI didn't behave intuitively and wasn't engaging with the user. As a result, despite having a robust search possibility, due to the disconnection of the user's interest, the current search UI didn't mint the money. They were especially pleased by the results page. The color scheme, the structure of the web page, the positioning of the surrogate documents and the interactive feedback met their goal of satisfaction.

use
academic,
technical
language.
Avoid
'sayings' in
a report
like this.
You are
writing to
inform, not
persuade.

Finally, we showed them a variety of special attributes that they could use to help them search more efficiently. This is shown from slide 4 in the Appendix. Their reaction was consistent to the previous section with regards to the callout. They were not able to make sense of most of the attributes as well. They claimed that the attributes were poorly worded or were not intuitive enough. In hindsight, we did realize that the wording of the attributes catered to a specific audience that are highly tuned with mathematical and programmatic terminology and variable standards.

We then proceeded to show them the working of one of the attributes, ‘isaccepted’. They didn’t seem to have much of a reaction. Instead, they were able to comprehend the reasoning of the type of results being shown by the feedback they noticed from the color of the votes of each surrogate document.

You should be summarizing results, not necessarily presenting things in the planned order (already described above).

Next, we introduced the updated UIs to them. We first showed them the new callout upon clicking the search field on the top of the page. This can be seen on slide 7 from the Appendix. Their first reaction was that they were pleased by the simplicity of the UI. The search bar within the UI for specific features was clear about its functioning. However, they did mention some wise modifications to this callout. They were still not sure of the meaning of the attributes, thus implementing some kind of a description next to each variable would be highly beneficial. However, they also mentioned that this small screen should not end up being too wordy as that would hamper the user experience. The position of the states for the Boolean attributes wasn’t intuitive enough. They would have liked it if the ‘yes’ was positioned to the far right with the ‘No’ being in the middle. They liked the color feedback that the options were giving, however, they were not convinced by the depiction of the setter of each attribute. By using the slider method, they thought that there could be something between ‘yes/no’, which is not the case. Instead they thought of having radio buttons or at least some clearer way of representing the toggles.

In order to allow the user experience the possible attributes, they could use it for their search, instead of going on a different page and seeing and remembering the attributes, after clicking on the callout, we showed a pop up floating window in the middle of the screen, as shown in slide 8. This was appreciated by the user as the user was able to see a wider set of attributes that they could use. They especially liked this as it was shown in an intuitive manner. However, upon further inspection of the UI, there were a few drawbacks that appeared ambiguous and not up the mark. They remained consistent about the slider change from the callout, that they would prefer a concrete way of displaying the toggling. They mentioned that they would prefer a different ordering of the rows in the two columns, like having the ‘hascode’ and the ‘code’ field filters side by side seems easier for the user. Upon further inspection, this change would allow a reduction in the use of the short-term memory of the user. They reiterated that the filter names could be changed to make it more descriptive or informative enough for a common user to understand its behavior instead of targeting a specific audience itself. They were not very

convinced with the working of the UI models, whereupon clicking on the new UI, would result in the floating window. They were concerned about the times when the user doesn't want any additional details but instead is still taken to the window. This would spoil the user experience. Instead, after continuing the talk, they suggested that having a type of a button in the new callout stating 'more attributes' would be a better and more intuitive approach in dealing with this. That way, the user would remain engaged and this wouldn't spoil the user experience. They were not convinced with the positioning of the pop-up window. They preferred the pop-up to be below the search bar rather than in the middle. They were also confused by having the 'must contain phrase' at the top of the pop-up window. They were not sure whether they should continue writing their search query on the official search field or the new text field on the top of the pop-up. This was an eye-opener for us as both the text fields behave completely differently. This kind of implementation of the pop-up window for the extra attributes not only cause hindrances for the user to search but it defeats the purpose of an intuitive and engaging approach.

Overall, the feedback that was received from the participants was immeasurable. There were several situations that weren't accurately identified, by us, while implementing the new UIs that have become abundantly clear. However, they were very much appreciative and thrilled by the introduction of an interactive UI. They claim that such a mechanism would make them want to use and learn about the extensive features of the search engine in Math Stack Exchange.

Conclusion

The conclusion was not required, and doesn't add new information to the analysis of the usability study outcome.

The study was incredibly successful. We were able to find out crucial shortcomings of the new search UIs and thus take appropriate measures to make needed changes to them. This allowed us not only to get back the creating an interactive UI, but it also gave us insight of how a specific consumer base tries to search thought and find their answers, what elements they highlight while observing, what elements immediately catch their eye and most of all, what genuinely is desired by the consumer base in order for them to have a good experience while searching for something. The feedback given by the participants were helpful in improving the UI.

Avoid using evaluative language ('good,' 'successful,' 'not up to the mark'). Present concrete results (events and facts) clearly and concisely, and then share opinions in a discussion.

Put simply: 'tell, don't sell.'

Appendix

record of participant comments missing

The screenshot shows the Math Stack Exchange homepage. At the top, there's a banner with the text "Mathematics Stack Exchange is a question and answer site for people studying math at any level and professionals in related fields. It only takes a minute to sign up." Below the banner, there are two sections: "Anybody can ask a question" and "Anybody can answer". A call-to-action button "Sign up to join this community" is visible. The main content area is titled "Explore our Questions" and lists several math-related posts. To the right, a sidebar titled "Hot Network Questions" displays a list of popular questions from other Stack Exchange sites. At the bottom of the page, a footer bar includes links for "Cookie Policy", "Privacy Policy", and "Terms of Service".

Slide 1: Home Page for Math Stack Exchange.

This screenshot shows the Math Stack Exchange homepage with a focus on the search functionality. The search bar at the top contains examples of search queries: "[tag] search within a tag", "user:1234 search by author", and "'words here'" exact phrase. Below the search bar, there's a "Ask a question" button and a "Search help" link. A large callout box highlights the search bar and provides instructions for using the built-in search, mentioning basic tips like activating the search button on small screens and using quotes for specific phrases. To the right, a sidebar titled "Our model" lists various topics such as "How can I format mathematics here?", "Expected Behavior", and "How do I find topics I'm interested in?". A "How do I search?" section is also present, listing common search queries like "What browsers do we support?", "How do I format my posts using Markdown or HTML?", and "What should a tag wiki excerpt contain?". At the bottom, a footer bar includes links for "Cookie Policy", "Privacy Policy", and "Terms of Service".

Slide 2: Illustrates the original callout under the search box.

The screenshot shows the Mathematics Stack Exchange search results for the query "multivariable calc". The search bar at the top contains "multivariable calc". Below it, the search results are displayed with 112 results found. The results are listed in a grid format, each showing a question title, a snippet of the question, the number of votes, the number of answers, and the date it was asked. The first few results are:

- Q: Multivariable Calc Proof [duplicate] (0 votes, 1 answer, asked May 30 '14)
- Q: Critical points in multivariable calc (1 vote, 1 answer, asked May 17 '13)
- Q: Multivariable Calc. Continuity at Origin (1 vote, 1 answer, asked Sep 30 '17)
- Q: Multivariable calc limits and continuity (1 vote, 1 answer, asked Sep 13 '15)

On the right side, there is a sidebar titled "Hot Network Questions" which lists various other popular questions from the network.

Slide 3: Search result page.

Advance Search in math stackExchange

- Specific phrases with “”
- isaccepted:yes/no
- hascode:yes/no
- isanswered:yes/no
- closed:yes/no
- duplicate:yes/no
- user:me or any other username
- code:"new"
- score:10..100
- views:100..
- answers:..3
- hasaccepted:yes/no

Slide 4: Advanced search keywords.

StackExchange differential equations isaccepted:yes

MATHEMATICS

Search Results

Results for differential equations Search options is accepted answer

differential equations isaccepted:yes

500 results

Relevance Newest Votes Active

0 votes A: Linear D Operator You can find the following references: (1) "Introductory Course in Differential Equations" by Daniel Alexander Murray (2) "Ordinary and Partial Differential Equations", and "Advanced... Differential Equations" by M. D. Raisinghani (3) "Differential Equations" by J. G. Chakravorty and P. R. Ghosh (4) "An Introduction to Differential Equations" by Ram Krishna Ghosh ... answered Jul 7 '19 by nmasanta

0 votes A: Differential equations: difference between first order DE and separable variable DE All separable differential equations are first order differential equations, but not all first order differential equations are separable. ... answered Aug 21 '18 by Robert Israel

1 vote A: Proving Something is a vector space? The differential equation in my question is an example of a homogeneous linear differential equation. The solutions to differential equations of this kind, indeed form a vector space (not the c a scalar, then cy is also a solution (linearity again). Solutions to other kinds of differential equations, e.g. nonlinear differential equations, in general do not form a vector space. If you want an easy example: simply change your differential equation to a non-homogeneous one. ... answered Nov 9 '16 by StackTD

1 vote A: What ODE book has good exercises? I love this one: Ordinary Differential Equations by Morris Tenenbaum, Harry Pollard Try it. It has a good taste :-). ... answered Feb 8 '14 by mrs

0 votes A: how to find the convolution of ordinary differential equations

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Hot Network Questions

- Security is easy, so why is the Hog's Head so dirty?
- Can I defer levelling up after reaching the XP threshold?
- I need a help about polyphony, will 128 be enough
- Trying to get text in square to transform together
- Why did the Apollo capsule have seats if the astronauts never were sitting in it?
- Is it the correct practice to keep more than 10 years old spaghetti legacy code untouched without refactoring at all in big product development?
- Is it normal to have several one or two month extension after a fixed term contract postdoc?
- What do you use for company name that resemble an existing company name in the UK?
- Writing to a shed
- What is difference between resonant and non resonant antennas?
- Does grep distinguish a variable and the \$ regex?
- Tripletts on full score or 12/12 (with dotted 4th as full beat)?
- Method to delegate command to other methods
- Why is there no effect in the mass of the bob on the period of the simple pendulum?
- Everyone has a book in them, but in most cases that's where it should stay. Does that apply to me?
- Does the location matter in a PhD choice?
- Should I prohibit a player from having a character goal that makes me uncomfortable?
- Why is this quotient of the punctured plane not Hausdorff (Hatcher 1.3.25)?
- Could an earth like planet turn into Venus and then back again?
- What tasks require or work best with a knife point?

Slide 5: Search result page with advanced search(isaccepted:yes).

StackExchange differential equations isaccepted:no

MATHEMATICS

Search Results

Results for differential equations Search options not accepted answer

differential equations isaccepted:no

500 results

Relevance Newest Votes Active

6 votes A: Examples of the Mathematical Red Herring principle All differential equations are stochastic differential equations, but most stochastic differential equations are not differential equations. ... answered Apr 9 '14 by Michael Hardy

2 votes A: What would be a good introductory book for ODEs and PDEs with good concepts? You can try the following references: (1) "Differential Equations" by Shepley L. Ross (2) "Differential Equations with Applications and Historical Notes" by George Simmons (3...) "Differential Equations: Theory, Technique, and Practice" by George F. Simmons and Steven G. Krantz (4) "Elements of partial differential equations" by Ian Sneddon Besides for theory ... answered Jul 1 '19 by nmasanta

3 votes A: Non-ordinary differential equation? -difference equation, which is a blending of differential and difference equations, such as $\frac{d}{dx} f(x) = f(x-1)$ So an ordinary differential equation is a differential equation that doesn't have anything "special" about it, it's just a differential equation. It is, quite literally, ordinary. ... In addition to what others have already said, there are other types of differential equation. There's the Stochastic Differential Equation, which contain random elements. There's the Differential ... answered Mar 29 '13 by Glen O

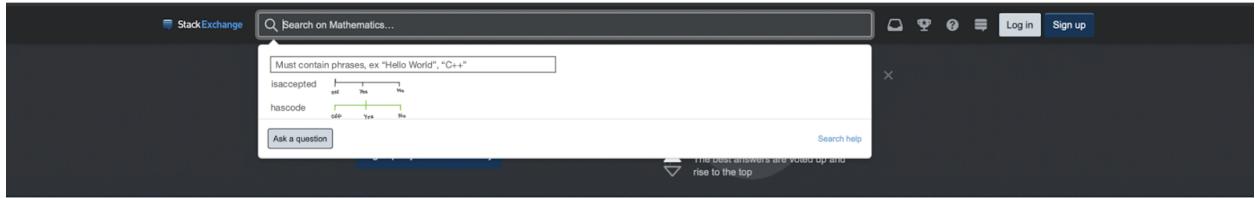
3 votes A: A book on the ins and outs of ordinary differential equations Here are some good books: Robinson - An Introduction to ODEs Pollard - Ordinary Differential Equations Boyce & DiPrima - Elementary Differential Equations Arnold - Ordinary Differential Equations Arnold is

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Hot Network Questions

- What do you use for company name that resemble an existing company name in the UK?
- Touch move rule loophole
- What does it mean for a polynomial to be the 'best' approximation of a function around a point?
- What is the difference between a USB port and a USB receptacle?
- What is the Schrödinger equation used for exactly?
- Is it possible for series connected battery cells to provide different currents?
- Demand Curve of Foreign Exchange
- Is giving a software team "Free Fridays" for their own projects mutually beneficial?
- Check if a binary tree is symmetric in Python
- Differential probe design ground copper pour
- How do I add technical exposition in my fiction novel?
- Did Apollo have braking rockets for soft landing on Earth?
- How was the mass of Venus determined?
- Is it the correct practice to keep more than 10 years old spaghetti legacy code untouched without refactoring at all in big product development?
- How do I create array of objects of alternating color?
- Do any other countries take as long as the US to transfer government power following an election?
- What is difference between resonant and non resonant antennas?
- What's exactly the new definition of kilogram, second and meter?
- Given a 4-4 tie, how would the Supreme Court determine results for a contested election?
- Has the construction team of the Northrop

Slide 6: Search result page with advanced search(isaccepted:no).



MATHEMATICS

A screenshot of the Mathematics Stack Exchange homepage. On the left, there is a sidebar with links for "Home", "Questions", "Tags", "Users", and "Unanswered". The main content area features a section titled "Explore our Questions" with several questions listed. One question is highlighted: "calculate the flux of the vector field" with 1 answer and 790 views. To the right of the main content, there is a "Hot Network Questions" sidebar with various questions from other sites like Stack Overflow and Super User. At the bottom of the page, there is a footer bar with the text "By using our site, you acknowledge that you have read and understand our [Cookie Policy](#), [Privacy Policy](#), and our [Terms of Service](#)".

Slide 7: New UI of the callout

A screenshot of the Mathematics Stack Exchange homepage, similar to the previous one but with a larger, more detailed callout for search terms. The callout is titled "Must contain phrases, ex 'Hello World', 'C++'" and contains two diagrams: one for "isaccepted" and one for "hascode". The "isaccepted" diagram shows "Off" (red), "Yes" (green), and "No" (blue) options. The "hascode" diagram shows "Off" (red) and "Yes" (green) options. Below the callout, there is a "Search" button. The rest of the page layout is identical to the previous screenshot.

Slide 8: Popup window in the new UI.