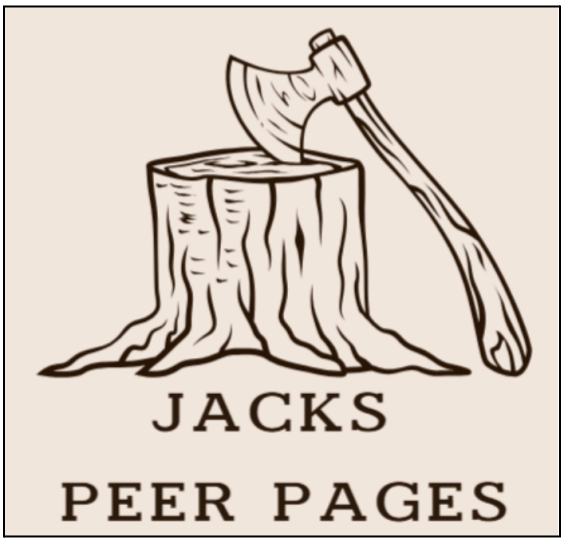
Requirements: Final



Jack's Peer Pages

November 26th, 2025

Sponsor: Dr. Keith Nowicki
Team Mentor: Md Nazmul Hossain
Faculty Mentor: Dr. Ana Chavez

Team: Haley Berger (Team lead), Haley Kloss (member), Jeremiah Lopez (member), Tyler Austin (member)

Accepted as baseline requirements for the project:

For the client: _____ Date: Nov 25 2025

For the team: Haley Berger Date: Nov. 26 2025

Table of Contents

Introduction

Science is dependent on the ability to share knowledge, but the system of research publication has failed to keep up with modern scholarship requirements. The area of interest for this project, the scientific peer-review system, was established more than seventy years ago and has undergone minimal changes since, leading to its faltering under the pressures of modern publishing environments. Scientific publishing is a vast field, encompassing a multi-billion-dollar industry that involves hundreds of thousands of researchers, publishers, and other contributors. Millions of fresh articles are produced annually, and with the growing use of tools like large language models for writing and editing, matters of credibility and trust have become increasingly pressing. What was once an assurance of scientific quality has now become an overused exercise that renders it difficult for researchers, particularly new researchers, to sift through an overwhelming amount of work.

Peer reviews are not currently widely and easily accessible. This makes it difficult for young researchers and students to learn from them to understand how to make their own. It also makes it difficult for researchers in general to find the most up-to-date information about a specific article. This could be, for example, a correction of a detail in a research paper that was found and published through a peer review. Peer reviews are often performed, but remain difficult to access and sometimes even locked behind a pay wall in journals. It's as though they are separate from the world of academics, despite its necessity.

The client for this project is Dr. Keith Nowicki. Dr. Nowicki is a professor and researcher in the Physics department at Northern Arizona University. He employs several undergraduate and graduate student researchers on his team and has written multiple scientific papers. As a result, Dr. Nowicki is immersed in the research and scientific publishing communities and is deeply invested in their success. He has seen the issues that have arisen or escalated in the system, and wants to improve these areas for upcoming generations of researchers.

Problem Statement

The current process of scientific publication has two ways in which peer reviews are performed. The first has three overarching steps:

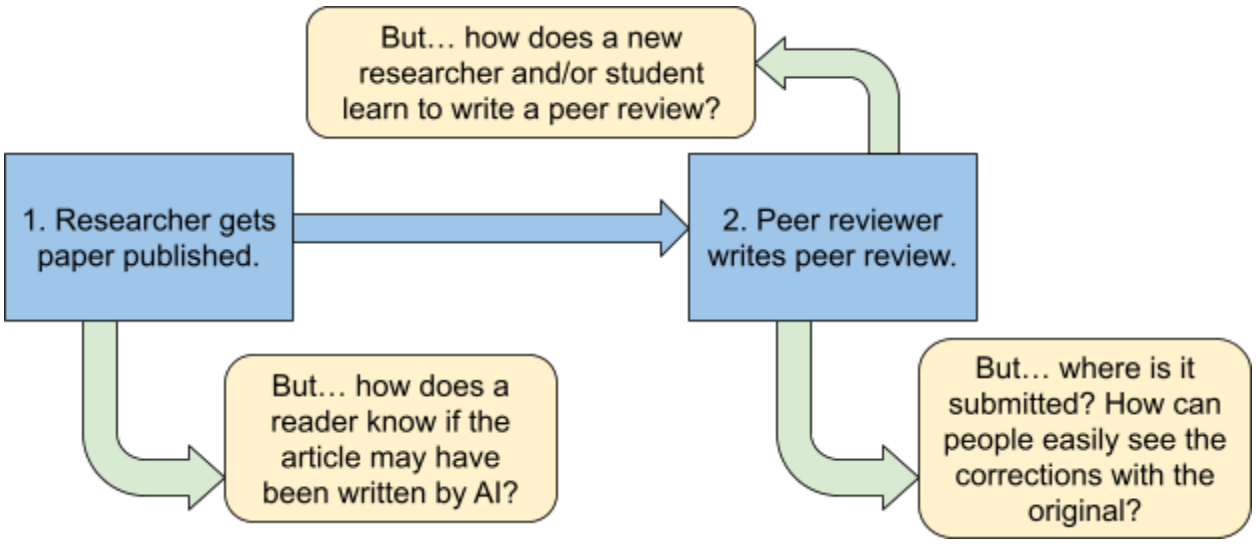
1. A researcher writes their paper and submits it to a scientific journal.
1. When a journal receives the paper, it reaches out to a few experts in the field to determine whether the paper is accurate and valuable (referred to as peer review).
2. If the submission is deemed to be both reliable and worthwhile, it is published in the journal, which indicates to readers that the paper is of high quality.

The second manner is called a post-publication peer review. This method is what our project will focus on. From this point forward, peer review as used in this document will refer to the following process (also depicted in Figure 1):

1. A researcher writes their paper and submits it to a scientific journal, where the journal publishes the paper after some internal deliberations and potential corrections.
2. After publication, other researchers perform peer reviews on the published paper to either validate or invalidate the paper's findings.

This system has remained relatively stagnant for the seventy years it has been in place. As people who are heavily involved in research and academia, Dr. Keith Nowicki and his research colleagues have recognized the challenges with scientific publishing, in particular, the peer review system. They have noticed that there is no real way for researchers to see other people’s peer reviews for articles, which could contribute to scientific understanding on the topic. Furthermore, he has seen the rise of AI cause article quality to decline, making the need to see other peer reviews even greater. Not only that, but in academia, he has found that many graduate students do not learn how to do peer reviews, and that even if he wanted to teach

them, there is not currently a platform that would facilitate this learning. Figure 1, shown below, demonstrates these issues in conjunction with the process that they stem from.



[Figure 1]

As pointed out by Dr. Nowicki's struggles, currently, there are considerable issues with the peer review system in academia that need addressing. The following are the primary issues that we have identified in this project:

1. It is difficult to find other people's peer reviews, making it incredibly challenging to know which publications are trustworthy or to determine whether other people have confirmed the validity of a publication.
2. It is difficult to see who has reviewed an article, making it difficult to see if validation came from a credible source.
3. Most curricula do not teach peer review, so new researchers often do not know how to write a peer review properly, leading to uncertainty and poorly written peer reviews when they start their careers.

4. AI is deteriorating article writing and reviewing with overuse and hallucinations, leading to publications that give false information. The increasing use of AI is also leading to overall distrust in the scientific community.
5. There is no collective compendium for articles and peer reviews to be viewed, making them very difficult to find and search for. This also makes peer reviews a hassle to find and search for.
6. There are no platforms where professors can have students submit peer reviews for review and editing, meaning that professors do not have a good way of teaching new and upcoming researchers how to properly write a peer review.

Solution Vision

To fix the issues detailed above, our group will be developing a web-based compendium of articles and peer reviews. The developed system will store these in a database that is easily searchable by article name and tag, where users can click on the article and see any peer reviews of it that people have posted, and are also given the option to post their own peer review. A user can also upload an article to the site if it is not already in the database. There will also be an option to flag an article for AI, and see if anyone else has flagged that article as written by AI or an author as an AI user, for the sake of transparency. The users on the platform will have to be both validated and sponsored by verified professors. These professors will be able to review all of their students' peer reviews before they are posted. A diagram, Figure 2, is shown at the bottom of this section and shows how our envisioned solution fits into the peer review process, fixing the previously mentioned issues.

Our features will include:

1. Allow users to make an account
2. Allow users to log in and log out
    a. Have account verification
    b. Allow users to change their passwords
3. Allow users to upload articles
4. Allow users to search for articles
    a. Have an advanced search to make finding specific articles or peer reviews easier
5. Page for viewing articles
    a. Show the details of the article, such as title, authors, abstract, and link to the full article

    b. Allow users to flag the article as having used AI
        i. If an article is flagged, so are all of its authors and all their papers
    c. Show a list of peer reviews made on the article, which links to a full viewing page for the reviews
    d. Allow users to make a peer review of that article
    e. Allow users to make a citation of the article
6. Allow users to upload peer reviews to associated articles, marking them as “in review” until the peer reviewer can be looked over by the student's guarantor/advisor (see related: 5d)
7. Allow the user to view peer reviews
8. Connect an account to a guarantor/advisor account (someone for whom a student user may work for, do research with, or learn how to peer review from)
9. View account (and associated peer reviews and uploaded articles with that account)

Some of the key details of the site are outlined below:

- The data that the system will use will all be provided by the users. A set of test users has already agreed to do initial uploads of several hundred articles that they would like to see on the website. Verified users can add to both articles and peer reviews, with approval from an advisor.
- The data from the system will be used to generate citations upon user request; otherwise, it is not transformed, only organized and displayed.
- The system will change the way that our sponsor, his colleagues, his researchers, and his students work. Instead of keeping their peer reviews to themselves, they will be able to upload their own peer reviews and look at the peer reviews of others to build scientific knowledge and learn from other researchers. Not only that, but Dr. Nowicki (and other potential professors) will be able to teach his students to do peer reviews by being able

to oversee and manage the associated students' peer reviews. This allows students to learn in a relatively low-stakes manner rather than just suddenly being pushed to make a peer-reviewed article with zero initial supervision. It will also help mitigate the fear of AI that many researchers face as they are looking at and for articles, as bots are kept off the website, and real users will be flagging articles for AI and/or mentioning it in their peer reviews of said articles. The trade-off is that the actual article will not be able to be displayed in full due to copyright, and will have to be linked to.

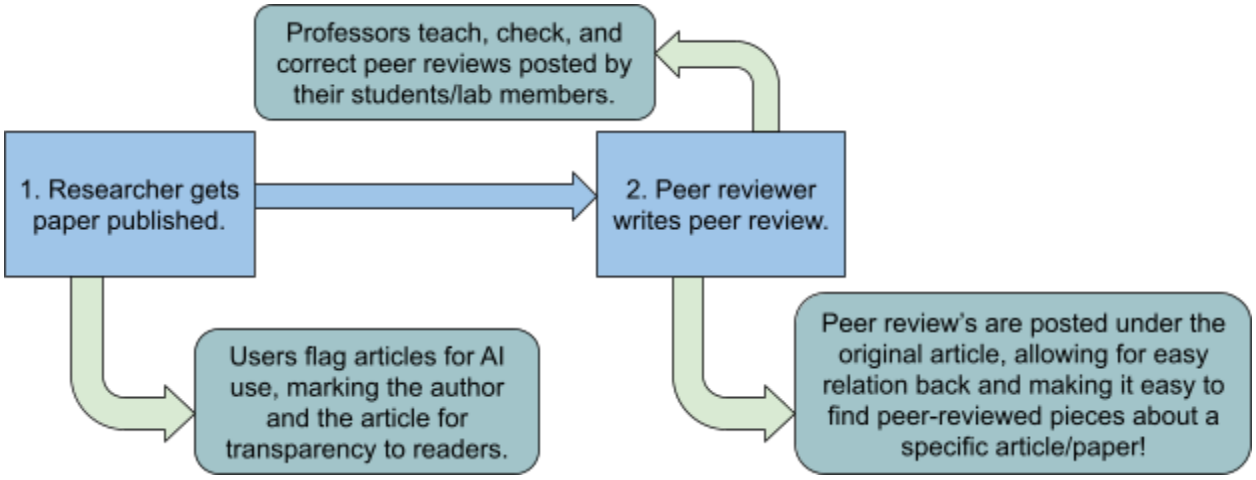
This system will allow researchers to revolutionize the peer review process so that it is collaborative, teachable, and flags authors who are untrustworthy. In this way, there will be better researchers producing more accurate content built on knowledge that has been discussed and added to in the peer reviews of other researchers, who have been taught to do high-quality peer reviews.

In summary, and to better connect our issues with our envisioned solution, the following table brings together both:

Problem	**Solution Feature**	**How is it addressed?**
1. Peer reviews are not easily accessible	Article and peer review database with a searchable interface	Makes peer reviews easily discoverable and viewable by verified users
2. Difficult to see who has reviewed an article	Lined reviewer profiles to peer reviews that are attached to the article page	Displays reviewer identity and credibility through verified academic accounts
3. Lack of peer-review education in curricula	Professor-student connection and advisor review system	Allows professors to teach and oversee student reviews directly on the platform
4. AI is degrading review and article quality	AI flagging system for articles and authors	Provides transparency and community moderation to discourage AI misuse
5. No unified compendium for	Centralized articles and reviews	Create a community-based database for peer-reviewed

reviews		content
6. No platforms where professors can manage and oversee student peer reviews	Instructor dashboards and workflow for approvals	Allows faculty to monitor, approve, and give feedback on student peer reviews

Overall, we envision our product to fix the peer review process such that:



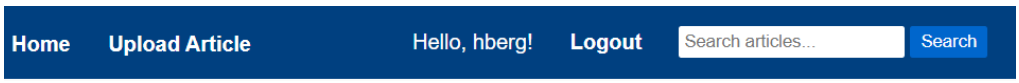
[Figure 2]

Project Requirements

Now, having defined our proposed solution, we would like to go over the specific requirements (functional, performance, and environmental) as we would need them to get to the solution we envision. The requirements are grouped in three categories: functional, non-functional (performance), and environmental. Functional requirements include things we must have in terms of use. It defines what users should be able to do. Non-functional requirements define what our website must be able to do from a performance perspective. This includes things such as how long a search for an article may take. Environmental requirements define things specified by our client, as well as specific hardware/software details we must consider.

Functional Requirements

To better clarify our functional requirements, we have organized them into a table, prioritized top down, and written user stories for each. When it comes to our 'must-haves', we have also attached screenshots of the current demo system.

<table>
<tr><td>Prioritization</td><td>Function</td><td>User Story</td></tr>
<tr><td rowspan="3">Must Have</td><td>Easily navigatable</td><td>As a user, I want to easily navigate the website and figure out just where it is I am trying to go with relative simplicity so that I can use the website effectively and not get frustrated.</td></tr>
<tr><td colspan="2"> 
</td></tr>
<tr><td>Account creation</td><td>As a student or researcher, I would like to be able to make an account so that I can perform the actions on the website.</td></tr>
</table>

Messages:

- You have signed out.

Menu:

- Sign In
- Sign Up

Sign In

If you have not created an account yet, then please sign up first.

Email: Email address

Password: Password Forgot your password?

Remember Me:

I'm not a robot reCAPTCHA Privacy - Terms

Sign In

Menu:

- Sign In
- Sign Up

Sign Up

Already have an account? Then please sign in.

Email: Email address

Username: Username

Password: Password

- Your password can't be too similar to your other personal information.
- Your password must contain at least 8 characters.
- Your password can't be a commonly used password.
- Your password can't be entirely numeric.

Password (again): Password (again)

I'm not a robot reCAPTCHA Privacy - Terms

Sign Up

Upload articles	As a researcher or student, I want to upload a new research article to the system so that others can review and reference it.

Upload Article

Publication number:

Title:

Abstract:

Authors: Enter multiple authors separated by commas.

Links

Url:

Delete:

Save

	Search for articles	As a user, I want to search for articles by title, tag, or author so that I can easily find specific research to review or cite.
		
	View articles	As a reader, I want ot open an article's page to see details about it, its authors, and read peer reviews about it so that I can understand the work and its feedback as well as learn about its credibility.

<table>
<tr><td></td><td colspan="2">

test article

Publication #: testpubnum

Abstract: feusifbkfbakb fueiwbfaib hewbfuywa h dead

Authors: test2, user1, user2, user3

Links:

- *No links provided.*

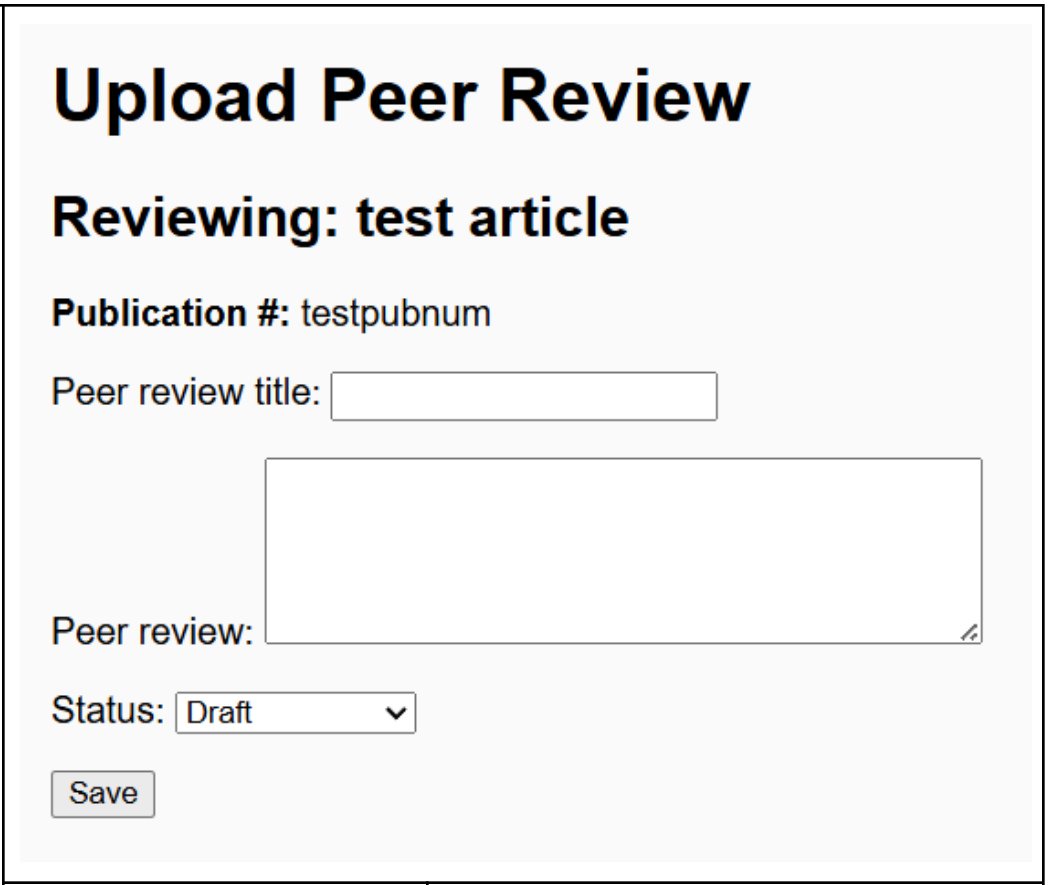
Uploaded by hberg

✏️ Edit Article | 📜 Generate Citation | Add Peer Review

Peer Reviews

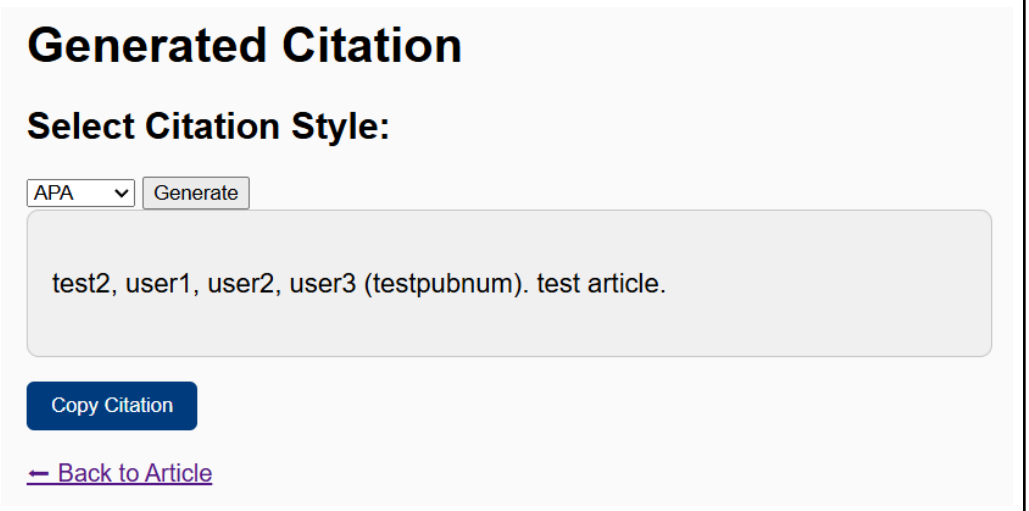
- *No peer reviews yet.*

</td></tr>
<tr><td></td><td>Post peer reviews</td><td>As a user (specifically a student or researcher), I want to post a peer review for a specific article so that I can correct or contribute a critique to an academic discussion.</td></tr>
</table>



View peer reviews	As a student or researcher, I want to view others' peer reviews for an article so that I can learn from what others are saying and learn about the article's credibility.

Copy article citation	As a researcher or student, I want to be able

		to copy the citation for an article I am viewing so that I can reference it in my own work or paper.
		
Should Have	Advisor peer review management (ability to mark a peer review as in review, denied, or reviewed)	As an advisor/guarantor training students for peer review, I want to review and approve my students' peer reviews before they are official, so that quality and accuracy are maintained and the students are able to properly learn to write peer reviews.
	Advisor/Student account connection	As an advisor, I would like to link my students' accounts to mine so that I can easily see what they post and be able to easily review their peer reviews.
	Flag articles for AI	As a researcher, I want to be able to flag an article for AI usage so that everyone has transparency on what was written by AI and what was not. I want to help maintain academic credibility.
	Save article to account (personal bibliography)	As a researcher or student, I would like to save articles to a bibliography so that I have all of my citations in one place for ease of use and access.
	Draft stage/save for peer reviews	As a student, I would like to be able to save my peer review at the draft stage so that I can come back to it later, but still have it posted for my advisor to look at.
Could Have	Comment on peer reviews	As a user, I would like to comment on others' peer reviews so that I can point out things

		they missed, ask clarifying questions, or just tell them I appreciate their review.
	Upvote/downvote peer reviews	As a user, I would like to upvote and downvote peer reviews so that the most helpful peer reviews for a specific article will appear at the top, and factually incorrect or entirely wrong reviews will be pushed to the bottom.
Won't Have	Full external journal integration.	As the development team, and for reasons relating to copyright, we will not have full external integration and will only include details that fall in the public domain.

Performance (non-functional) requirements

Now that functional requirements have been stated, we would also like to generally go over the performance requirements we have decided fit this project. Those include:

1. The article search will retrieve and display related articles within 1 second
    a. This supports our functional requirement of users having the ability to search for articles.
2. Article and Peer Review upload will take no longer than 0.5 seconds
    a. This supports our functional requirement of allowing users to upload articles and peer reviews.
3. Users will be able to understand the basics of the interface (article searching & peer review viewing) within 10 minutes of using the website
    a. This supports our functional requirement of the website being easy to navigate and intuitively understand.
4. Advisors will get an account authentication email for new users within 5 minutes of new user sign-up

a. This supports our functional requirement of account creation and connecting a student's account with their advisor's account.

Environmental Requirements

The development and deployment of our website must operate within several external constraints related to technology, hosting, academic policy, and data privacy. These factors define the bounds of what the team can control, what is out of our control, and what needs to be supported through the project's lifespan.

1. Hosting Platform
    a. The system must be simple to deploy and maintain by the client and future developers.
    b. This constrains us to an easily manageable development platform such as DigitalOcean. The team, as such, needs to rely on recovery systems from the host provider. Outages or service interruptions are beyond our control.
    c. The host must also be able to support a multitude of concurrent users.
2. Database
    a. The database system needs to be familiar to many. MySQL was a specific request, but we also found it to be the better choice than most options due to its versatility, ease of use, and general familiarity among developers.
    b. The system will use a MySQL database for structured storage of user accounts, article metadata, and peer review. This will be hosted again on DigitalOcean. While DigitalOcean has automatic database backups, we will still be at the whim of the hosting service if something goes wrong
    c. The database must also be able to be backed up somewhere where it is not connected to/communication with regular users

d. All data models, queries, and other details must then be designed around MySQL syntax and conventions.

1. Future Expansion
    a. The system needs to be easily expandable and support continued development.
    b. Given the intent for future use, an easily expandable and learnable web framework is needed (we chose Django). All systems must also be able to support flexible, growing development - hence we need a host that is easy to grow from and on, as well as a database that is easy to expand.

Potential Risks

As with any project, there are a multitude of risks and scenarios that could occur where operations go wrong and users can see/experience the effects. Our goal will be to minimize these occurrences as much as possible, but there will always be some instances where such problems arise. Outlined below are the risks that have been deemed most relevant to occur within the scope of our project.

One such case is spelling errors, causing the article search engine not to return the desired results to a user. Most times, this can be simply fixed by the user just re-entering the search with spelling modifications, and then the system will return the proper, relevant articles to them. Rarely, there will be some scenarios where the article asked for does not exist, and the requester will need to go elsewhere to find the scientific articles they require until the database is further expanded, as it will be continually growing.

A big risk for this product is that a user uploads an article to the database that has been made with AI. The main purpose of the project is to provide an environment that is free from AI-written articles that contain information that is simply untrue. As a result of this, the current method for detecting this sort of issue is to have advisors or peer reviewers determine that the scientific article has been made with AI tools and then flag the article in the system. This will leave an undetermined amount of time where regular users will be able to read and use this article, which should not be within the database itself, and contains wrong information.

Another risk of the project is our hosting platform, DigitalOcean, going down and not coming up for a significant period of time. This would cause users to be unable to use our service and, therefore, make our product unavailable during that period. In this scenario, there is not much that can be done on the development end as hosting relies on their servers, but we have decided to go with their managed hosting option so that the product will automatically go

back online as soon as possible. Thankfully, DigitalOcean has proven to be reliable in its uptime, and some research has shown it to have more uptime than AWS.

All of these risks thankfully only pose minor threats to the product due to the fact that there are systems or decisions in place to keep them in check. For instance, there will be minor spell checking and like spelling returns for articles when users misspell their searches. Then, for AI articles, there will be a flagging system for peer reviewers and advisors to screen all articles before they are put into the database. Finally, for the site going down, DigitalOcean has automatic reinitialization for the product in place that will bring the compendium back online as soon as possible.

Project Plan

Currently, our execution plan for our project has 5 major milestones that are as follows:

1. Our plan starts off with ending this semester with the basic tech demo/prototype of our project, working through PythonAnywhere. This demo will consist of the ability to upload articles, have a basic search bar, view articles, see & post peer reviews, a page for advisors to review submitted peer reviews, and a basic system to flag articles for AI. The initial articles and peer reviews in this demo will not be official and will only be for demo purposes.
2. At the start of next semester, we will be migrating over to DigitalOcean from PythonAnywhere with the goal of having that migration done within the first couple of weeks. This will have the same functionality as the demo, but with the expectation that official scientific articles and peer reviews will make their way in soon.
3. Once this is complete, we will begin working with the Steering Committee for this project to get all of them signed up on the platform so that they can begin user testing. This will include the addition of the first official information for the database, as well as the full test of the demo functionality systems (article upload, peer review creation, etc.).
4. Following their addition to the system, we will then get the system fine-tuned off on their feedback to have a user interface that works best for them. This will result in the fine-tuning of the article and peer review creation/upload elements, as well as determining how search functionality will be fine-tuned for further use.
5. Finally, after the Steering Committee has determined that the UI is ready to go and has the initial functionality necessary for broader usage, we will begin rolling out to graduate students and other faculty within the Physics department for more robust testing while we further fine-tune elements like search functionality, as well as working on stretch goals (should have & could have functional requirements).

Please see the diagram below, Figure 3, for a full overview of our planned schedule.

Task/Activity Name	Due Date	Prev Sem	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15	Week 16
Requirments Doc	11/26/2025																	
Tech Demo	11/26/2025																	
Project Poster	11/17/2025																	
Demo Flight Plan	11/21/2025																	
Final Website	12/5/2025																	
Project Marketing Video	12/5/2025																	
Wk 1 - 2: DigitalOcean Migration	1/23/2026																	
Wk 2: Test DigitalOcean Demo	1/25/2026																	
Wk 3: Introduce Steering Committee to Demo	1/27/2026																	
Wk 3: Testing Period for Steering Committee	2/1/2026																	
Wk 3: Take in feedback and adjust	2/1/2026																	
Wk 4 - 6: Work on fine-tuning base functionality	2/8/2026																	
Wk 6: Meet again with Steering Committee to discuss progress	2/22/2026																	
Wk 7: Improve Search Functionality for complex queries	3/1/2026																	
Wk 8: Final base testing with Steering Committee	3/8/2026																	
Wk 9: Begin testing roll out to graduate students	3/14/2026																	
Wk 10: Gather feedback from testing	3/21/2026																	
Wk 11: Make fixes and updates from feedback	3/29/2026																	
Wk 12: Continue taking feedback	4/5/2026																	
Wk 12: Begin work on stretch goals	4/12/2026																	
Wk 13-14: Continue Work On Stretch Goals	4/26/2026																	
Wk 15: Discuss project handoff with client	5/3/2026																	
Wk 16: Finish hand off and transfer of project	5/5/2026																	

[Figure 3]

Capstone Gantt Project Plan

Conclusion

Although the process of scientific publishing is essential to the advancement of knowledge, it still faces many obstacles in terms of accessibility, transparency, and educational value. Students and researchers who are learning how to contribute to their fields are heavily impacted by these problems. With our sponsor, Dr. Keith Nowichi, our team hopes to develop a platform that significantly improves peer review education and dissemination.

By developing a community-based website that brings together students and researchers in a common environment, we hope to address the shortcomings of the current peer review system while providing a safe place for students to learn how to properly write a peer review. An open and transparent environment, like the one we aim to create, will be great for producing high-quality peer reviews. Being able to search for articles and see if they are marked as made by AI, or see peer reviews of the article to decipher the credibility of the article, will also be greatly beneficial for those looking to find sources or information about a specific topic. The system will take what is currently a relatively independent process, where the results are often lost on the wide collective internet (meaning, it is sometimes difficult to find written peer reviews even if they exist) and turn it into something more collaborative, where students can get support from an advisor as they learn to write peer reviews, get inspiration and get ideas of what a peer review looks like by reading other peer reviews, and learn more about articles and easily get information about articles as they are relevant, making details about the article and its integrity more accessible.

This document has outlined the foundation of the vision as well as the necessary features needed to achieve this goal. We discussed the current issues with the peer review system and translated the needs to fix it into functional, non-functional, and environmental requirements. We also described potential risks, their mitigation steps, and a structured project plan for delivering a working prototype and full deployment, providing us with a significant

milestone in formalizing the project and development plans to ensure they all align with what the client and his group wish to achieve with our product.

The team will continue with the development of the project, refining the prototype and working to where we can effectively gather user feedback from user testing after the completion of our demo. We believe we are in a well-defined position and strongly understand the project, its impact, and our scope. We are excited to work towards a fully functional demo and improve the current peer review process, and scientific integrity that comes with it, as it stands.