

Lab 1 – Product Description

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1. Introduction

Students' interest in reading is in steady decline. This lack of interest in reading is significantly affecting students' performance in school. The lack of interest in reading is likely caused by students not having access to or not knowing about books that really connect with their interests. Students need a way to find books that they can engage with and get them interested in learning. Currently students are limited in their opportunities to find such books. The most likely way a student will find a book they connect with is through their school either by teacher or librarian recommendation. This is an inefficient method to search for books of interest. Software can help fill this gap in student learning. This can be achieved through using machine learning to identify student interest similar to how Netflix and other such streaming services recommend shows. As students begin to read more they will inevitably become more interested in learning in addition to the many other benefits of reading. AskMissy is the software we plan to develop to bridge the gap between students and reading. It will utilize machine learning to connect students with books that connect with them.

1.1. Societal Problem

When a younger student beginning their academic journey goes to find a book to read they are most likely to turn to teachers, librarians, and their peers. These kinds of people, depending on how well they know the student and how many books they know about, could make a recommendation that works for the student and get them interested in reading overall. However, because this is entirely dependent on both knowing the student well and having a wide array of books to recommend. This method is inefficient and a bad recommendation could lead to a student becoming disheartened with reading in general.

Specifically younger students would likely not know a lot about the wide range of book topics and genres. This lack of knowledge closes them off from a whole other world of learning

they otherwise could possibly enjoy. Exposing students to a wide variety of topics and genres is important for the learning process at all ages. So a lack of knowledge of what is out there could be detrimental to a student's education.

Many students, specifically those in poorer school systems, might not have access to many books or resources at their local library. This kind of lack of access greatly limits learning to those who may benefit from it the most.

Figure 1:

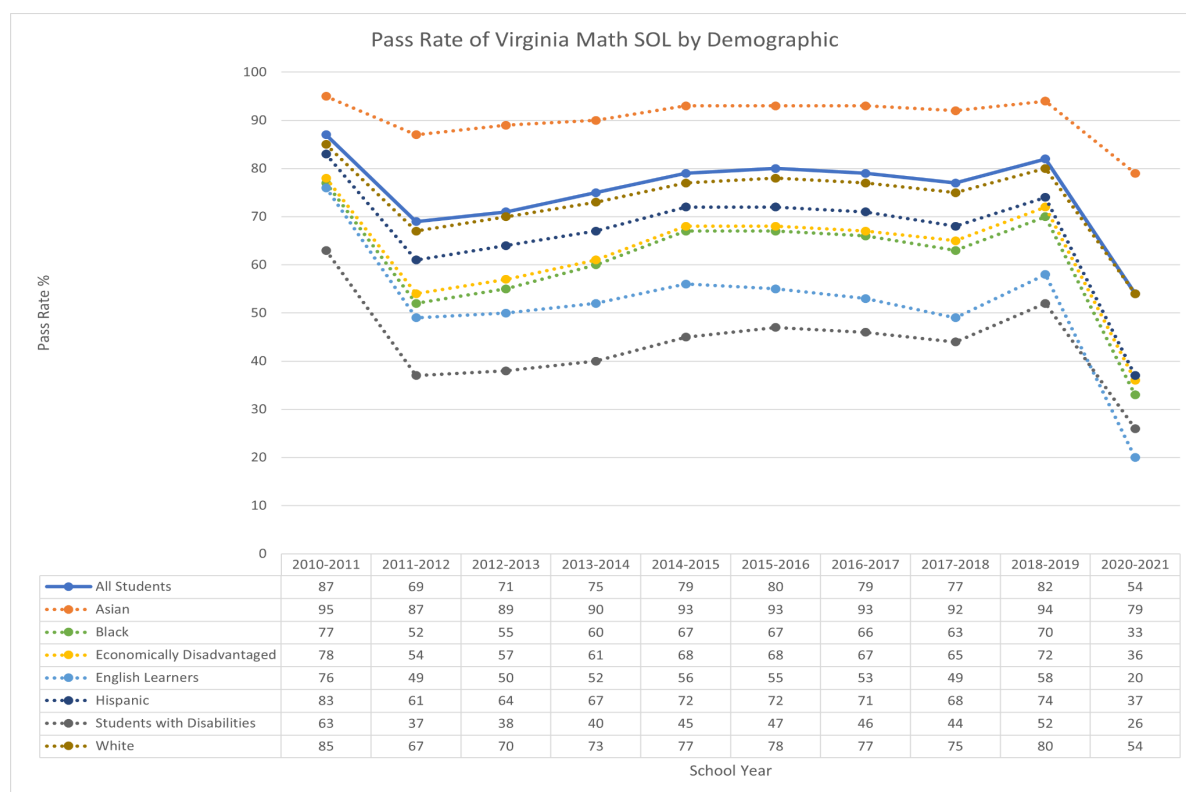
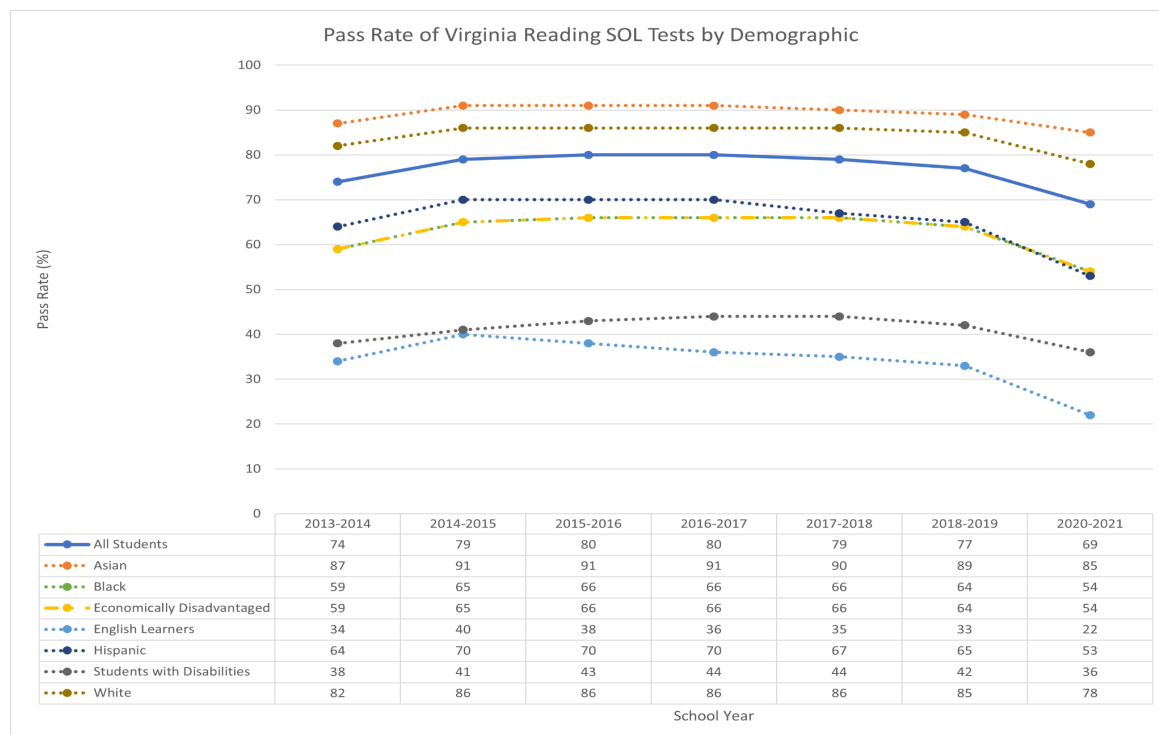


Figure 2:



As shown above, students' SOL scores have been in significant decline since the 2015-2016 school year. The most recent and significant of these drops was this past year 2020-2021. The pandemic has caused a gap in students' learning and disconnected the student from their school. Students would be more successful if they had an easy way to interact with and find their school's resources.

Teachers are struggling to get students invested in their own learning. Which is key to raising a child to be a lifelong learner. When students learn and what interests them and how they learn it empowers them in many aspects of their lives extending even beyond schooling.

Middle and high school students specifically are in the process of discovering themselves and providing a way for them to explore a possible interest in reading is important to our future. Students themselves are an investment in our future and it is important that they are given every opportunity to succeed and become happy and healthy learners.

1.2. Solution - AskMissy

Finding resources and books doesn't have to be as difficult as it currently is. Machine learning enables us to teach machines to do amazing things. Machine learning is already used by companies such as Netflix to find show recommendations so why not apply the same concepts to books? That is where AskMissy comes in. AskMissy seeks to use machine learning to produce personalized recommendations for students to get them more engaged in their own learning than they otherwise would be. Once students are more engaged in their learning it is likely that SOL scores will increase with that.

The age range AskMissy seeks to target is students in early middle school up to high school seniors. This age range is where SOLs are taken most often and where students would benefit the most from having an additional way to find books to read. Students

AskMissy will utilize machine learning to recommend books that students would engage well with based on their preferences, previous searches, teacher feedback, and their own feedback. The machine learning algorithm will take all of those factors into consideration when recommending a book to a student when they search.

Teachers and librarians are integral parts of the school system and students' learning. AskMissy does not seek to replace teachers and librarians as resources but to enhance their ability to help a wide range of students. Teachers and librarians will be an integral part of the design of the AskMissy program.

2. Product Description

2.1. Summary

As part of AskMissy's dedication to empowering both teachers and students AskMissy will implement a classroom feature that allows teachers to create class groups for students to join. This class group feature will allow teachers to give input on recommendations for students

as well as recommend books for the class as a whole. The teachers and students will be able to provide feedback on books recommended to provide more data for the machine learning algorithm to pull from.

AskMissy will be a web based application with user logins and user profiles that can be private or public based on user preferences. A user without a profile will only be able to access a basic search through the AskMissy and local libraries database. Once a user has created a profile they will have access to machine learning based search results. Which uses inputs from several sources to create results that will connect with the students.

There are two key machine learning algorithms involved in the AskMissy design. The first one is the language recognition algorithm. That algorithm is used to generate tags from book summaries gathered from the Goodreads API. These tags are then used as part of the second machine learning algorithm to connect users with tags that are in their preferences or they are likely to be interested in based on user feedback.

2.2. Goals

The goal of AskMissy is to improve students' ability to find supplemental educational materials. While striving for this goal we also seek to keep teachers and librarians informed on students' interests and educational journey so that they can better do their job in assisting students in their educational journey. As students become more engaged and invested in their own learning we expect SOLs to improve along with them. This is because reading SOLs are largely based on reading comprehension that would inevitably increase as students read more.

2.3. Key Product Features and Capabilities

AskMissy will be a web based application hosted online so users can have access to the program wherever they are. With the rise in smartphones and other smart devices it is important to develop a program that works on all types of internet devices. Users who do not have an

account will be considered guests and have limited access. However, users who do make accounts with AskMissy will have access to the full capabilities of AskMissy. If student and teacher users wish to connect their account with their school they will need to.

2.3.1. User Capabilities

Table 1:

Key: M = Manipulate A = Access							
Category	Feature	Guest	Student	Teacher	Librarian	Administrator	Tester
Data Retrieval	Metadata Report			M, A	M, A	M, A	
	Basic Search	A	A	A	A	A	
	AskMissy Search		A	A	A	A	
Data Management - Live Product	Machine Learning					M, A	
	Source Tag Creation						
	Source Tag Management				M	M	
	Lesson Plans			M, A	M, A	M, A	
	Internal Database Manipulation				M, A	M, A	
	External Database Manipulation					A	
Data Management - Development	Source Tag Development						A
	Machine Learning Training						A
	Simulated Data						M, A
	User testing reports						A

Security	Login/Authentication	A	A	M, A	M, A	M, A	
	Data Encryption, moving					M, A	
	Data Encryption, resting					M, A	
Account Management	User Profile		A	M, A	M, A	M, A	
	Feedback		A	A	A	M, A	
	Group Management			A	M, A	M, A	
	Login/registration	A	A	M, A	M, A	M, A	
UI	Group Interaction		A	M, A	M, A	M, A	
	Bug Report	A	A	A	A	M, A	
	Basic Search	A	A	A	A	A	
	AskMissy Search		A	A	A	A	
	Communication		A	M, A	M, A	M, A	
	Personal Data Report	A	A	A	A	M, A	

2.3.1.1. Guests

Guest users will be using a limited version of AskMissy. They will not be able to access the main functionality of AskMissy being the personalized recommendation search. This is because without an account we cannot track preferences properly.

2.3.1.2. Students

Students who sign up for an account will be able to use the full functionality of AskMissy. They will get access to personalized recommendation search as well the ability to build a user profile that can be public or private. They also gain the ability to join classrooms and school systems provided they have a valid ID on file. They gain the ability to provide feedback to AskMissy and the school system. They do not have any manipulation privileges.

2.3.1.3. Teachers

Teachers who have verified accounts with a school system will be able to do all the same functions as students but also gain the ability to create and manage classrooms as well as receive feedback from the classroom.

2.3.1.4. Librarian

Librarians who have verified accounts will be able to receive and manage data from student feedback. Most importantly they will be able access and manage the database to update their local AskMissy library with new entrants.

2.3.1.5. Administrator

Administrators will be able to access and manipulate almost every aspect of the AskMissy program as to ensure proper use and smooth operation. Notable access to the database and machine learning algorithms will be important.

2.3.1.6. Tester

Testers are purely for development purposes only and are meant to simulate our most basic user, a student, while having access to the sample database to manipulate data to run appropriate tests with different sets of data.

2.3.2. Feedback

Users and teachers will be able to provide feedback to the AskMissy algorithm when they are given recommendations based on preference based searches. If the recommendation

is or is not a good recommendation the feed back will good back into the algorithm and the algorithm will learn to avoid books with certain tags or recommend more books with certain tags.

2.3.3. Database

There will be several databases involved in the AskMissy system. Firstly there will be the school local database for their library which AskMissy will pull from to provide students with an inventory of books in the library. There will also be an AskMissy database which will contain user profiles, classrooms and outside resources. The final database will be the external API and database we will be using to get book information and summaries to put through the language recognition algorithm.

2.3.4. Machine Learning

There will be two main machine learning algorithms applied in the AskMissy design. Firstly the language recognition algorithm will be used to generate tags from book description pulled from an external API. These tags will then be attached to the book in the database and are used in the second machine learning algorithm. The second algorithm will be the resource matching algorithm. This algorithm will match users with recommendations when a user uses the AskMissy search functionality. The matching will be based on the tags generated in the first algorithm and user preferences.

2.4. Major Components (Hardware/Software)

The only user hardware that will be required to use AskMissy will be an internet capable device. As mentioned before, AskMissy will require three databases to work. The local library database, the AskMissy database, and the external API's database. The only database that will

be kept and manipulated by the AskMissy team will be our database. We do not need access to manipulate any school or external database.

Since AskMissy will be built on and for the internet AskMissy will be utilizing HTML5, CSS3, and Javascript to create the frontend being the website itself. The backend algorithms will utilize python due to its strong machine learning and data management support. Such supports include Scipy and pytorch which will be integral to developing the prototype. The package manager we plan to use is anaconda to manage the code libraries the python code will run off of. The IDE we plan to use is Microsoft Visual Studio Code. For the repository and version management we will be using Gitlab due to the support it has with ODU servers. The database management tool we will be using will be mySQL.

3. Identification of Case Study

AskMissy is targeted at middle school and highschool students and their schools. AskMissy seeks to improve student SOL scores by enhancing student learning by getting students invested in their own education by providing them resources that connect with them. Getting a student interested in reading and learning would inherently increase SOL scores because the student would have a personal interest in learning rather than being forced to learn.

AskMissy will be used by school libraries to enhance their ability to recommend good books to their students. This is not meant as a replacement for teachers and librarians but as a supplementary material to help them get to know their students' interests better. The program does this allowing teachers to create classrooms and providing them with class statistics and classroom feedback.

As student interest in books grows, this product could also benefit local bookstores and book publishers. If AskMissy accomplishes its original intent it will grow the demand for books from the younger generation which is notoriously reading less.

4. Product Prototype Description

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5. Glossary of terms

- **Administrator:** A user who is responsible for managing a majority of AskMissy's working data.
- **Agile:** Set of frameworks and practices where solutions evolve through collaboration between self-organizing cross-functional teams
- **AskMissy:** A software application that will help users find more relevant resources
- **API:** Application Programming Interface
- **Data Retention:** The continued storage of an organization's data for compliance or business reasons
- **Database:** Structured data held in a computer
- **Economically Disadvantaged:** A student in Virginia is considered economically disadvantaged if the student:
 - is eligible for Free/Reduced Meals
 - receives TANF, or
 - is eligible for Medicaid
- **Exact Match Search:** A search for a single specific type of resource.
- **File Server:** Controls access to separately stored files
- **Guest:** A user who is not a student, teacher, librarian, or administrator; has limited access to the AskMissy program.
- **Librarian:** Responsible for managing the library's inventory/database, communicating with teacher and students
- **Personal Learning:** An educational approach that aims to **customize** learning for each user's strengths, needs, skills, and interests.
- **Student:** A person studying at a K-12 education institution in need of reliable resources.
- **Teacher:** A person who helps students (K-12) to acquire knowledge; Responsible for making plans, managing students' groups/communication.
- **Temporary Assistance for Needy Families (TANF):** Provides eligible families with a monthly cash payment to meet their basic needs
- **Tester:** Responsible for designing and conducting testing suites for usability testing
- **User:** A user will be anyone using the AskMissy Interface and will fall into the category of a guest, student, teacher/mentor, librarian or admin.
- **Web Scraping:** Extracting/scraping data from websites

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