Lab 1 - Study Buddy Description

Joi Best

CS 411

Mr. Thomas Kennedy

25 March 2019

Version: 3
Table of Contents

1 Introduction ................................................................................................................................................. 2

2 Study Buddy Product Description ........................................................................................................... 5
   2.1 Key Product Features and Capabilities ............................................................................................... 6
   2.2 Major Components (Hardware/Software) ........................................................................................... 8

3 Identification of Case Study .................................................................................................................. 10

4 Study Buddy Product Prototype Description ......................................................................................... 11
   4.1 Prototype Architecture (Hardware/Software) .................................................................................... 12
   4.2 Prototype Features and Capabilities .................................................................................................. 13
   4.3 Prototype Development Challenges ................................................................................................... 14

5 Glossary .................................................................................................................................................... 15

6 References .................................................................................................................................................. 16

List of Figures

Figure 1: Current Process Flow .................................................................................................................... 3
Figure 2: Proposed Process Flow .................................................................................................................. 5
Figure 3: Intelligent Buddy Matching Algorithm .......................................................................................... 7
Figure 4: Major Functional Components Diagram ...................................................................................... 8
Figure 5: ODU Find a Study Group webpage .............................................................................................. 11

List of Tables

Table 1: Prototype Features ........................................................................................................................ 13
1 Introduction

Study Buddy will be a web application designed to help anyone pursuing knowledge find the ideal match for a study group. Student Success Center at Eastern Illinois University (2018) defines a study group as a small group of students with similar goals who meet regularly to review course material and prepare for exams. Study Buddy will provide users with an organized way to match with like-minded individuals.

One benefit of joining a study group is being able to share talent and knowledge within the group. Students with different perspectives can offer insight on new topics and improve the group’s collective understanding of course materials. Study groups tend to be more fun because there are individuals to discuss content and create exciting activities to help the group retain information. Studying with a friend also makes students less likely to procrastinate and increases students’ commitment to the coursework, which improves learning outcomes.

The peer support in study groups helps students retain lecture material. Keith Sawyer, a professor at Washington University, conducted a study where he followed college students in study groups and in the classroom. He noticed that when the students took notes during lecture classes, they were so busy writing that it was hard for them to really absorb the material. However, in study groups, they constantly looked down at their notes and back up to their peers. Through those interactions, Professor Sawyer determined that “study groups are so effective because they provide a way for students to make the lecture notes their own” (2016). Lynden Barry, a master’s student at Southern Cross University, explains the importance of study groups for online students. Barry has her own study buddy and she found that the additional peer support and encouragement “can be the difference between passing and failing” (2016).
Joining a study group can benefit students in several ways, however, it is often difficult for some students, particularly for shy students and online students, to form study groups. Figure 1 shows the struggles some students face during the process of finding a study group. Students have limited ways to communicate, such as posting on a discussion board or emailing a classmate, but this can lead to a negative response and the student will be left to study alone. Shy students sometimes do not feel comfortable asking other students for help, so they miss out on being matched with a study buddy. Online students are physically unable to meet up with study groups, so they also miss out on the great benefits of joining study groups.

Figure 1: Current Process Flow

Along with the difficulties of physically forming study groups, some students find it challenging to find like-minded peers with similar study habits, lifestyles, and motivations. Different study habits can lead to students clashing in a group, and not getting work done. Some students choose to prioritize studying during study groups to only focus on the coursework,
while others enjoy socializing and chatting while they study. Some individuals prefer studying at night, so it would be difficult to adapt with students who prefer to study during the day.

Incompatible learning styles can make it difficult to find ideal study partners. Auditory learners best comprehend information by listening to information rather than reading it or seeing it visually. Reading/Writing learners learn best by reading texts and rephrasing it in traditional lecture and note-taking environments. Visual learners best understand information by visualizing relationships and ideas through maps, charts, diagrams and essays. Kinesthetic learners work best by participating in activities or solving problems in a hands-on manner. Learning styles within groups can make a difference in students’ ability to focus and maintain motivated while studying.

Different motivations for joining a study group can influence the students’ test outcomes as well. Some students may be motivated to join a study group to get a head start and meet deadlines on assignments, while other students feel the need to join a study group for the sole purpose of reviewing for upcoming assessments. Students choose which study groups to join depending on the motivations of other students in the group.

Another challenge is connecting with people due to different responsibilities and scheduling conflicts. Students often have various family, work, and school responsibilities that may interfere with one another and hinder participation in a study group. It can also be difficult to create a schedule that works for everyone in the study group.

Study Buddy will improve study group organization and allow people to share knowledge between like-minded individuals. The end-user will utilize the application to match with others based on set preferences and filters. Figure 2 displays the proposed process flow for Study
Buddy. Online and shy students will be able to easily set up a study group based on specific preferences such as class, subject, and topic. The user will be able to find study buddies that have similar learning styles, availability, and motivations. The application will also have integrated tools for groups to use to enhance communication and collaboration.

![Flowchart](image)

*Figure 2: Proposed Process Flow*

2 Study Buddy Product Description

The Study Buddy application will consist of a feature to match people with others based on set preferences and filters. Individual availability, study subject, learning styles, and group size, will be used to find potential study buddies for individuals. In addition, the application will have integrated tools for groups to use to improve collaboration and communication. End users will be able to rate individuals after having studied with them, to facilitate in better study buddy matching. Study Buddy will consistently adapt to users’ preference and will show that studying can be organized, fun, and achievable.
### 2.1 Key Product Features and Capabilities

Study Buddy will utilize a web user interface to capture the end users’ input. The application will use the Intelligent Buddy Matching algorithm to match users with their ideal match. Users will also be able to utilize external applications to facilitate communication and collaboration.

The User Interface will be equipped with several features to help users navigate the website. The Home Screen will consist of a returning user’s option to sign in or a new user’s sign up option. Returning users can click on the returning user option and be prompted to enter their email and password. New users will have to sign up by entering their name, email, school, phone number and create a password. After entering the site, end users will arrive at the Main Menu, which consists of the Study Buddy questionnaire that allows them to select availability, study preferences, courses, study topic(s), group size preference, and time/location (online/in person). Users will create profiles with their preferences, and the data will be gathered. Once each student is done using the Study Buddy application, they will be prompted to an Exit Screen that will allow them to close the application. The data collected from the end users will then be used in the algorithm to find a Study Buddy match.

One key feature of the Study Buddy application will be the Intelligent Buddy Matching algorithm. To match users with one another, Study Buddy will use a proprietary intelligent buddy matching system which gathers information from the users’ answers to a questionnaire. First, the Study Buddy system will create a possible match list. Then, a similarity score will be computed based on users’ preferences. Lastly, the users will use the matched buddies list to form study groups.
The Preprocessing algorithm will create a list of possible matched buddies. Once the end users enter class/subject or topic into the system, a list of people who are searching for the same class or topic will also be created. Next, the system will remove users with different availabilities and remark buddies who are on the blocked list.

The Intelligent Buddy Matching algorithm will match users based on study preferences. Study preferences will be stored in vectors and the similarity score will be measured by computing the cosine of an angle between 2 vectors. When the preprocessing is done, the system will compute a similarity score, of each study preference vector, between the user’s vector and the possibly matched buddy’s vector. The possible matches list will be sorted according to the sum of the similarities. Figure 3 shows an example of the Intelligent Buddy Matching algorithm.

\[
\cos \theta = \frac{\mathbf{W} \cdot \mathbf{C}}{\|\mathbf{W}\| \|\mathbf{C}\|}
\]

\[
= \frac{2}{\sqrt{2} \times \sqrt{3}} = \frac{2}{\sqrt{6}} \approx 0.8165
\]

<table>
<thead>
<tr>
<th>Learning Style</th>
<th>User: Jamal Williams</th>
<th>User: John Crotzer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual</td>
<td>[1]</td>
<td>[1]</td>
</tr>
<tr>
<td>Auditory</td>
<td>[0]</td>
<td>[0]</td>
</tr>
<tr>
<td>Kinesthetic</td>
<td>[1]</td>
<td>[1]</td>
</tr>
<tr>
<td>Reading/Writing</td>
<td>[0]</td>
<td>[0]</td>
</tr>
</tbody>
</table>

*Figure 3: Intelligent Buddy Matching Algorithm*

The cosine of an angle is the result of the dot product of two vectors over the magnitude of vector A times the magnitude of vector B. Two vectors with the same orientation have a cosine similarity of 1, orthogonal vectors have a similarity of 0, and two vectors diametrically opposed have a similarity of -1. In Figure 3, the two vectors have more similarity if the result is closer to 1, so with a cosine of approximately 0.8165 the two users have a strong similarity. This similarity score will be used to sort the possible buddy match list in descending order.
Study Buddy will also use external services to facilitate better online study group communication and collaboration. Some APIs that will be integrated into Study Buddy include: Google Drive, Google Hangout, Codeshare, Jupyter Notebook, Slack, and Git. Google Hangouts will be used to help online students communicate with live students during study groups. Slack chat will be embedded directly into Study Buddy for private messaging and video calls. A feature will be added to also allow users to create and share repositories using Git. Google Drive will be used for file storage and sharing. Codeshare will be used for real time collaboration on software assignments, and Jupyter Notebook will be used for sharing mathematical equations and visualizing data.

2.2 Major Components (Hardware/Software)

Figure 4 depicts the Major Functional Components of Study Buddy where end users will be using devices with internet access to access the Study Buddy Web Application. The database will store and process the users’ information and the server will host the Study Buddy application. The Study Buddy web application will be developed using Java Enterprise Edition (Java EE). To facilitate online study groups, the application will be integrated with some online collaboration tools such as the ones mentioned in Section 2.1.

Figure 4: Major Functional Components Diagram
Study Buddy will incorporate several design patterns for clean, concise code, and a well-planned design. The Model View Controller (MVC) pattern will divide the three different component layers of the application to allow for efficient development. Some developers can work on the front end (View), while others can work on the back end (Controller) at the same time with code changes having no impact on one another. The facade design pattern will allow for abstracting complex backend business logic behind a facade interface. The purpose of a facade interface is to make the subsystem easier to use and hides the complexities from the client. The Data Access Object (DAO) pattern provides all of the database querying logic. DAO will be used as the doorway into the data persistence layer and will provide all the necessary methods needed to add or search the database.

The foundation that the Study Buddy application will rest on is the Java Server Faces (JSF) Framework. The intuitive framework will allow for a strong and modern user interface design. The JSF framework is an MVC framework that will support expression language and will enable the communication of data to and from the front end and back end server.

The Java Persistence API (JPA) will be used to access, and manage data between Java objects, classes and relational database tables. Tables are modeled from entity classes which are Java classes, and JPA supplies a mechanism for SQL query construction. The issue of data persistence will be solved by the Java Persistence API, which implements the object-relational mapping technique to achieve object persistence. JPA will supply the entity annotation that marks classes that need to be saved in a database and will create the tables inside the database from the fields of the entity classes. The entity manager and its supplied methods make basic database operations: Create Read Update Delete (CRUD) simple and easy to achieve.
3 Identification of Case Study

The intended customers for the Study Buddy Application will be High Schools, Universities, and Organizations for Certification & License. High schools can use the product to help students’ study for the SAT and ACT. Universities can use the product to connect online students with live students. Organizations for Certification & License such as CompTIA, AWS Certifications, and The Bar Examination will be able to offer individuals the ability to match with other students who are studying for the same assessment.

Study Buddy will be designed for anyone pursuing knowledge, with particular focus on students. Universities will be the target consumer group because there is a nice mixture of online and shy students. As shown in Section 1, online and shy students often find the most difficulty joining study groups, so an application that can help these students is very necessary. Students with varying majors, personalities, and schedules attend Universities and this will be a great place to market Study Buddy. Universities also have several different students who may take similar classes, so the Study Buddy application will come in handy when students want to join study groups. Students will be able to form groups with people in their classes or online and experience an effective study group by utilizing the application.
Old Dominion University (ODU) will be the first University in which Study Buddy will be implemented. ODU has a large population of online students and can use the application to promote better studying habits. ODU currently has a Find a Study Group web application, as shown in Figure 5. The current version is a quick solution to the problem, but ODU needs a better site to help students find effective study groups.

Figure 5: ODU Find a Study Group webpage

4 Study Buddy Product Prototype Description

The Study Buddy prototype will consist of similar functionality of the end product. The Study Buddy Prototype will implement the majority of the algorithms required for the final product. The Intelligent Buddy Matching algorithm will be altered on the prototype to match users on a reduced set of study preferences. The distribution of the web application will be limited to an internal testing team. The geographical area will be restricted to Old Dominion University for testing purposes.
4.1 Prototype Architecture (Hardware/Software)

The prototype architecture will consist of a server and a database. The prototype database will be similar in structure to that of the final product. The web application functional components will be similar to those of the final product, shown in Figure 4 and Section 2.2.

A computer with Internet access and a Web browser will be used to access the Study Buddy Web site. The foundation that the Study Buddy prototype will rest on will also be the Java Server Faces (JSF) Framework. The framework will allow for a robust and innovative user interface prototype design. The Java Persistence API (JPA) will be used to access, and manage data between Java objects, classes and relational database tables. The prototype application will utilize a Microsoft SQL Server 2017 to store user’s personal information, and industry best practices will be used to secure the data. JSF and JPA will run in a Java Enterprise Edition (Java EE) container such as Glassfish. Glassfish Application Server version 4.1.2 will be used to host the prototype web application.
4.2 Prototype Features and Capabilities

As discussed in Section 2.1, the Intelligent Buddy Matching algorithm is the innovative feature that will be demonstrated by the Study Buddy prototype. This feature will allow both online and shy students to find the ideal match in a study group. Some prototype features will differ from the real-world project in scale. Some features will be eliminated from the project due to limited development time. A complete list of features is available in Table 1.

<table>
<thead>
<tr>
<th>Features</th>
<th>STUDY BUDDY Final Product</th>
<th>STUDY BUDDY Prototype</th>
</tr>
</thead>
<tbody>
<tr>
<td>GUI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Login</td>
<td>Allows user entry of authentication credentials</td>
<td>Will be implemented</td>
</tr>
<tr>
<td>New User</td>
<td>Allows a user to create an account</td>
<td>Will be implemented</td>
</tr>
<tr>
<td>Study Preference Setting</td>
<td>Allows users to set study preferences for intelligent buddy matching algorithm</td>
<td>Will be implemented with limited study preference fields</td>
</tr>
<tr>
<td>Search for buddies</td>
<td>Allows user to search for study buddies</td>
<td>Will be implemented</td>
</tr>
<tr>
<td>Create a study group</td>
<td>Allows user to create a study group</td>
<td>Will be implemented</td>
</tr>
<tr>
<td>Set wait time</td>
<td>Allows user to set wait time in case of no matched buddies found</td>
<td>Will not be implemented</td>
</tr>
<tr>
<td>Features</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Web Application</td>
<td>The way in which the user will interact with the Study Buddy application using a web browser</td>
<td>Will be implemented</td>
</tr>
<tr>
<td>Mobile Application</td>
<td>The way in which the user will interact with the Study Buddy application using their smartphone device</td>
<td>Will not be implemented</td>
</tr>
<tr>
<td>Private Message</td>
<td>Allows users to send and receive private messages within the Study Buddy App</td>
<td>Will not be implemented</td>
</tr>
<tr>
<td>Block buddies</td>
<td>Allows users to block buddies with different goals</td>
<td>Will not be implemented</td>
</tr>
<tr>
<td>Partner match by subject of interest</td>
<td>Matching Study Buddies by their own subject interest</td>
<td>Will be implemented</td>
</tr>
<tr>
<td>Intelligent Buddy Matching</td>
<td>Matching Study Buddies with the proprietary algorithm</td>
<td>Will be implemented</td>
</tr>
<tr>
<td>Google Hangout Integration</td>
<td>Allows users to integrate their Google Hangouts accounts for setting meeting times and web conferencing</td>
<td>Will be implemented</td>
</tr>
<tr>
<td>Google Drive Integration</td>
<td>Allow users to share documents</td>
<td>Will not be implemented</td>
</tr>
<tr>
<td>Slack Integration</td>
<td>Allows users to integrate their Slack accounts, allowing channels to be made to aid in communication between Study Buddies</td>
<td>Will not be implemented</td>
</tr>
<tr>
<td>Git Integration</td>
<td>for creating repositories to share with your study buddies</td>
<td>Will not be implemented</td>
</tr>
<tr>
<td>Codeshare integration</td>
<td>Allows users to share their code real time with their Study Buddies</td>
<td>Will not be implemented</td>
</tr>
<tr>
<td>Schedule syncing</td>
<td>Allows users to make matches with Study Buddies based on the availability they input</td>
<td>Will not be implemented</td>
</tr>
<tr>
<td>Rate your buddy</td>
<td>Allows users to provide feedback on their Study Buddies</td>
<td>Will not be implemented</td>
</tr>
</tbody>
</table>

*Table 1: Prototype Features*
The study preference field will be limited due to time constraints. The feature to allow users to set wait times for study groups will not be implemented on the prototype. Block buddies list, private messaging, rate buddy feature, and scheduling synching, will not be added to the web application prototype. Some external tools will not be integrated such as Slack, Git, Google Drive, and Codeshare due to limited development time.

4.3 Prototype Development Challenges

The prototype development process comes with some challenges such as language unfamiliarity and framework unfamiliarity. Team members will have to learn about several programming languages such as Java, HTML, and CSS to complete the prototype. To understand how the different languages will be utilized in the prototype, members will research, ask questions, and help one another to gain a better understanding of the language.

Along with knowledge of the language, understanding the framework may also be a challenge. While working on the prototype, members will be able to gain knowledge about different development tools and frameworks to build the application. Knowledge about the Java Server Faces (JSF) Framework will be needed to start designing the user interface of the prototype. Learning more about the Java Persistence API (JPA) is also necessary to understand how the data will be managed.

Another challenge of prototype development is understanding how to use the external collaboration tools’ APIs. Each collaboration tool uses its own set of APIs that may be difficult to learn if there is no proper documentation. It may be challenging to integrate these APIs into the prototype with little knowledge of the interface, but members will mitigate this by researching, watching tutorials, and asking questions.
5 Glossary

**Auditory Learner** - best comprehend information by listening to information rather than reading it or seeing it visually.

**Business Logic** - The programming that manages communication between an end user interface and a database.

**CRUD** - Stands for Create, Read, Update, and Delete. Basic database/application operations.

**Entity Class** - A simple Java Class with member variables and getter and setter methods defined.

**JPA** - Java Persistence Application Programming Interface is an API for handling all database operations such as storing or retrieve entities from the database.

**JSF** - Java server faces is a java framework that couples the view and servlet into one managed component.

**Kinesthetic Learner** - best comprehend information by participating in activities or solving problems in a hands-on manner.

**Learning outcomes** - statements that identify the knowledge, skills, or abilities learners should gain by the end of a particular assignment, class, course, or program.

**Modern Interface Design** - the process of making manageable interfaces for computing devices, with a focus on current styles.

**ORM** - Object-relational mapping. Technique for persisting objects into a database table. Tables are modeled after Entity classes.

**Procrastination** - delaying or postponing a task, which needs to be completed, often to the detriment of the procrastinator.

**Prototype** - the prototype of Study Buddy will be a reduced scale version of the final product and will demonstrate the functionality of the completed product in a simulated environment.

**Reading/Writing Learner** - best comprehend information by reading texts to further absorb information by condensing and rephrasing it in traditional lecture and note-taking environments.

**Study Group** - a small group of students with similar goals who meet regularly to review course material and prepare for exams.

**Visual Learner** - best comprehend information by visualizing relationships and ideas through maps, charts, diagrams and even essays.

**Web Application** - an application that uses a website as the interface
6 References

Benefits of Joining Study Group., Retrieved October 1, 2018, from:  
https://www.educationcorner.com/studying-groups.html

Codeshare information, Retrieved September 12, 2018, from: https://codeshare.io/


Find-A-Friend, Retrieved September 16, 2018, from:  
https://www.blackboard.odu.edu/webapps/discussionboard/do/message?action=list_messages&course_id=_323209_1&nav=discussion_board_entry&conf_id=_351171_1&forum_id=_309142_1&message_id=_7355155_1

Forgetting All Your Coursework, Retrieved September 16, 2018, from:  
https://www.blackboard.odu.edu/webapps/discussionboard/do/message?action=list_messages&course_id=_323209_1&nav=discussion_board_entry&conf_id=_351171_1&forum_id=_309142_1&message_id=_7348213_1

ODU Find a study group, Retrieved January 29, 2019, from:  
https://padlet.com/sscinstruction/odufindastudygroup

Schoenherr, N. (2016, January 13). Discovering why study groups are more effective | The Source | Washington University in St. Louis. Retrieved October 2, 2018, from  
https://source.wustl.edu/2006/07/discovering-why-study-groups-are-more-effective/

Slack Information, Retrieved September 12, 2018, from: https://slack.com/ 
Google Meet information, Retrieved September 12, 2018, from:  
https://support.google.com/a/answer/7303775?hl=en
