

# DocuShare

## Redesigning Document Sharing in Academic Settings

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Engineering Psychology I – Professor Corso

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## Introduction

When our group set out to find a system that we felt was in need of improvement, we began by brainstorming ideas on poorly designed systems from our own everyday experiences. We discussed frustrations with InterLibrary Loan, Netflix, Digital photos, printers and copy machines but what do these all have in common? They all involve two of the main ideas that grew out of our early brainstorming sessions : document reproduction and photo sharing. In a stroke of genius, Dr. Corso suggested that we combine these two ideas into one; thus, the DocuShare was born.

Before the idea for the actual DocuShare device came about, we had to narrow down the broad overall system of “document sharing and reproduction.” As our group discussed the topic, it became clear that we as university students had a great need for such a system that would help us manage all of the shared documents that we needed to keep track of, such as class notes, group project assignments, and research papers. The current systems we were using were too ad hoc and did not support true live collaboration. The sections that follow will detail our process of analyzing those struggles and using what we learned to redesign the system of document sharing for academic settings. We begin with documenting the vision for our product.

## Mission Statement

*Our document sharing system aims to facilitate knowledge transfer and collaboration in higher education settings. Students, faculty, and researchers will now have a way to instantly share and seamlessly edit documents with ease.*

## Mission Scenario

Here is what we envision DocuShare doing in the life of a hypothetical college student, Ian:

Ian is excited about his first CHI Conference and even more excited that it is being held in Florence Italy! He makes a list of all the presentations he wants to attend on his DocuShare device (which allows him to share documents anywhere, anytime in an efficient manner). As he enters the Tuscany Room of the Conference Center, where the first presentation will be held, the powerpoint slides and a copy of the paper being presented entitled "Social web browsing" are transferred to his Doc-U-Share device instantly. He notices this because his Doc-U-Share subtly blinks a red light to indicate the receipt of a new document.

As the presenter begins speaking, she advances through the slides and they advance on the Doc-U-Share device in concert, unless Ian begins to jot down comments or questions he plans to ask. In these cases, the system waits for him to finish writing.

At the end of the talk, the person sitting next to him jokes about his feverish scribbles and Ian mentions that he was linking concepts in the talk to social shopping sites he had seen before. His colleague is

intrigued and asks if she can see his notes. Ian is happy to share and uses his Doc-U-Share device to instantly share the speaker's slides annotated with his notes plus his business card which he quickly appends to the document. Later that evening, Ian returns to his hotel room. His Doc-U-Share indicates that he has been invited to a live share session, with the colleague he met earlier in the day. Ian quickly joins the session. Ian and his colleague, Jennifer, converse using the Doc-U-Share chat feature, and they collaboratively edit his notes from the "Social Web Browsing" presentation. When finished, the Doc-U-Share immediately saves the shared document. By the time Ian returns to Atlanta, he has amassed a good deal more of these annotated slides and during a meeting, three of his research lab mates were all interested in those documents as well. Ian simply pulled out his DocuShare device and send all of his CHI 2008 files to their email addresses with just a few clicks.

## User Analysis

	Criteria	User
<b>Physical/ Motor/ Sensory</b>	Age	18+
	Physical Ability	Varying physical abilities Normal hand-eye coordination Normal strength Diminished visual acuity in older users Diminished motor skills in older users
<b>Sensory</b>	Vision	Normal or corrected vision
<b>Cognitive</b>	Memory	Normal memory capacity
<b>Cultural</b>	Language	English, many bilingual, many with English as a second language
	Profession	University students, professors, researchers
	Education	Education high school degree or higher
	Nationality	Varying widely; Students and Professors from all over the world
	Technological Experience	Some experience using digital devices
	Comfort Level with Technology	High in younger audience and lower in older adults.

## User Tasks and Goals

It is also beneficial to look at typical user tasks related to document sharing:

- Professors
  - Wanting to distribute hand outs to students
- Researchers
  - Needing to circulate pertinent research papers among members of their lab.
  - Desiring to share research information and business cards in conference settings
- Students
  - Wanting to share and keep track of project documents to members of a group, many of which are in various formats (PDF, Word, spreadsheets etc)

## Environmental Analysis

- A description of our target environment is as follows:
- Classrooms, conference rooms, auditoriums, campus common areas inside and outside, labs, library (varying sizes)
- Outdoors in potentially bright light
- Adequate lighting in classrooms and library
- May be dark in auditorium or during slideshow presentation
- Moderate temperatures (unless outdoors)
- Limited personal space, crowds
- Limited access to electrical outlets
- Restricted and/or variable wireless availability

## System Requirements

- The following initial system requirements emerged. Our device needs to
- Always be up to date with minimal user intervention. In other words, automatic updates of documents need to be supported.
- Support various file formats, allow format conversion or implement a universal format that would ease formatting issues that often arise in document sharing
- Make it as easy to share with single user as with multiple users
- Facilitate Real-time editing
- Facilitate "Instant" sharing i.e. the time to receive a shared should be at an absolute minimum
- Be Secure
- Support Public/private sharing and permissions on shared documents
- Be Scalable – supporting a growing number of documents gracefully
- Reduce paper waste where possible
- Low cost or Free
- Durable
- Light-weight
- As our research progressed, we discovered new system requirements and we will document those as we go along.

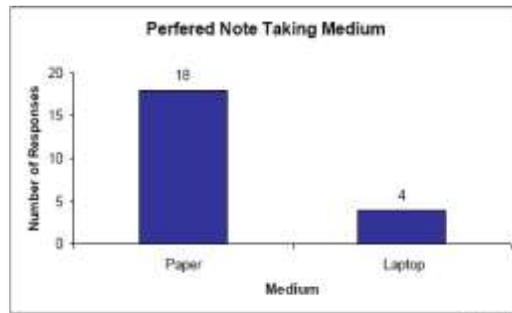
## Preliminary Task Analysis

### *Procedure*

We deployed a survey to investigate how people share documents, and what they use to share. The survey was administered to twenty-two students, enrolled in a graduate level Engineering Psychology course.

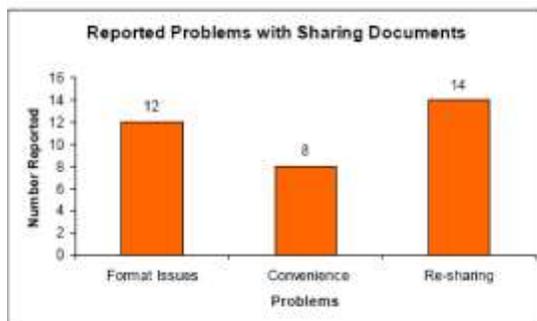
### *Results*

The survey provided insight to what people use to share, and what problems they may encounter while sharing or collaborating on a document with others. While a large amount of data was collected, several principal findings directly influenced the design of DocuShare: An overwhelming percentage (81.82%) of people surveyed preferred to use paper over laptop while taking notes. These participants reported that their preference for paperbound note taking was primarily due to the ability to draw diagrams, figures, and pictures, which is not easily done on a laptop.

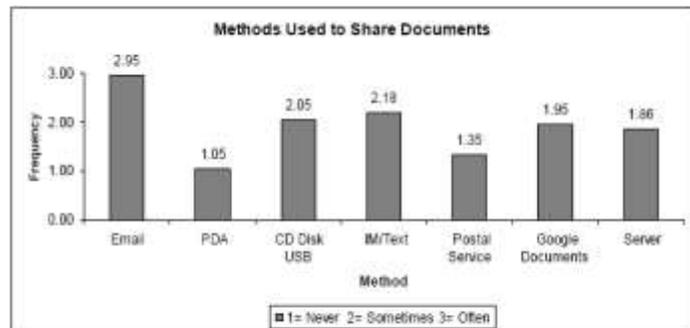


N=22

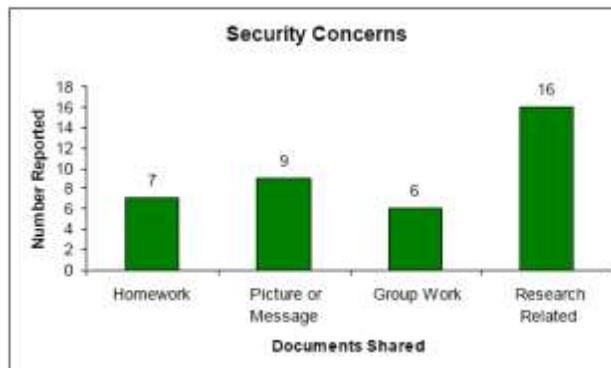
When asked about common problems encountered while collaborating on a document, participants reported issues with formatting, convenience, and re-sharing (e.g. keeping people up to date on the latest version). Additionally, participants reported a large array of methods used for sharing, which may contribute to the complaint about formatting.



N=22



Finally, security was reported as a large concern. Research related documents caused the largest concern in this area, which we took into consideration since DocuShare is to be implemented in a higher educational setting. The survey we use in our preliminary task analysis as well as the raw responses can be found in the appendices.



N=22

## Existing System Analysis

### Manual Methods

We began with a wide net looking at both manual and electronic processes for sharing documents from snail mail (e.g. UPS) and email (e.g. gmail), to software supported file sharing (e.g. Microsoft OneNote). The functional flows for a system like snail mail or email are quite complex and one thing we learned from this exercise was that document sharing by manual methods (e.g. snail mail or class handouts) involved a high number of tedious, repetitive tasks and was quite costly and sometimes wasteful (buying stamps and special mail packages or paying for paper and ink when printing lots of class documents). In addition, the user had to keep track of lots of information about the recipient and had an overwhelming amount of choices on how to share their document (for e.g. UPS, USPS, Fedex, USPS Priority, USPS Express, Airmail, Next Day, Two-Day etc). There is no automatic way of telling a person which sharing method is best for them. We knew that our system had to drastically reduce the number of steps it takes to share and also keep track of recipients' information so they didn't have to.

### Google Documents

Next we began looking at electronic means for file sharing. Google Docs is one such platform, allowing users to host word, spreadsheet and presentation documents online. Sharing is done by email address and one can invite viewers (those who can view the document only) and collaborators (viewers who can edit and reshare the document). See the Appendices for the functional flow and decision action diagrams for Google Docs.

### Microsoft OneNote

#### Description of One Note

OneNote is an idea processor, a notebook, an information organizer — some even call it an "*add-on pack for your brain*". OneNote aims at enabling its users to do the following things:

#### Capture ideas and gather information

You can quickly *capture* meeting notes, brainstorming notes, ideas and thoughts, audio from discussions, video from interviews, diagrams, and so on using the keyboard, pen or the recording capabilities in OneNote. You can also *gather* clippings from the Web, e-mail, miscellaneous materials for projects, customers, and classes, files, pictures, and so on using convenient integration with your Web browser and the Office system.



### Keep things organized

With OneNote, all this information stays *in one place*. It is easy to *organize* it, or pile it together (if that's your preference), and then *search* and find it again — even words in pictures and audio or video recordings! Since OneNote uses the familiar concept of notebooks divided into sections with pages, you can get going right away.

### A team effort

You can also work *with your whole team* — in a *shared notebook* that everybody can edit at the same time and view even while not connected to the network. OneNote *seamlessly merges the changes* each time anyone updates the notebook. A shared notebook is a great way to see what information the team has gathered, what files and notes are available as sources, even what action items remain for the team to work on.

We have looked at other existing document sharing tools like Google Docs but we chose OneNote for our evaluation since it had most of the features provided by others and more. The feature of seamlessly merging changes made during live sharing sessions is also unique to OneNote. OneNote also supports taking notes at any point on the canvas which is similar to the way in which people take notes on a paper.

We have included functional flows and decision action diagrams for OneNote in the Appendices.

### OneNote Heuristic Analysis

During the evaluation process a heuristic interface analysis of OneNote was done. See next page for the interface analysis table, in which we list the most serious problems with OneNote as well as features that help to enhance the experience. At the end of the table, we summarize our findings according to each heuristic. The number of negative factors is subtracted from the number of positive factors for each heuristic resulting in a final number at the end of the table, revealing that OneNote is particularly good at “Recognition rather than Recall” and “Help and Documentation” and particularly bad at “Visibility of System Status”. This is one issue we aimed to address in DocuShare and we discuss this in the DocuShare Section.

# Heuristic Analysis of One Note

Problem Description	Heuristics*											
	Visibility of System Status	Match between System and Real World	User Control and Freedom	Consistency and Standards	Error Prevention	Recognition not Recall	Flexibility and Efficiency of Use	Aesthetic and Minimalist Design	Error Recognition, Diagnosis and Recovery	Help and Documentation	Pro	Con
Title bar updates as you change page title	↑						↑				Pro	Con
No tooltips exist for the widgets under the scrollbar.	↓				↓						Pro	Con
Hard to remember which tab you filed in.	↓				↓						Pro	Con
System lacks history log	↓										Pro	Con
When a participant in a live session edits in a tab that another collaborator does not have in focus, that tab lights glows/blinks to let the collaborator know that someone is editing in that tab. However, the tab only glows/blinks for a short period of time and can easily be missed by a collaborator.							↓				Pro	Con
Closing the live sharing window didn't close live sharing - there is no indication that live sharing is still going on. One would expect that closing down a window would close all activity within that window.	↓			↓	↓						Pro	Con



DocuShare 11

	Visibility of System Status	Match between System and Real World	User Control and Freedom	Consistency and Standards	Error Prevention	Recognition not Recall	Flexibility and Efficiency of Use	Aesthetic and Minimalist Design	Error Recognition, Diagnosis and Recovery	Help and Documentation							
Some icons not recognizable					→	→											
Scrolling down should simply produce more whitespace, instead of adding a separate widget to do this			→				→										
Imported files cannot be edited							→										
Typical Windows program, lots of toolbar options						→											
Useful error message when dragging page on live sharing								→									
After switching to Full Page View, not clear how to get back - the button moves to the other side									→								
Some long error messages that require a lot of reading									→								
No error feedback (telling user what to do next) if incorrect password entered									→								
Extensive help built in the same paradigm. Up to date help is also available online	→									→							
Not easy to figure out how to add title to untitled page										→							
<b>Totals</b>	<b>1</b>	<b>8</b>	<b>-7</b>	<b>1</b>	<b>3</b>	<b>4</b>	<b>1</b>	<b>4</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>-2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0</b>

	5	4	3	2	1
	One Note Performed the Best on this Heuristic			One Note Performed the Worst on this Heuristic	
	* Heuristic Analysis List taken from Jakob Nielsen's ten general guidelines for user interface design and can be found at <a href="http://www.useit.com/papers/heuristic/heuristic_list.html">http://www.useit.com/papers/heuristic/heuristic_list.html</a>				

## Evaluation

### Procedure

We asked two groups of three to collaborate on a document using OneNote. Each participant was separated to eliminate communication, aside from the communication facilitated by using OneNote. They were provided with a story and given the task to collaboratively discuss and compose a possible ending. One participant was randomly chosen to serve as the host. The host was responsible for inviting the other two participants to the OneNote live sharing session, and to upload the story. The participants worked collaboratively for 15 minutes and were then asked to return to a designated area. Here, they participated in an informal focus group to discuss their experience, and fill out a subjective workload analysis survey before exiting.

**Evaluation Prompt** *Janice hated cats. That's why she could never see things working with Ryan. It wasn't that Ryan liked cats; he loved them. He loved to be with them; he loved to admire them; but most of all, he loved to talk about them. Example? The other day, Ryan tried to draw Janice into a discussion about a new business idea he had for a cat gym that would keep felines fit. Janice hadn't seen it coming. She had merely suggested that Ryan might want some company during the day. Ryan, you see, was a cartoonist who quite literally doodled all day. He was always calling Janice and asking her what she was doing. Janice had thought that a cat might keep Ryan busy. But not like this! Janice couldn't break up with Ryan; he was too good-looking. She loved how her friends' mouths would drop when she would enter a room with him. (They would drop even further if they heard him talk about cats, she thought.) Yes, Janice was too shallow to part with Ryan. So naturally her only choice was to get rid of that damn cat....*

### Results

A combination of results from the participant focus group, as well as our observation of their performance, contributes to our analysis of Microsoft OneNote. The following problems were observed:

#### **Joining session problematic**

Participants disliked the email-based invitation. One participant received his/her email invite long after the session was complete. Invite email uses IP address which may be confusing to some

#### **No indication of who is making notes or changes and lack of chat feature**

Since there was no chat facility in OneNote, participants resorted to creating their own chat by typing on the page in different areas and using color to differentiate who is making the notes. Some users even deleted others' text to make room.

#### **Lack of log or timestamp**

Participants complained about this issue, stating that there is no way to 'go back' to an older version of the document.

#### **Needs workspace separation**

Participants disliked that discussion and final edits occur on the same page. They want a more professional interface that facilitates editing and chat in an organized manner.

### **Password and Security Issues**

If a problem occurs with your password, the system offers no clear indication of what to do to fix that issue. Moreover, passwords offer some security but the host has to find a way to distribute the password to others which could be done through an insecure means. Finally, since the invite is made via email, some participants left the machine with their email open after the live sharing session was done. The participants were so focused on the session that they forgot to log out of their email after it was done. These actions have even more grave consequences than an unsecure document.

### **Other OneNote Problems**

- program lacks a history log
- program lacks a chat mode
- program lacks voice over internet protocol (VOIP)
- unable to hold more than one session at a time
- inserted files cannot be shared
- if host leaves, the session ends
- program needs more options to control for editing control- i.e. need option of letting some group members edit, and not allow others to edit. Currently the option is all or none (other than host)
- if you want current lecture notes to appear on screen you have to take multiple screen clips (need "select all" option). The current select all option only selects text, not pictures.
- program unable to import word document. You have to copy the text in. you can "import" using printout but then it is not editable (but can write notes on top).

Screenshots from our evaluation session can be viewed in the Appendices.

## Task Analysis Table

Task Description Table					
Subtask	Time	Control	Activity	Indication	Remarks
4.1 Create New Doc	30 sec	Need to collaborate on document	Type up or copy document	Document created	
4.6 Start Live Sharing	3 min	Document created	Set up session in <u>OneNote</u>	Live Sharing panel open	<ul style="list-style-type: none"> <li>*Uncertainty about which email address is being used</li> <li>*Computer lag when system is opening attachment. We had a lag of at least 10 seconds here.</li> </ul>
4.8 Invite Participants	1 min	Live Sharing panel open	List e-mail addresses of participants	E-mails sent	
4.5 Join Session	30 sec	E-mails sent	Open e-mail attachment	Live Sharing session open	<ul style="list-style-type: none"> <li>* Someone got the invite email after the session entirely.</li> </ul>
4.7 Collaborate	variable	Live Sharing session open	Discuss document with others	Document updated	<ul style="list-style-type: none"> <li>* Users tried to double click on participant's names in the bottom left corner to chat with them</li> <li>* No feedback as to who said what at what time (throughout the session)</li> <li>* No idea "where to start"</li> <li>* Confusion about notes appearing all over the page.</li> <li>* No sequential chat flow</li> <li>* Due to lack of feedback about who is typing and where they are typing, users can become frustrated at the other people's perceived unresponsiveness.</li> <li>* habit of hitting enter to send "chat"</li> <li>* Two people typing in the same color can lead to confusion.</li> <li>* Running out of space to type</li> <li>* Typing over other participant's text</li> <li>* Fixating on getting a conversation flow working rather than the actual task at hand (which involves the document)</li> <li>* Being unaware of someone typing on a part of the document that is off the screen</li> <li>* Difficulty enlarging the window to see as much of the workspace as possible</li> <li>* Lines of text suddenly disappearing due to text scrolling within a text box or overlapping text. Some confusion about this.</li> <li>* Collaborating on the wrong document. Not clear which one was the 'right' document if more than one documents are opened.</li> <li>* Screen opened initially scrolled down so that initially it looked like there was no document.</li> <li>* blinking document tab not recognized as meaning that someone is typing in that document.</li> <li>* Not sure when someone has stopped typing</li> <li>* Some people were typing in a sequence similar to a chat flow.</li> </ul>
4.9 End session/ 4.10 Leave Session	5 sec	Document updated	Press the End or Leave button	Live Sharing session ended	<ul style="list-style-type: none"> <li>* Some participants did not close One Note or go back to their email to log out, which is a potential security issue</li> </ul>

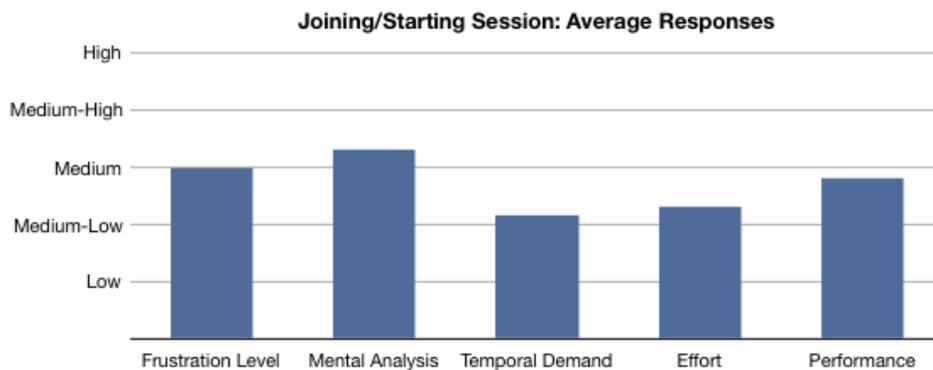
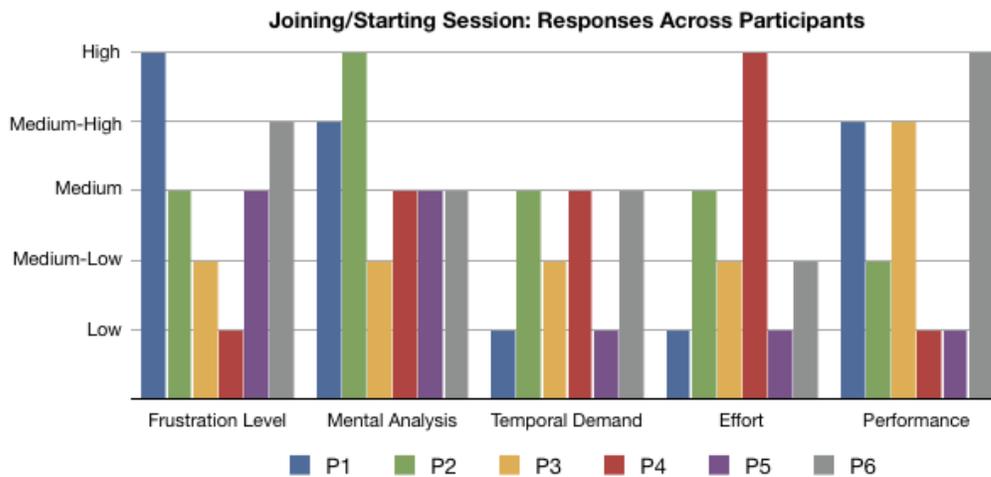
## Workload Analysis

We performed a workload analysis with all of our participants via a written survey. Responses to workload analysis varied widely across participants, but this is somewhat expected. As each person in a live sharing session takes on different roles and different levels of participation, their personal assessment of workload will reflect that. One unexpected finding is that the average frustration level for joining/starting a session was higher than that of collaboration. This suggests that reducing frustration for this task is one of the key improvements we can make to this system. The survey we used in our evaluation can be found in the Appendices.

**Joining/Starting Session**

	P1	P2	P3	P4	P5	P6	AVG
<b>Frustration Level</b>	5	3	2	1	3	4	3
<b>Mental Analysis</b>	4	5	2	3	3	3	3.33
<b>Temporal Demand</b>	1	3	2	3	1	3	2.17
<b>Effort</b>	1	3	2	5	1	2	2.33
<b>Performance</b>	4	2	4	1	1	5	2.83

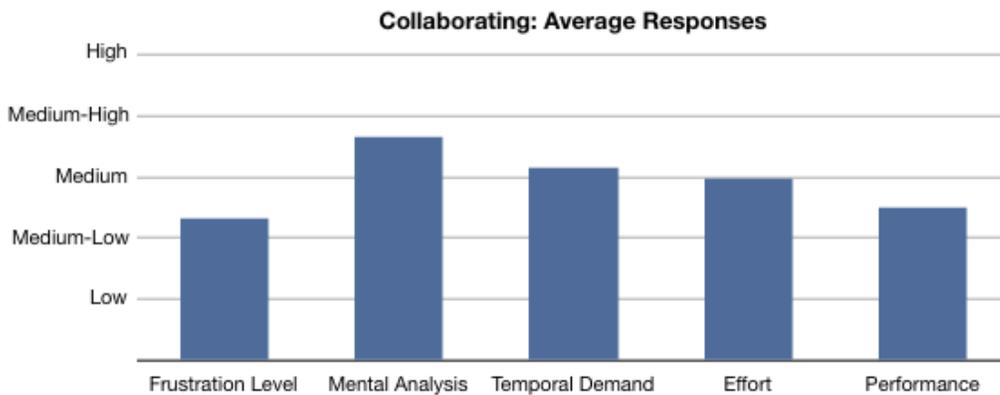
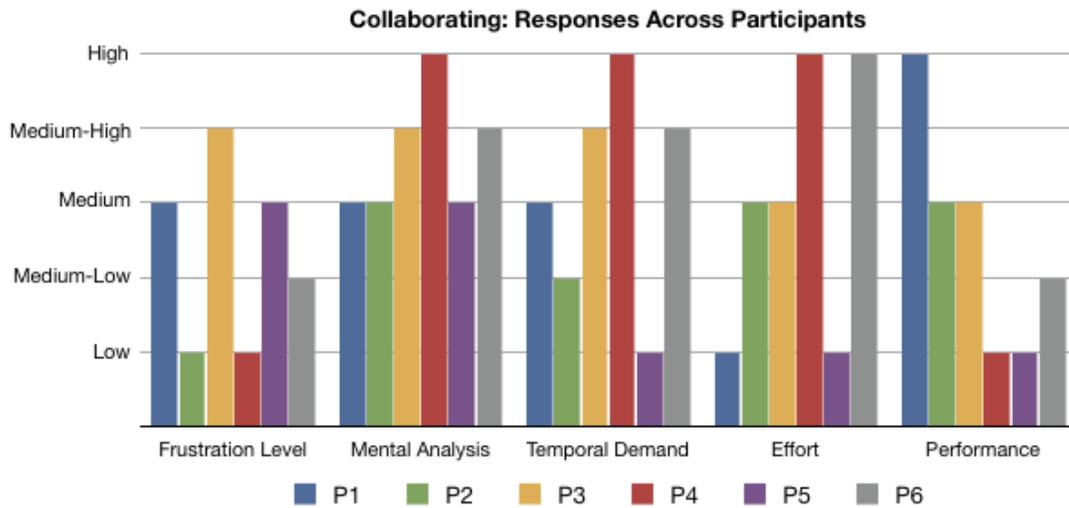
1=Low, 2=Medium-Low, 3=Medium, 4=Medium-High, 5=High



**Collaborating**

	P1	P2	P3	P4	P5	P6	AVG
<b>Frustration Level</b>	3	1	4	1	3	2	2.33
<b>Mental Analysis</b>	3	3	4	5	3	4	3.67
<b>Temporal Demand</b>	3	2	4	5	1	4	3.17
<b>Effort</b>	1	3	3	5	1	5	3
<b>Performance</b>	5	3	3	1	1	2	3

1=Low, 2=Medium-Low, 3=Medium, 4=Medium-High, 5=High



## Function Allocation and Alternatives

The function allocation table is according to the functional flow diagrams for DocuShare and the previous allocations are with respect to Microsoft OneNote- the application which we analyzed.

**Function Allocation Table**

Functions and Description	Previous Allocation	Analysis	Revised Allocation	Improvement	Alternatives
<b>1.0 Turn on Device</b>	Human	Prerequisite task to be accomplished by human only. Machine cannot determine when to open the application.	Human	No Change	Machine: Control taken away from human  Human/Machine: Control taken away from human at some times which is undesirable especially in light of security.
<b>2.0 Log in to DocuShare</b>	-none-	Logging into the application was not present previously, we have added this function since our users desired more security	Human	Security	Machine: Automatic login for this would be unsecure.  Human/Machine: N/A
<b>3.0 Take Notes</b>					
3.1 Download class lectures	Human	Previously the human has to manually download/import documents into OneNote. In DocuShare, since the device knows the users and the classes taken by them, application	Machine	Comfort and Efficiency	Human: Manual downloading of class documents would be tedious repetitive and require an additional level of login other than the fingerprint on the DocuShare.  Human/Machine: The DocuShare could

			automatically downloads class notes, material.				download some class materials and have the user manually download others. The same problems above arise so we decided to design 'Opt-Out' download instead of 'Opt -in' download
	3.2 Download conference presentations	Human	Previously the human has to manually download/import documents into OneNote. In DocuShare, since the device knows if the users are at a conference and attending a talk, the device automatically downloads related material.	Machine	Comfort and Efficiency	Same as 3.1	
	3.3 Open saved pages	Human	Users have to choose which documents they want to work on manually. The computer can not decide without user's input.	Human	No Change	Machine: N/A Human Machine: N/A	
	3.4 Type/draw/write notes						

					Human	Human	Stylus has to be used by Human for writing and interaction.	No Change	Machine: N/A Human/Machine: N/A
			3.4.1 Place Stylus	Human	Human	Human	Previously, the application used to be run on a computer which has its own keyboard, Since we wanted to make the device more portable as desired by the users, we removed the physical keyboard and gave the virtual keyboard option	Better portability in using the device.	Machine: a physical keyboard available on the device would add to its weight and use up valuable screen space permanently.  Human/Machine: N/A
			3.4.2 Show virtual Keypad	-none-					
			3.4.3 Start Writing/ Drawing	Human	Human	Human	The content or notes has to be written by the user. The computer will not automatically know what the user wants to add as notes.	No Change	Machine: N/A Human/Machine: N/A
			3.4.4 Begin typing	Human	Human	Human	The content or notes has to be written by the user. The computer will not automatically know what the user wants to add as notes.	No Change	Machine: The machine could use voice recognition to automatically type text. However, There would be no way to verbally dictate diagrams.

							Human/Machine: various modes of textual input available i.e. voice recognition, text recognition and digital keyboard input
<b>4.0 Organize content</b>			Human	Previously, all the content has to be organized by Human. In DocuShare, some of the downloaded documents are automatically transferred to their respective sections. E.g: Slides of a particular class get automatically added to that particular class section.	Human/Machine	Comfort, Better Management and Efficiency	Machine: Automatic machine categorization and no control given to the user  Human: Human would need to manually created document hierarchies which may be time consuming and repetitive.
<b>5.0 Collaborate</b>							
	5.1 Create a new document	Human	Human has to decide if he wants to collaborate on a new document and accordingly create a new document.	Human	No Change		Machine: N/A Human/Machine: N/A
	5.2 Browse existing documents	Human	Human has to decide if he wants to collaborate on an existing document and accordingly	Human	No Change		Machine: N/A Human/Machine: N/A

				browse to the required document.	Machine	No Change	Human: Human would need to remember recipient or host information for example, email addresses, IP Addresses etc. These identifiers tend to be hard for humans to remember. Human/Machine:same problems arise when human takes control.
5.3 Get session invitation	Machine	When someone sends an invitation, machine automatically transfers the invitation to the particular contact (person).	Human	Human has to decide on the document he wants to work/collaborate on and accordingly open the document.	Human	No Change	Machine: N/A Human/Machine: N/A
5.4 Open a document	Human		Human	Human has to decide and accept the invitation to join a collaborative session.	Human	No Change	Machine: N/A Human/Machine: N/A
5.5 Join Session	Human		Human	Humans have to collaborate and discuss what they want to communicate with others.	Human	No Change	Machine: N/A Human/Machine: N/A
5.6 Collaborate on the document	Human						
5.7 Invite Participant							
	5.7.1 Choose from list of		-none-	Previously there	Human	Convenience,	Machine: N/A

	existing members		was no existing list of contacts and humans have to enter the email addresses of people with whom they wanted to collaborate. DocuShare presents the user with a list of all the contacts related to a particular section and also shows the user if they are online at the same time.			Additional contextual information to reduce cognitive load	Human/Machine: N/A
	5.7.2 Enter new contact	Human	Humans can enter the email addresses of people with whom they would like to collaborate.	Human	No Change		Machine: N/A Human/Machine: N/A
	5.7.3 Send Invitation	Human	Humans have to send invitations to the chosen people	Human	No Change		Machine: N/A Human/Machine: N/A
	5.8 Leave Session	Human	Humans have to decide on when they would like to leave a session. Machine leaves session securely.	Human	No Change		Machine: N/A Human/Machine: N/A

## DocuShare

### Problems Addressed

As demonstrated in our prototype, we have specifically designed the DocuShare to address the problems with existing systems. As we learned in our preliminary task analysis, users prefer to take notes with paper rather than a laptop because of the flexibility to draw free illustrations and diagrams. We addressed this concern by creating a flexible digital paper device that imitates a paper-bound notebook. The device is touch sensitive and employs handwriting recognition for direct input. A stylus will be included to allow for natural writing and to allow user to draw diagrams or pictures. Since the DocuShare is approximately the size of a notebook, it will easily fit in users' current backpacks and bags. Along these lines, the DocuShare will also be lightweight for mobility.

Security of documents is also a concern for the respondents of our preliminary survey. Because the DocuShare may contain varying levels of confidential data, we address this concern by using fingerprint recognition to unlock the system. Alternately, the device can be password protected. In addition, we address the fact that users share a variety of different file formats by integrating a universal, automatic conversion between document formats.

Another feature desired by users is the ability to always stay up to date with the latest version of the document. DocuShare helps you achieve this by providing notifications whenever a new or updated document is received. A flashing light is one indicator, but the system also stores the specific notification messages so that the user can access them at any time. Because the DocuShare is linked to your university or to any conferences you attend, you know that you will automatically receive the documents that you need.

In terms of collaboration, the DocuShare makes many improvements over its predecessors. Starting a live session is as easy as pressing the "Collaborate" button or menu item. Inviting participants is easy because classmates are pre-programmed into the device based on which classes you have



Figure 1 The DocuShare device: flexible digital paper allowing seamless sharing and collaboration



Figure 2 - Security enabled by finger print recognition



Figure 3 - Collaboration is easy with DocuShare : Users can append notes to each page or collaborate live.

registered for. A dot next to the name indicates whether they are online or not, and the notification is sent directly to their DocuShare device to begin sharing. To solve the problem of workspace separation, we have

created distinct areas within the DocuShare interface. By default, a large area is devoted to the document itself. Another area is dedicated to individual notes about the document, in which you can find out who created the note, along with a timestamp and history. Another important area is the chat. The DocuShare supports an audio link between multiple devices so that a conference style collaboration can take place. However, sometimes audio is not appropriate, so we have a text chat that clearly shows who is saying what.



Figure 4 - When Collaborating in a Live Session, a chat feature automatically organises collaboration and keeps a log of past comments

### Additional Features

DocuShare has some additional features to support our specific user group of university students, faculty, and researchers. Each device is associated with your school so that it can be customized to the courses and activities you are involved in. For instance, the DocuShare has a "Courses" tab where all current courses are listed. This is also an organizational feature of the DocuShare. Tabs such as "Courses" and "Projects" can be used to organize documents so they can easily be located. The user can create additional tabs to further organize his or her documents. The DocuShare also utilizes a menu structure similar to current software products to enhance the familiarity with the system. Character recognition is employed throughout the system to convert handwriting to ASCII text, and spell checking can be employed at the user's discretion.



Figure 5 - DocuShare provides built in sections for Project and Course related documents. Users can interact with the document via direct handwriting recognition as well as a digital keyboard.

A live version of our prototype can be found here:

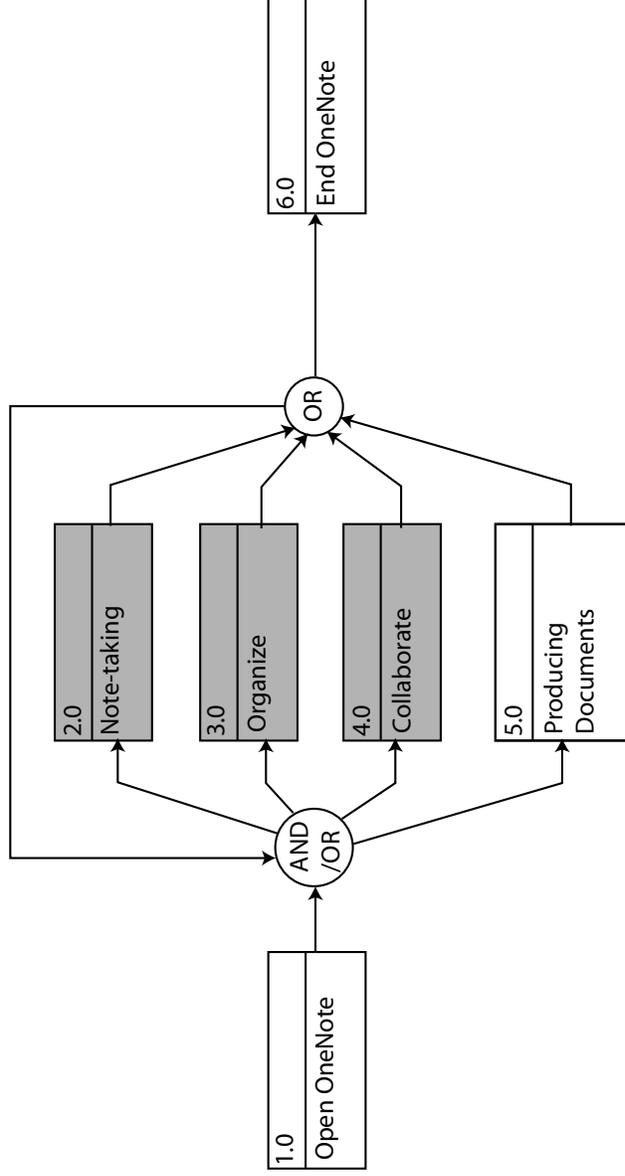
<http://www.prism.gatech.edu/~dnagar3/EngPsych/DocuShare.swf> .

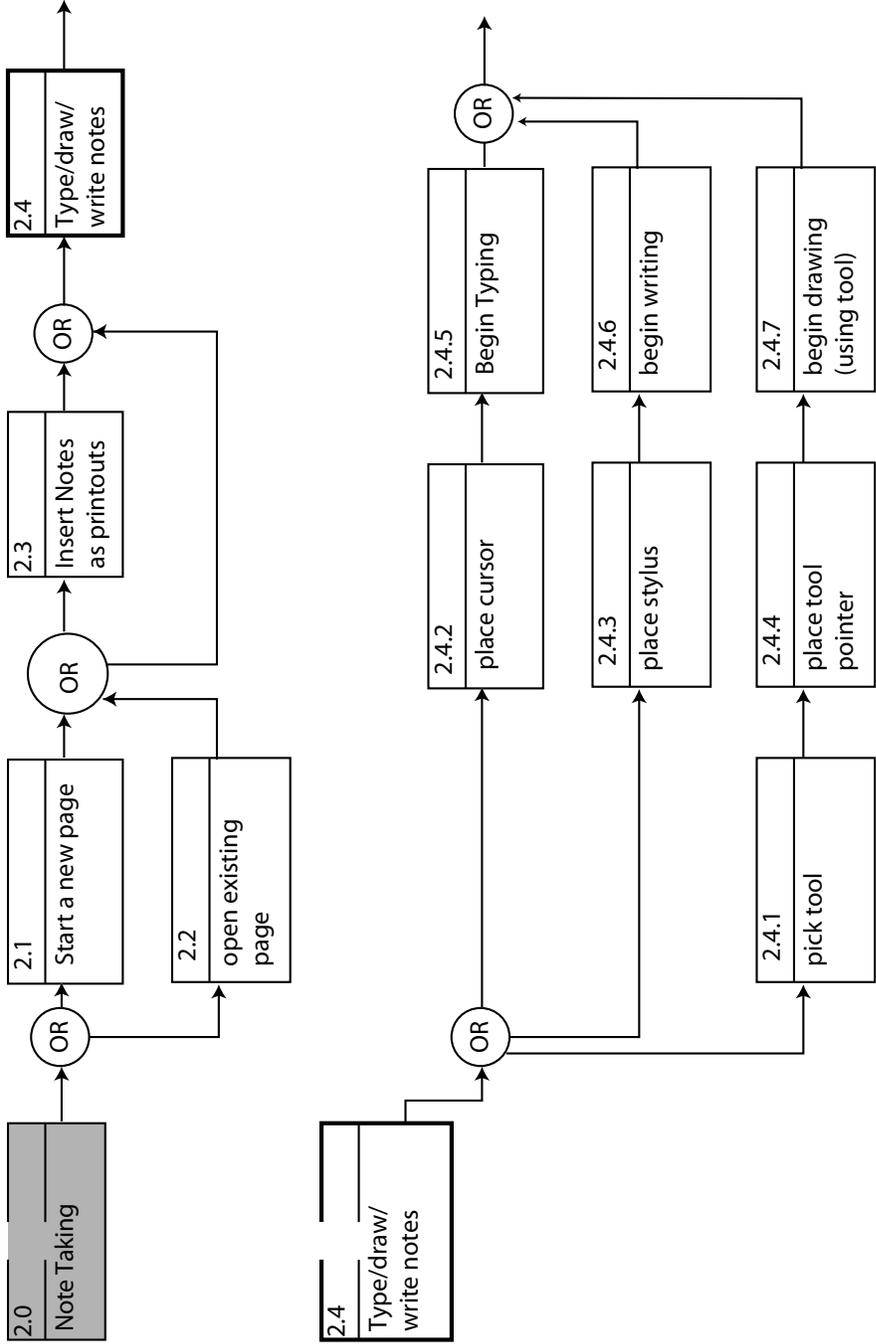
## **Conclusion**

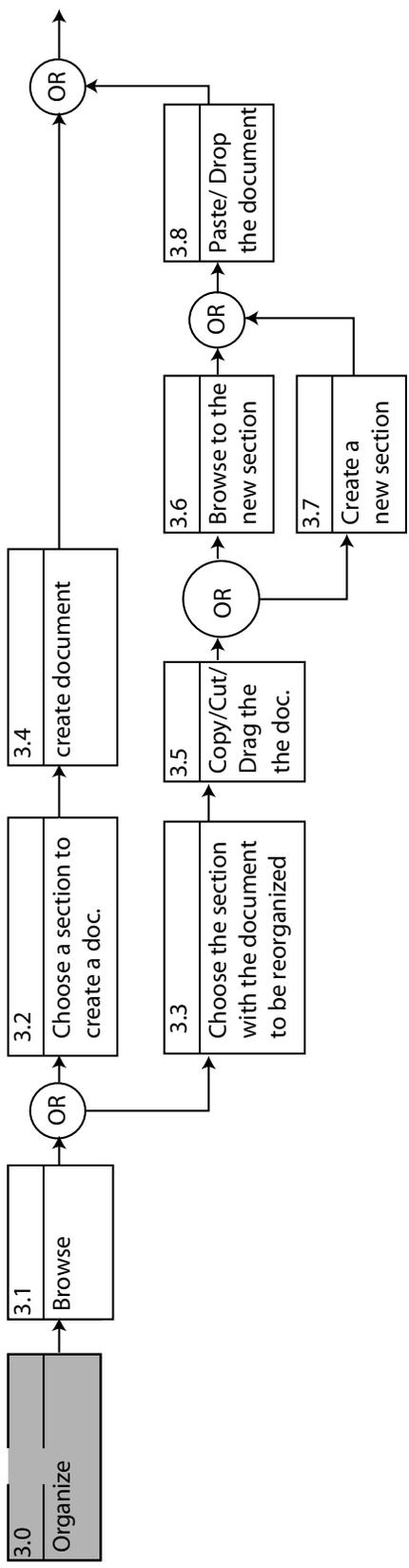
Throughout this project, we have used methods of engineering psychology to realize a better document sharing system for our users. The value of such a design process is that we can feel more confident that our end result matches with the users' expectations and desires for the product. To find out if we had succeeded on that count, we asked some of our participants from our study of OneNote to give us their impressions on the new DocuShare system. Happily, we received enthusiastic praise on our improvements over the existing system. Of course, and engineering psychologist's work is never done, and the future of the DocuShare would be an iterative process in which the user is always at the center of our work.

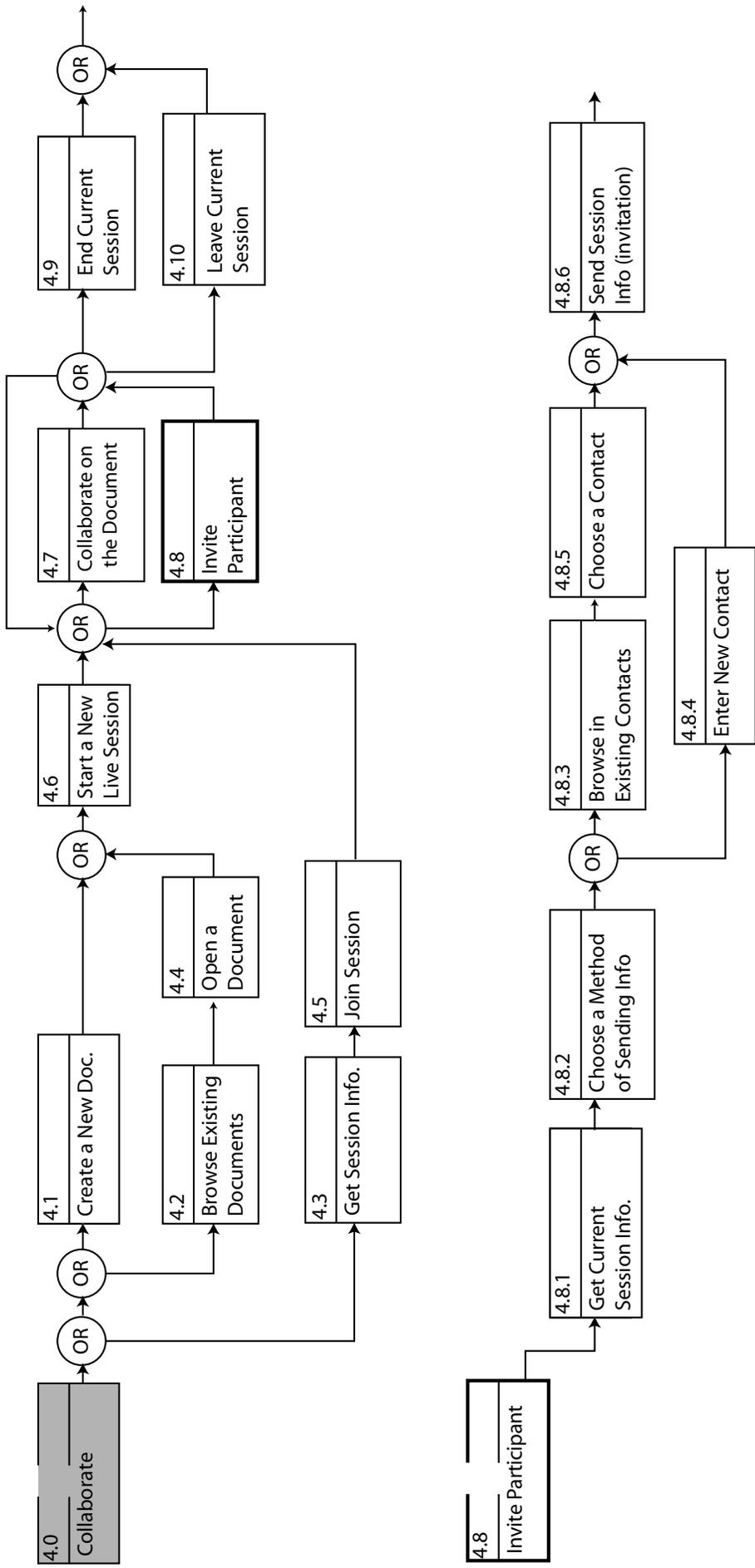
## **Appendices**

# Functional Flow Diagram for OneNote

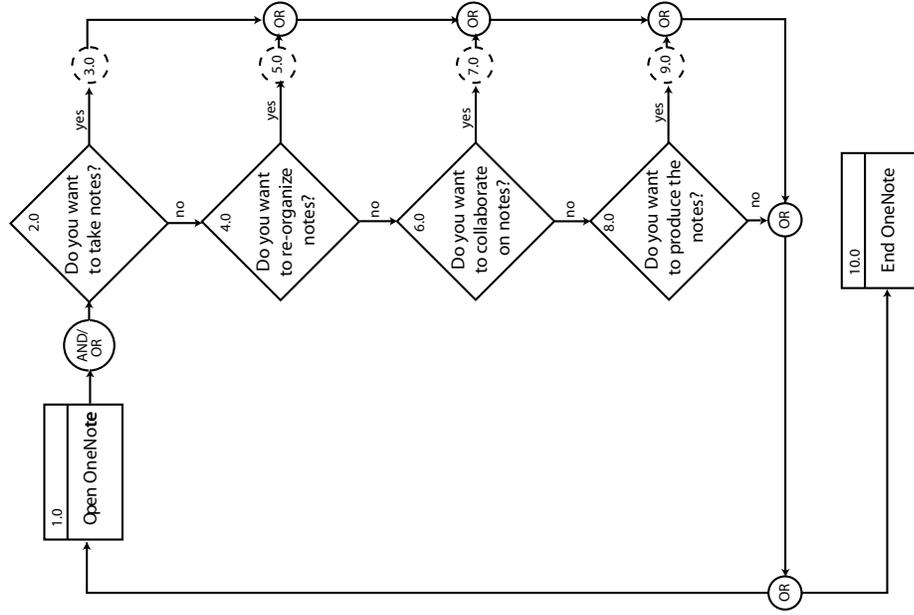






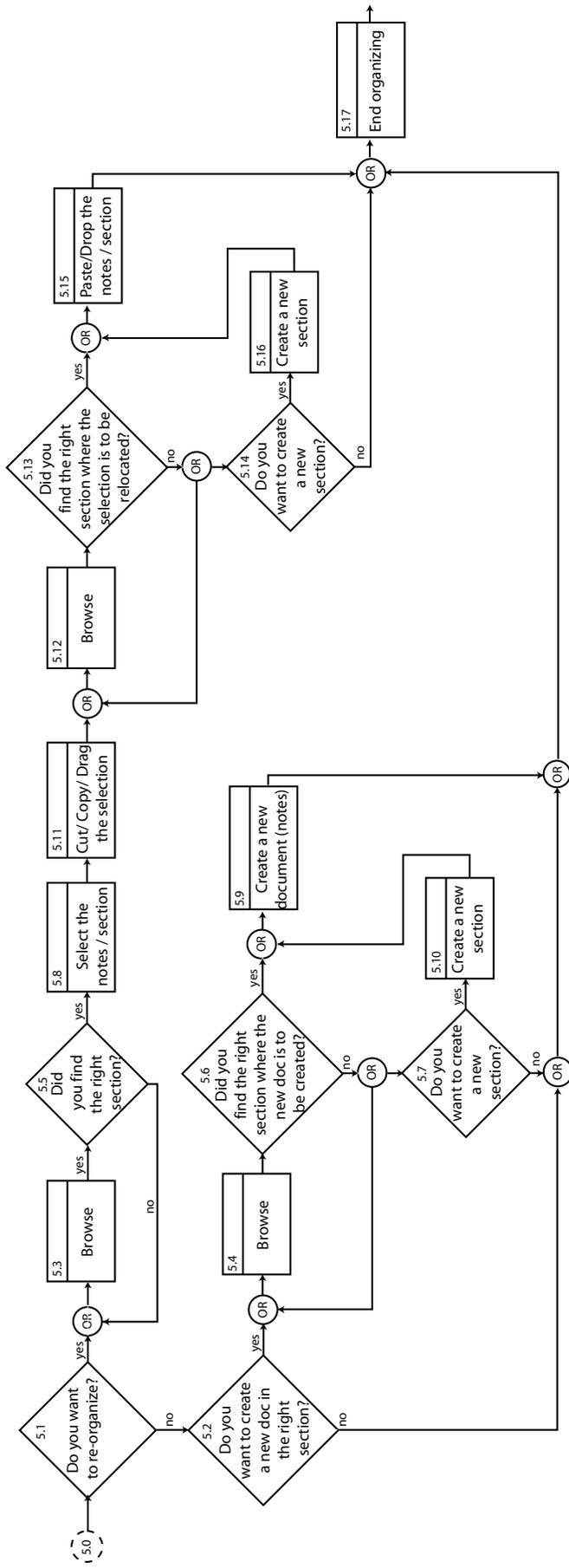


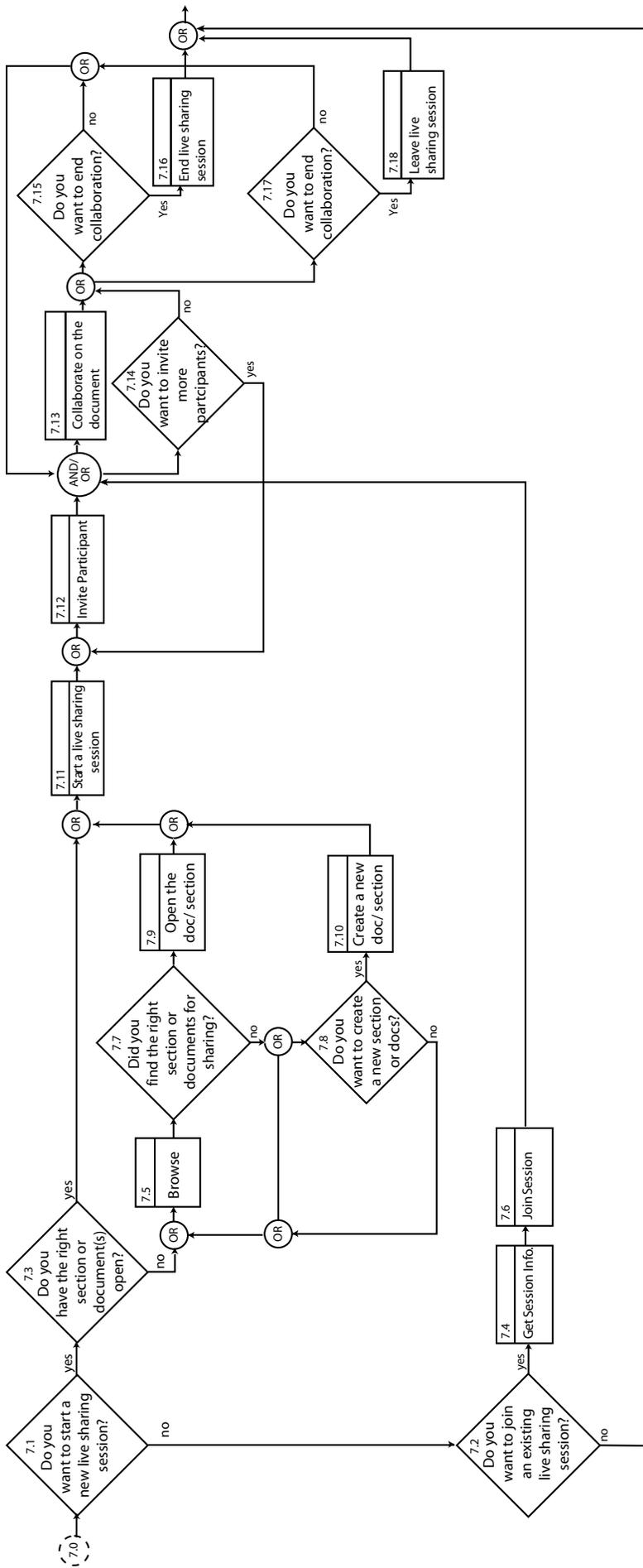
## Decision Action Diagram - OneNote



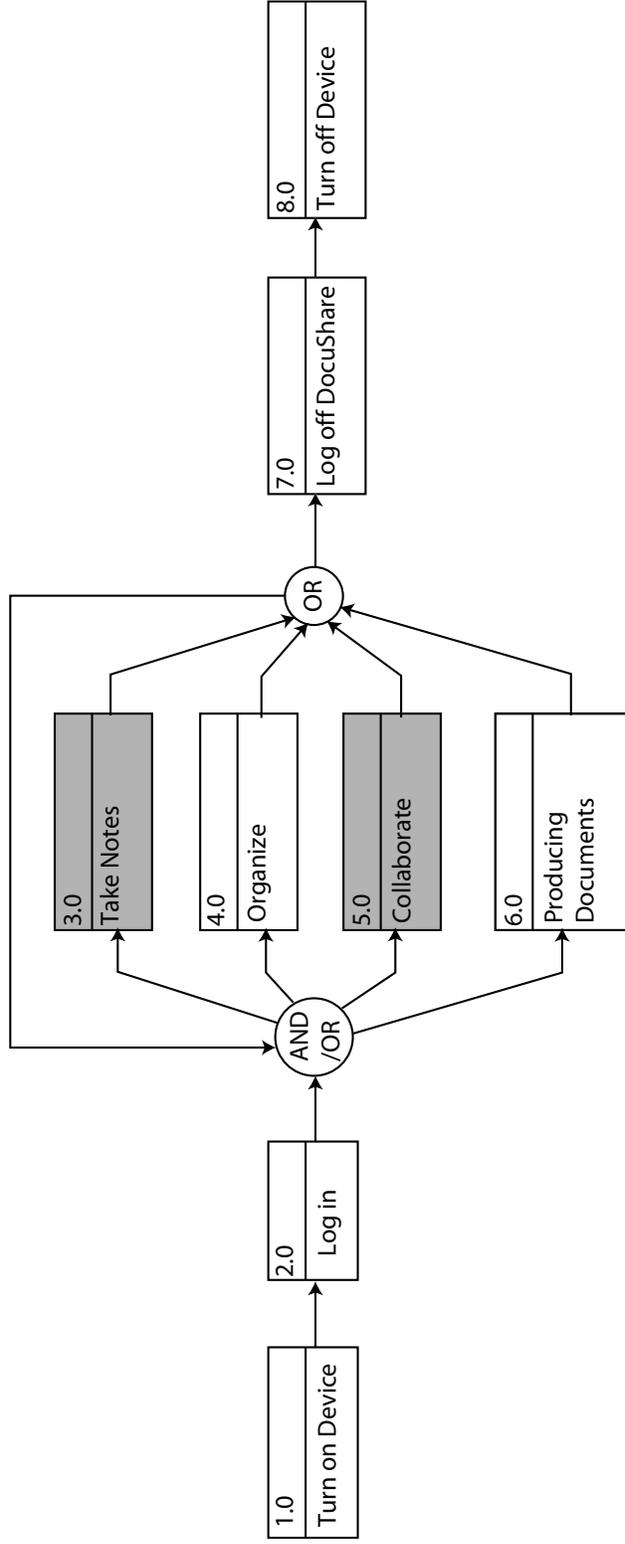
Note:

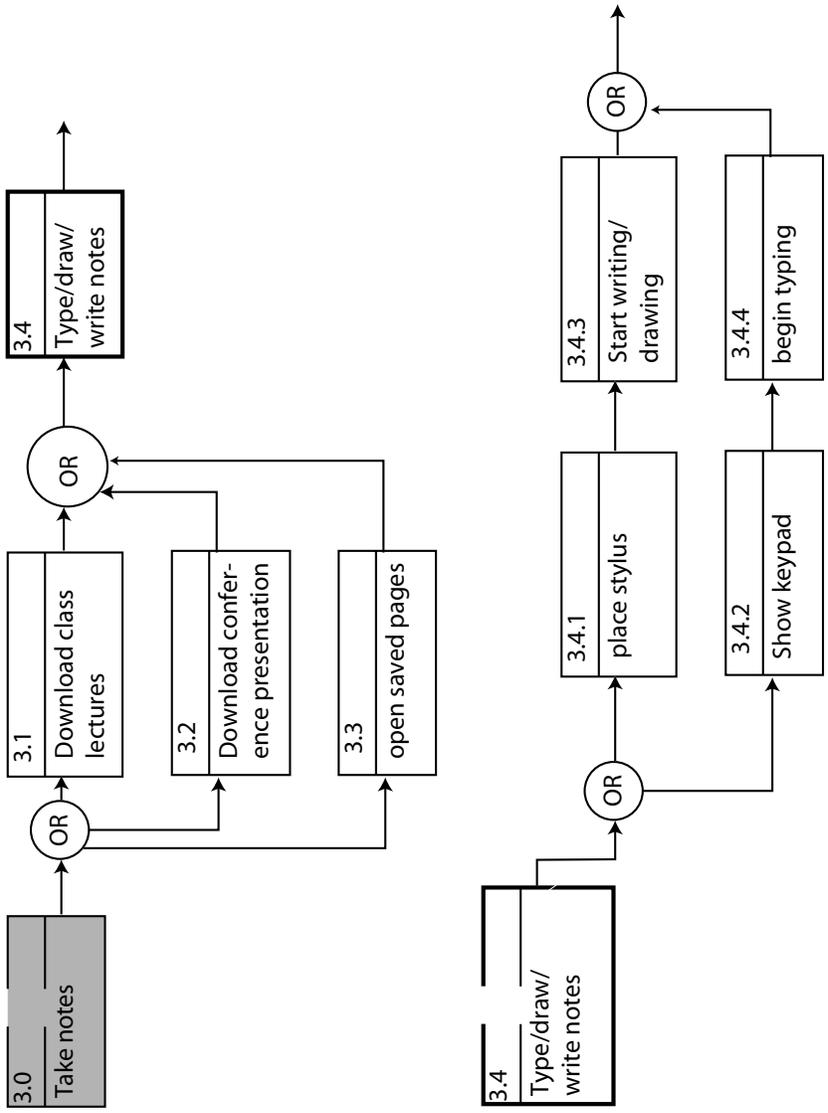
We are only analyzing the re-organization of the notes and collaboration in OneNote and hence we have made decision action diagram for 5.0 and 7.0 only.

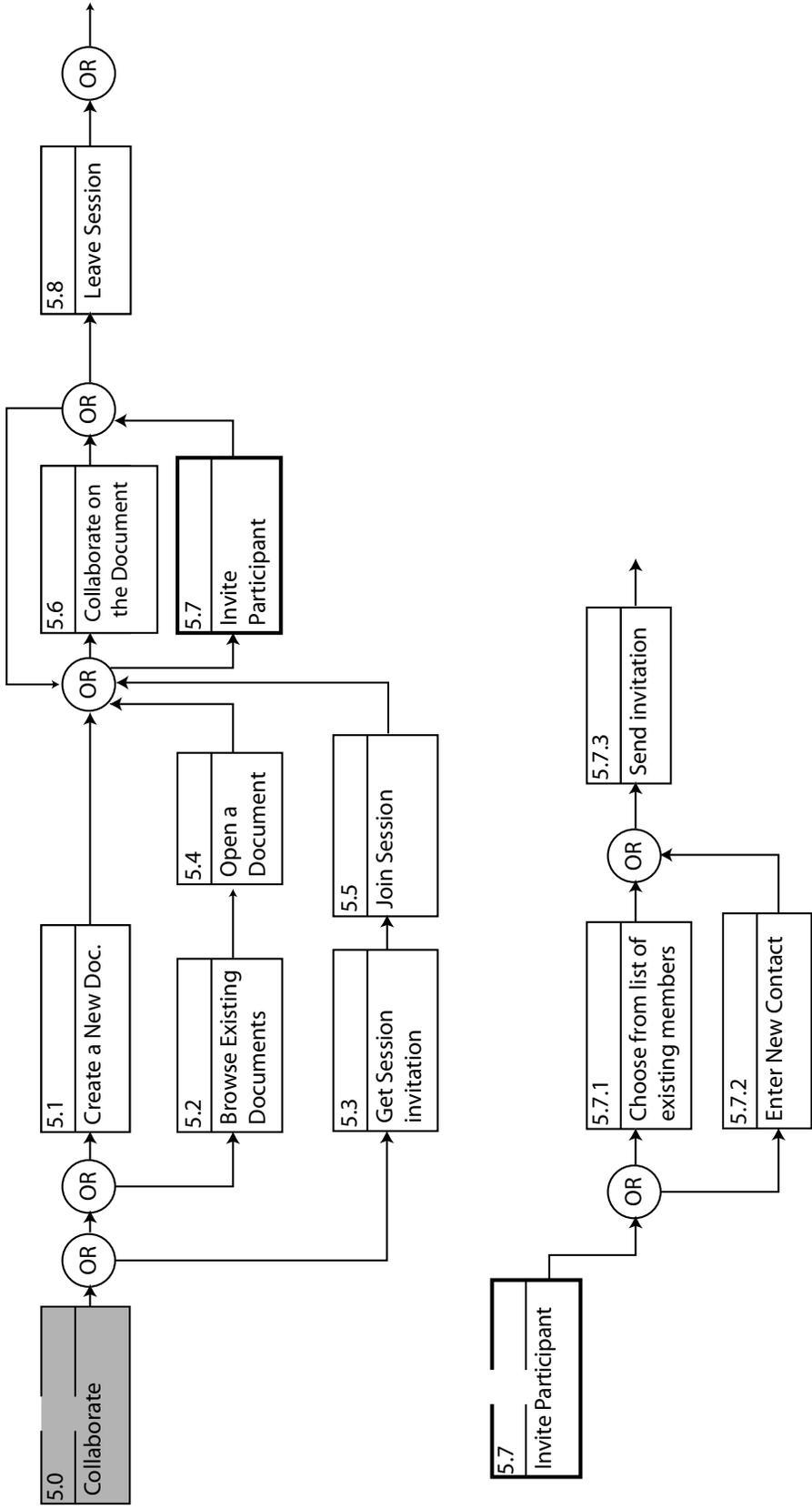




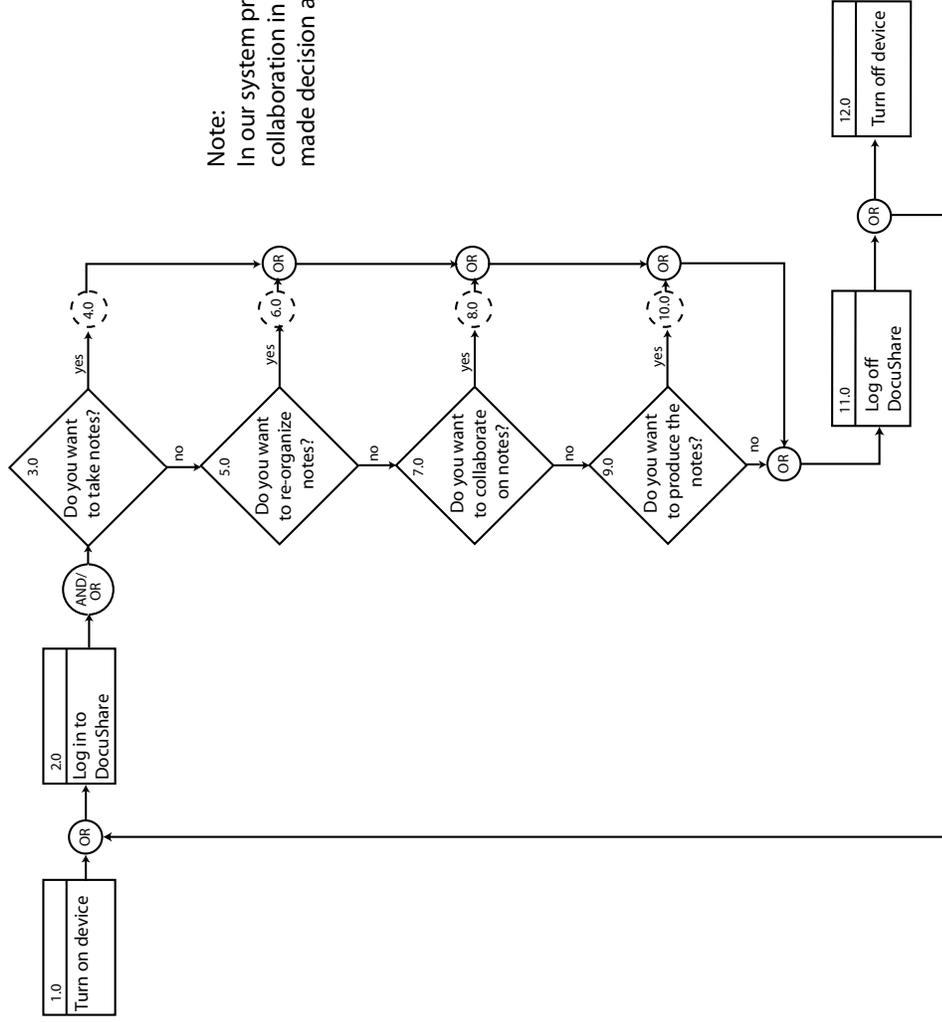
# Functional Flow Diagram for DocuShare



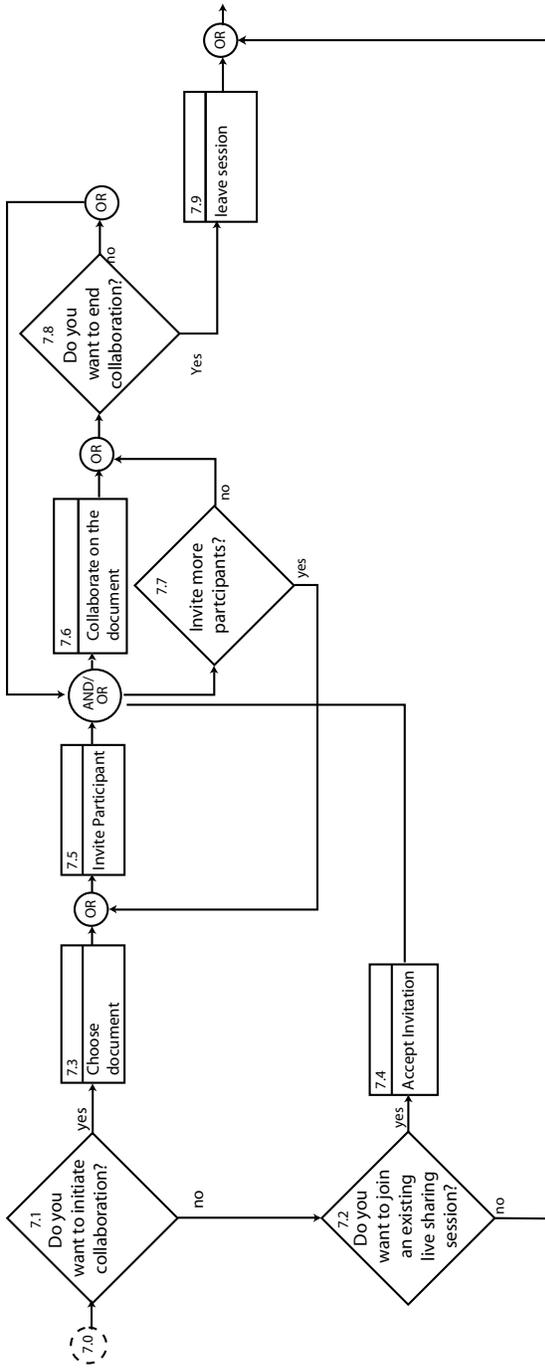




# Decision Action Diagram - DocuShare



**Note:**  
 In our system prototype we have worked only on collaboration in DocuShare and hence we have made decision action diagram for 7.0 only.



## Preliminary Task Analysis Survey

- In class, do you prefer to take notes on paper or laptop (assuming you had convenient access to either option). Check one please.  
 Paper  Laptop  
 Why? \_\_\_\_\_
- Rate your concern for saving paper. Check one please.  
 Not concerned  Somewhat concerned  Often concerned  Very concerned
- Rate how often you use the following methods to share documents (i.e. to send a document to a friend, professor, group member, etc) 1= never, 2=sometimes, 3=often.  
 1 2 3 Email 1 2 3 mail or postal service  
 1 2 3 iphone/smart phone/pda 1 2 3 Google Documents  
 1 2 3 burned cd/ disk/ USB 1 2 3 via network drive/server  
 1 2 3 instant messaging/ text messaging 1 2 3 Other \_\_\_\_\_
- What items do you regularly share with another person?  
 Homework  Research  
 Pictures  Letters (via email or regular mail)  
 Videos  Other \_\_\_\_\_  
 Publications/articles
- What do you often use to create electronic documents? (you may choose more than one)  
 Word document  Publisher (or equivalent)  
 Excel  gif, jpg, bitmap  
 Power point  html  
 Pdf  Other \_\_\_\_\_
- When sharing a document with another person, what are some problems you have encountered (you may choose more than one)  
 Format of document (i.e. sometimes you do not have correct software to download document)  
 Don't have convenient access to sharing devices (devices listed in #3)  
 Don't have time to share documents  
 Irritated with constantly re-sharing documents with group members/professor/etc to keep them up-to-date with most current document  
 Other \_\_\_\_\_
- Please mark which of the following instances you would *most likely* be concerned about the security or privacy of your shared documents (you may choose more than one )  
 When sending homework to a professor  
 When sending a picture or message to a friend  
 When sending documents to a group member (for work or school)  
 When sending documents that are research or publication related  
 Other \_\_\_\_\_

## Preliminary Task Analysis Results

	Frequency n=22	Percent
<b>Medium used for note taking</b>		
Paper	18	<b>81.82%</b>
Laptop	4	18.18%
<b>saving paper</b>		
not concerned	3	13.64%
somewhat concerned	13	<b>59.09%</b>
often concerned	4	18.18%
very concerned	2	9.09%
<b>items regularly shared</b>		

homework	5	22.73%																													
pictures	20	<b>90.91%</b>																													
videos	11	<b>50.00%</b>																													
publications/articles	10	<b>45.45%</b>																													
research	7	31.82%																													
letters (email/mail)	19	<b>86.36%</b>																													
other	3	13.64%																													
<b>Create electronic documents</b>																															
word	21	<b>95.45%</b>																													
excel	12	54.55%																													
powerpoint	17	<b>77.27%</b>																													
pdf	16	<b>72.73%</b>																													
publisher	0	0.00%																													
gif/jpg/bitmap	9	40.91%																													
html	4	18.18%																													
other	4	18.18%																													
<b>problems with sharing</b>																															
format issues	12	<b>54.55%</b>																													
lack of convenience	8	36.36%																													
lack of time to share	1	4.55%																													
irritated with re-sharing	14	<b>63.64%</b>																													
other	6	27.27%																													
<b>Security or privacy</b>																															
homework	7	31.82%																													
picture or message to friend	9	<b>40.91%</b>																													
documents to group	6	27.27%																													
documents research related	16	<b>72.73%</b>																													
Other	1	4.55%																													
<b>What was used to share</b>																															
<table border="1"> <thead> <tr><th></th><th>Email</th><th>PDA</th><th>USB</th><th>IM/Text</th><th>Postal</th><th>Google</th><th>Server</th></tr> </thead> <tbody> <tr><td>Average:</td><td>2.95</td><td>1.05</td><td>2.05</td><td>2.18</td><td>1.35</td><td>1.95</td><td>1.86</td></tr> <tr><td colspan="4">1= Never</td><td colspan="2">2= Sometimes</td><td colspan="2">3=Often</td></tr> </tbody> </table>									Email	PDA	USB	IM/Text	Postal	Google	Server	Average:	2.95	1.05	2.05	2.18	1.35	1.95	1.86	1= Never				2= Sometimes		3=Often	
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1= Never				2= Sometimes		3=Often																									

## Workload Analysis Survey

### 1.) Joining a group/Starting Session:

#### Frustrations Level:

Insecure, discouraged, Irritated,

Secure, gratified, content,

Stressed, annoyed

relaxed and complacent.

Low-----Medium-----High

**Mental Analysis:** how much mental and perceptual activity was required: thinking, deciding, calculating, remembering, looking, searching, etc.

Low-----Medium-----High

**Temporal Demand:** How much time pressure did you feel due to the rate or pace at which the tasks or task elements occurred?

Low-----Medium-----High

**Effort:** How hard did you have to work to accomplish your level of performance.

Low-----Medium-----High

**Performance:** How successful do you think you were in accomplishing the goals of the task set by the experimenter.

Low-----Medium-----High

**2.) Collaborating:**

**Frustrations Level:**

Insecure, discouraged, Irritated,

Secure, gratified, content,

Stressed, annoyed

relaxed and complacent.

Low-----Medium-----High

**Mental Analysis:** how much mental and perceptual activity was required: thinking, deciding, calculating, remembering, looking, searching, etc.

Low-----Medium-----High

**Temporal Demand:** How much time pressure did you feel due to the rate or pace at which the tasks or task elements occurred?

Low-----Medium-----High

**Effort:** How hard did you have to work to accomplish your level of performance.

Low-----Medium-----High

**Performance:** How successful do you think you were in accomplishing the goals of the task set by the experimenter.

Low-----Medium-----High

## OneNote Live Sharing Screenshots



Figure 6 - One Note Live Sharing Opening Screen

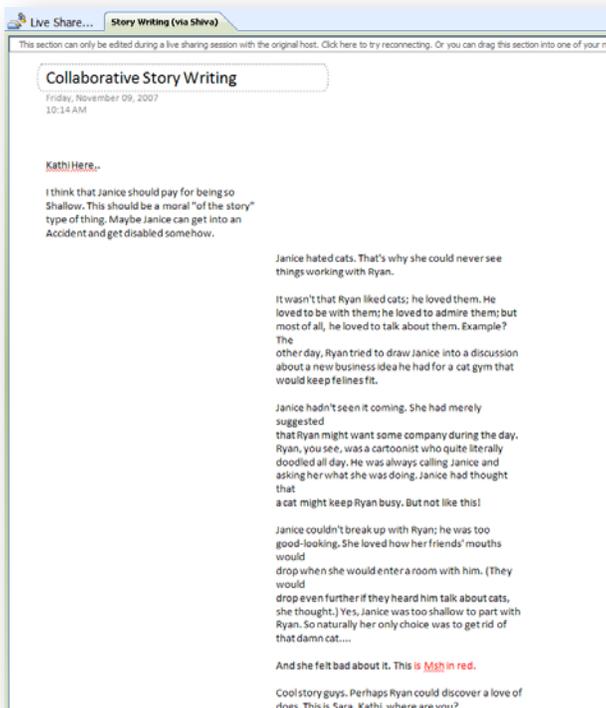


Figure 7 - The Original Story Given to Participants. One Participant is already beginning to brainstorm about the story

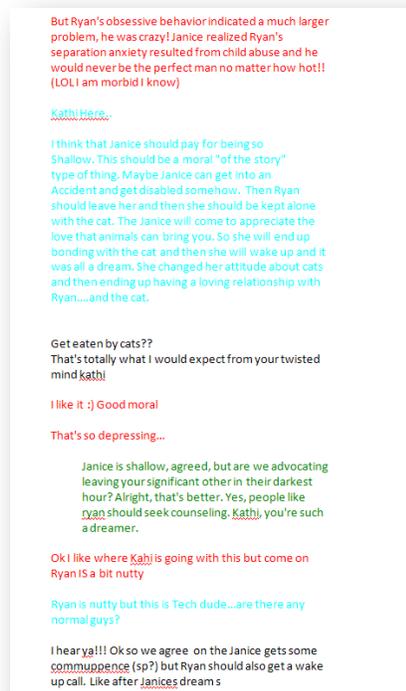


Figure 8 - Users are forced to devise their own chat scheme by color coding their comments

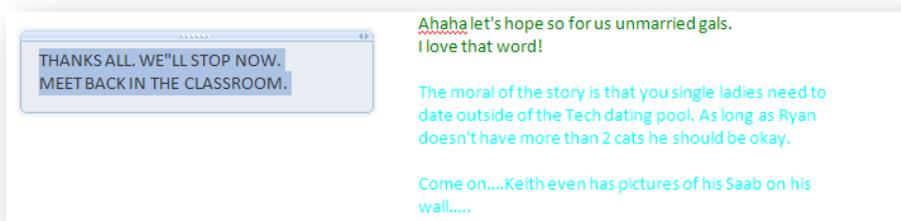


Figure 9 - Indication that the session is to be ended was given by one of the JASDD group members