CASSY(Classroom and Administration Support System): An Extensible Personal Task Management and   
Toolkit System for Teachers

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# The Problem and Its Background

## Introduction

The teaching profession has been called as the noblest of all professions, for indeed, no other profession could exist without it. As such, teachers are expected to possess all the qualities and the skills needed to perform all the duties that a teacher has. This includes class management skills that help a lot in providing a permissive and stimulating atmosphere that encourages pupils to raise questions and suggest alternative solutions to problems. As such, the teacher always has many things to do: preparing and teaching lessons, preparing teaching devices, marking student output, student counseling, and a countless other things that are intended to facilitate learning.

However, recent changes in curriculums and national policies have also brought changes to the work of teachers particularly as the K-12 program under the Revised Basic Education Curriculum became effective a few years ago, as of writing. Teachers have been required not only to adjust their lessons and teaching styles to the new program but also to do countless paper works for monitoring many things, such as students’ proficiency in English, among others. These changes added new burden to the already burdensome work of the teachers. Due to the growing workload of teachers, some have contemplated leaving the teaching profession itself. This is aside from the accompanying issues of teachers feeling underpaid and the students feeling overworked, too. Being underpaid means that some teachers have to do other things in order to augment their already small take home pay and, unwittingly, pay for their surmounting loans, taking away from what little time they have for their families and themselves.

The issue of teachers feeling overworked is not unique to the Philippines, as teachers in other countries have also experienced similar issues. Some teachers have even avoided promotions, as ascending to higher positions potentially meant additional work. Too much workload has also affected teachers’ performances in adverse ways. Because of these impacts, it is, therefore, imperative to address this issue in order to mitigate its effects on teacher performance and on education itself.

One of the things that can be used to deal with the ever-increasing workload not just of teachers but also of everyone else is time management. Some studies have linked proper time management of teachers to better teacher performance. As such, the numerous tasks of teachers can be dealt with better through time management.

Time management, however, has its drawbacks. For instance, it has been observed that as more tasks are done, even more tasks are left to do, possibly causing more stress and anxiety. On the other hand, task management can help not only in completing tasks but in accomplishing their goals as well. If time management aims for efficiency and productivity, task management aims for effectiveness and goal accomplishments. As such, task management can complement, if not replace, time management.

Many tools are already available to assist people with time management and task management. Task organizers are being sold in various stores. Likewise, in these days of automation, applications for task and time management have also been available for quite some time, as of writing. There are even apps that have been designed for use by teachers. Incidentally, many teachers already appear to have mobile phones and some access to computers, which makes the utility of these apps even more appealing. However, some of these only feature task management features, whereas teachers’ work have several dimensions. A teacher is not only an instructor: they also are managers, clerks, administrators, counselors, and other things as well. In order to accommodate such a multifaceted set of roles, a teacher might need to mix and match apps available on app stores just to have the right mix of features. However, maintaining multiple apps just for a single line of work can prove to be grueling and inconvenient. As such, it will be preferable to have a single system to manage all teacher roles in one place. This system should have everything under one application and be designed with the roles and capabilities of teachers in mind.

It is, therefore, the position of the proponents that an extensible personal system and toolkit for task management that is tailor-fit for teachers and other academic personnel be developed for their ever-evolving needs.

## Statement of the Problem

As the various roles of teachers can never be understated, teachers need to be able to manage their work as efficiently as possible. Their workflow should be smooth and effective enough so they can provide the best quality of instruction while still affording them enough time and energy to do more in life or at least ample time for rest. Unfortunately, teacher tasks have increased more than ever, with non-teaching tasks adding more weight to the already heavy burden of teachers at work. When left unmanaged or poorly managed, the surmounting work causes teachers more stress and a decline in their well-being. Utilizing the desktop and mobile device technologies already accessible to teachers to provide task and workflow management capabilities, teachers can go about their daily work more efficiently by letting the machines guide them in organizing their tasks and provide them with most of the appropriate tools needed for each type of work. The resulting workflow efficiency can then lead to lower stress levels and ample time or energy that can be spent either for lesson preparations, for rest, or for other relevant things in life.

In their line of work, teachers should always be effective and in top shape, despite all the burdens that their work presents. A personal system for managing teacher tasks is therefore proposed to assist them in making them efficient in their daily work.

## Objectives of the Study

The main objective of the study is to create an appropriate support software for teachers with consideration for the nature of their work as professionals in the academic sector. The proposed system shall be implemented as an extensible digital task and workflow management software that supports mobile and desktop devices. Toward this end, the following secondary aims need to be accomplished:

1. Investigate the different tasks and roles that teachers undertake and the factors that can affect these such as the work and organization environments, habits, and preferences, and incorporate findings into the software design.
2. Provide tools as plugin-based subsystems that will serve both as support software for various tasks and management activities and as sample plugins for demonstrating various functions.
3. Supply ample documentation and an accompanying plugin SDK (software development kit) to support system extensibility and guide future plugin development endeavors.
4. Create a reliable preferences editor to accept user customizations and maintain an online facility for bug report submissions, user feedback and suggestions, plugin proposals, and system updates.

## Significance of the Study

This study will benefit teachers and other academic professionals by developing a system that can assist in the management of their workflow and provide other tools to fulfill or even automate other work-related functions as well. Likewise, the resultant system will also provide a platform for which other custom-designed tools that further increase efficiency in work can be developed through institutionally backed endeavors. As mobile devices are more commonplace than ever, the product system will extend the functionalities of these devices to add more task and information management functions.

This study will also benefit software developers who have the needs of teachers in mind by providing a platform that can host subsystems that cater to the needs of teachers and other academic professionals.

This study will also benefit the students in such a way that, if their teachers are always able to efficiently manage their time and work, they will receive more well prepared instruction and, ultimately, a better quality of education.

This study also intends to provide education sector administrators and policy makers another choice for workflow management in both classrooms and school offices.

## Conceptual Framework

Figure ‎1–1 Conceptual Framework

The paradigm in Figure ‎1–1 represents the logical proceeding of this study. Inputs comprise of software requirements, development tools, and the software development life cycle (SDLC) model. The data for generating the software requirements shall include those gathered from target user interviews, document surveys, and information system surveys. The proponents shall also select the appropriate tools and development paradigm according to the needs of the development endeavor. The inputs shall then be processed by following through with the appropriate phases of the selected SDLC framework in order to produce the desired output, which is the proposed system itself. Outputs shall include both Android and Windows front-ends, software documentation, and the plugin SDK. Cross-platform development shall be preferred throughout the SDLC in order to target more devices.

## Scope and Delimitation

This study shall focus on the roles and workflow of respondents that can be supported by different types of information systems. The respondents of the study shall mostly include teachers but may also include school administrators and office personnel in the academic sector. The respondents shall also come from selected schools and offices that would agree to participate in the study.

This study will also look at existing information management systems that are already in place in the school and academic settings and how these can either be replaced or adapted to interface with the proposed system. Restricted management systems may also be studied, but the degree of liberty in doing so will depend on the authorization level that the respondents’ respective parties are willing to grant to the proponents for this study.

Software development tools selection will also be dealt with in this study. The study will not look at these tools in depth. However, these tools shall be considered according to utility and practicality to the proponents.

The development cycle will also focus on creating an extensible system that can accommodate changes and additional features in the future, particularly in cases where there are changes in policies and workflows. As a corollary, an attempt to design a developer kit to address the related issue of independent plugin development shall be undertaken.

Finally, this study will initiate a cross-platform development but efforts shall be exerted for the Android and Windows desktop versions only due to hardware and software constraints on the proponents’ part.

## Definition of Terms

Some terms used in the study have already been defined in-text or through notes. However, this list of recurring terms with their accompanying definitions are included for further reference. The following terms are defined either nominally or operationally, whichever the case may be:

* **Academic Personnel/Academic Professional** – refers to all classroom and office personnel working in the academic/education sector, including but not limited to teachers and school heads.
* **Android** – refers to the Android OS, a mobile operating system developed by Google.
* **Counseling and guidance** – the activity of a guidance counselor, a professional who counsels people, especially on personal problems and difficulties. A teacher performs this role to assist students in their many and varied problems.[[1]](#footnote-2)
* **DepEd** – refers to the Department of Education, a government agency in the Philippines.
* **Emotional Design** – a design perspective by Donald Norman.
* **Extensibility** – refers to a system feature that allows addition of features on demand.
* **Human Factor** – refers to human characteristics, abilities, and limitations.
* **Human Factors and Ergonomics** – refers to the field of human factors and ergonomics.
* **Information System** –
* **iOS** – refers to a mobile operating system created and developed by Apple Inc. exclusively for its hardware.
* **Platform** – depending on context, this could refer either to the different operating systems that can host current system or to the system itself, which can host other subsystems. When taken to refer to operating systems, this includes Android and Windows.
* **Stakeholders** – refers to all people or parties that have interest in the development of the proposed system. These includes but is not limited to target users, developers of the proposed system, and research mentors.
* **UWP** – refers to the Universal Windows Platform, a platform-homogeneous application architecture created by Microsoft and first introduced in Windows 10. UWP apps are also known as Windows Store apps. UWP apps are formerly called Metro-style apps, Modern UI-style apps, and Windows 8-style apps.
* **Windows** – refers to Microsoft Windows, a graphical operating system developed, marketed, and sold by Microsoft.

# Review of Related Studies and Literature

In order to design a task management system that is tailor-fit to the needs of the respondents, it is imperative to have a fuller grasp of the issues that they deal with. As such, various materials are reviewed, ranging from various local and foreign articles to reference works. Likewise, related studies and special problems that can provide better design insight are also consulted.

## The Teacher’s Work

Lardizabal, et al. (1995) provides a detailed and very informative reference regarding the work and functions of a teacher, such as classroom management, planning of lessons, and evaluation of learning. According to this reference text, teachers are expected to have not only teaching, guidance, and evaluation skills, but management skills as well. Furthermore, the teacher’s job is summed up in the following tasks:[[2]](#footnote-3)

1. **Guiding the learning process.** The teacher should promote learning by planning and organizing meaningful learning experiences, among others.
2. **Counseling and guidance.** In performing the guidance function, the teacher uses various sources and procedures to know the pupils and their needs, works closely with the guidance counselor, and learns the techniques of individual as well as group guidance. This responsibility is especially important when there is no guidance program in the school.
3. **Sponsoring extra class activities.** Extra class activities are considered part of any school program, as they are important in contributing to the development of children. Some of these activities may include student organizations, publications, athletics, speech, drama, music, and others depending on school. In assigning a teacher to any extra class activity, an administrator usually considers the teacher’s interest and ability.
4. **Working with parents and the community.** The teacher’s important responsibility is the establishment of harmonious relationships between the school and the community. As such, the teacher interprets his/her work and that of the school to parents by conferring with them about their children at school or at home, cooperates actively in community organizations, and participates in various PTA[[3]](#footnote-4) activities and in community activities for social, economic, and political improvement.
5. **Professional responsibilities.** As a member of the teaching profession, a teacher has the responsibility to improve one’s self by maintaining high standards of personal and professional conduct and by continuing to grow professionally.

The World Book Encyclopedia describes a teacher’s job as follows:[[4]](#footnote-5)

A teacher’s job involves four main duties. (1) Teachers must prepare for their classes. (2) They must guide, or assist, the learning of students. (3) They must check student progress. (4) Teachers must set a good example for their students. In carrying out these duties, teachers try to identify and respond to the needs of individual students.

Kelly (2017), a web article, also includes a list of teacher tasks organized into basic categories covering everything from planning lessons to classroom management:[[5]](#footnote-6)

1. Planning, Developing, and Organizing Instruction
2. Housekeeping and Recordkeeping
3. Managing Student Conduct
4. Presenting Subject Material
5. Assessing Student Learning
6. Meeting Professional Obligations

Considering all the tasks in store for every teacher, new teachers experience some struggles at work. Llego (2017), from the TeacherPH website, lists some of them: (1) lesson plan making; (2) some administrators are making it hard for the new teacher; (3) students; (4) “I am overworked.”; (5) overexpecting[[6]](#footnote-7) co-teachers; and (6) “May be teaching is not for me.”[[7]](#footnote-8)

It is very clear that, even from the very beginning of a teacher’s career, the teacher is always busy and even struggling with work (Abraham 1990) (Llego 2017). A teacher’s work does not stop at teaching in the classroom and managing student learning: a teacher also needs to deal with co-teachers, school administrators, parents, and the community itself (Lardizabal, et al. 1995) (Llego 2017). Likewise, a teacher should also take care never to neglect professional obligations and continuous personal and professional development (Kelly 2017) (Lardizabal, et al. 1995). This still does not mention all the paperwork and recordkeeping that teachers have to deal with in their work.

Teachers cover such a wide variety of tasks that related issues arise due to the number of tasks they need to fulfill. For instance, in a web article, de Dios (2012) describes the predicament of underpaid and overworked teachers, who try their best to augment their income to support their family and pay their loans. The article also raises the issue’s impacts on both the pupils and the educational system, as a whole:

Public school teachers in the Philippines do not have the time, energy and money to spare. x x x

... Teachers who have to resort to additional ways to augment their income are not able to give their undivided attention to the education of the pupils in their classrooms. Both their time and attention are now compromised. On top of this, there is very little reason to be motivated, much less participate in renewing and reforming education.[[8]](#footnote-9)

Another article from a news site (Clerigo 2016) also reports about a certain incident involving an overworked teacher from the Philippine DepEd of Region XI who was hospitalized after collapsing. The article reports that she finished 30 lesson plans, prepared activities until 12:00 midnight, and skipped meals. Although the news article mentioned that the teacher allegedly skipped meals, it is still clear that she is indeed overworked and possibly sleep deprived, as well. The article also reported that a lack of teachers is also to blame for the incident.[[9]](#footnote-10)

The issue of teachers having too much work not only exists in the Philippines. Various web articles from foreign sources report about this issue as well. For instance, Adams (2017) cites a report saying that young teachers are being driven out of the profession after only a few years in the job because of the demanding workload, with many of them saying the job has affected their mental health.[[10]](#footnote-11) A survey (Toplikar 2007) highlights the issues of teachers having less time to do their jobs, with paperwork and record keeping adding much to their workload and stress leading some teachers to “burn out” and leave the profession.[[11]](#footnote-12) Similarly, a teacher union’s general secretary (Cockroft 2015) has released a statement about increased workload and bureaucracy making teaching an unappealing profession, thereby pushing some teachers to leave the profession or inhibiting prospective teachers from entering.[[12]](#footnote-13) Furthermore, a survey of 4382 teachers (Lover 2016) points out the following results:[[13]](#footnote-14)

1. Almost a third of teachers work more than 60 hours a week, 82% stated that their workload was unmanageable, 73% said that their workload was affecting their physical health, and 76% their mental health.
2. One in five teachers intends to leave due to workload concerns.
3. One in four teachers wants to be a deputy head, but only 5% want to be a headteacher[[14]](#footnote-15), for fear of increased workload and poorer work-life balance.
4. It’s[[15]](#footnote-16) tough to fill teaching vacancies due to a lack of good candidates.
5. The teacher shortage is already affecting children.

More than enough has been said about the plight of the overworked teachers. However, when the students are factored in, things look somewhat worse. For instance, Benn (2014) reacts to a report released by the UK’s Association of Teachers and Lecturers (ATL) and posits that overworked teachers are also teaching overworked schoolchildren, further saying, “Overtired children don’t learn.” In this light, teachers’ stress is not really the culprit but the entire system itself that requires people to do more.[[16]](#footnote-17)

The sad plight of overworked and, oftentimes, overworked teachers had already been called to attention numerous times (de Dios 2012) (Clerigo 2016). The effects of overburdening teachers with work had also been raised not just locally but abroad, as well (Adams 2017), which included effects to the personal and professional welfare of the teachers themselves (Toplikar 2007). This still did not even mention the effects on people’s perception of the teaching profession (Cockroft 2015) (Lover 2016) and on the quality of education, as well (de Dios 2012). Solutions to this dilemma had been, therefore, long overdue.

There are, however, some proposals that aim to alleviate the issue of overworked teachers. Local education officials, for example, suggest that every school must regulate their programs and employ schemes that will not burden the teachers.[[17]](#footnote-18) Likewise, in the United Kingdom, a four-point plan is suggested (Harris 2017) to address issues in four key areas that school administrators need to look at so as to reduce the longer and longer hours of work faced by teachers:[[18]](#footnote-19)

1. Every school needs to know the direction it is going in, and this needs to be understood by every member of staff.
2. Planning and assessment needs to be radically reduced.
3. Marking should never be for the benefit of the senior staff or the parents. It’s to move children’s work.
4. Meetings should be restricted to just two evenings a week and their relevance needs to be recognised.

The Department of Education (DepEd) also continuously updates its policies whenever the need arises. One of these is related to the issuing of a department order (DO 9, s. 2005) that provides measures to lessen activities that take teachers and students away from the classroom, maximize the use of the time allotment for every subject, and reduce the non-teaching duties of teachers. It also reiterates the policy that the prescribed 205 school days shall be strictly spent on engaged time-on-task and any school day or part of a school day spent otherwise is classified as a disruption.[[19]](#footnote-20) Another measure to improve the tasks of teachers is embodied in a department memorandum (DM 60, s. 2015) that provides for the use of electronic class records, which afforded easy computation of total and average scores.[[20]](#footnote-21)

To sum up, the importance of teachers’ work can never be underscored enough despite being a potential cause of burdensome work. However, to mitigate the impact of teachers’ work to themselves, to their students, and to the education system as whole, steps should be taken by authorities and policy changes should be put in place. Aside from these government- or institution-backed initiatives, it has also been suggested by various studies and literature that teachers can also benefit through time management and task management.

## Time Management and Task Management

Sima (2017) defines Time Management as “the process of planning and organizing how much time you spend on specific tasks, projects or goals. It involves taking conscious control over how long you spend engaged in any given activity in order to become more effective and more productive.” On the other hand, Task Management is defined as “the process of managing a task through different stages: planning, development, and completion. It works both on an individual and on a group level by getting people to accomplish their goals.” Time management and task management both aim for efficiency and effectiveness but there are clear differences. Time management works on the assumption that, if you learn to spend your time correctly, you will get more things done. However, as more things are done, more work awaits. This can result to over scheduling, divided attention, stress, and an overall decrease in effectiveness. With task management, a task is simply a piece of work that needs to be undertaken and it comes with clear limits, which make them easier to manage. On the other hand, as time is both large and clearly undefined, it is way more difficult to manage.[[21]](#footnote-22)

Likewise, Ravenscraft (2015) points out that, although time management helps get more things done, “the result of getting more done is often having even more to do.” As such, the article suggests that “Rather than try to cram as much as possible into one day, focus on managing your tasks first, then dole out your time.”[[22]](#footnote-23)

Even though task management can prove to be superior to time management, the significance of time management still cannot be diminished, particularly in setting priorities. Various web articles provide many tips by which tasks can be more effectively done while using time more efficiently. BusinessTips (2017) proposes 10 tips for better time management while also suggesting that urgent but not so important tasks may be delegated to focus on the important tasks:[[23]](#footnote-24)

1. Decide what tasks must be prioritized and do them first.
2. Focus on one task at a time.
3. Get rid of all possible distractions.
4. Manage tasks in collective groups.
5. Know your deadlines.
6. Do not linger on details too much.
7. Delegate.
8. Give yourself some break time after finished task.
9. Sleep around 7 to 8 hours a day.
10. The last and most important is to be committed.

According to Madsen (2015), “Not only does effective time management allow you to get better results at work, it also helps you withstand stress and live a more fulfilling life outside of work.” The article also suggests seven essential time management strategies:[[24]](#footnote-25)

1. Start your day with a clear focus.
2. Have a dynamic task list.
3. Focus on high-value activities.
4. Minimize interruptions.
5. Stop procrastinating.
6. Limit multi-tasking.
7. Review your day.

Cox (2014) directly gives teachers some tips on time management:[[25]](#footnote-26)

1. **Ask for Help.** To save time that can be used for something more productive.
2. **Prioritize.** Teachers should prioritize to keep on track when something unexpected occurs.
3. **Give Homework.** Leaving all of the assignments that relate to practice for homework helps clear up extra time in class for those important lessons.
4. **Organize Everything.** A well-maintained classroom runs on its own.
5. **Plan for Transition Times.** Quick, five-minute activities for transitions help save time.
6. **Maximize Lesson Planning.** Use apps or go to websites that have lesson ideas already planned.

Cox also suggests the following additional ideas for classroom management that can also help save time:[[26]](#footnote-27)

* Pull out all materials needed for a lesson the day before and keep them together in a tote.
* Make transparencies for all directions to activities.
* Assign a student assistant to help pass out papers and materials.
* Place all materials that need to go to the office in one container so you only make one trip.
* Use apps to help your grading go faster.
* Create a bulletin board for roll call and lunch count that students can complete themselves.
* Divide paperwork into categories: To do, to read, to hold, to grade, etc.

I

II

III

IVI

Urgent

Not Urgent

Important

Not Important

Figure ‎2–1 Time Management Matrix

Savara (2018) poses a question about highly productive people: “how were they able to prioritize their work quickly, and get the most done?” He goes on to propose Stephen Covey’s time management matrix[[27]](#footnote-28) (see Figure ‎2–1), also called the Eisenhower method,[[28]](#footnote-29) which makes it easy to figure out what you “need” to be doing with your time and attention. Quadrant 1 represents important, urgent items that **need to be dealt with immediately.** Quadrant 2 represents important, but not urgent items that are important but do not require your immediate attention, and **need to be planned for.** Quadrant 3 represents urgent but unimportant items, which **should be minimized or eliminated.** Quadrant 4 represents trivial time wasters, unimportant items that are also not urgent which don’t have to be done anytime soon, perhaps add little to no value, and also **should be minimized or eliminated.**[[29]](#footnote-30)

For task management, Sima (2017) offers the following tips for task management:[[30]](#footnote-31)

1. **Prioritise** to make sure that important things get seen to right away. This works for both time management and task management.
2. **Do the hardest task first.** Getting down to the thing you dread the most will help you cut procrastination. In addition, completing important work will allow you to feel that you have made progress. It can also provide a push for getting more done.
3. **Use the appropriate tools** to manage your tasks as effectively as possible.

Cooper (2015), from her research through a Reddit discussion, also suggests the following methods for task management:[[31]](#footnote-32)

1. **Tag tasks with a time allotment.** Tags add a context, time allotment sets a definite deadline.
2. **Start every day with a new piece of paper.** This adds focus and keeps to-do lists short.
3. **Focus on your current task, covering up the others.** This helps focus on current task.
4. **Contrast long- and short-term goals.** This includes “Year Milestones”, “Month Milestones”, and “Weekly Tasks”.
5. **Make use of Markdown.** Markdown is a type of markup language. It can also be used to organize tasks with tags.
6. **Combine flexible tools.** It helps in filling gaps in the workflow.
7. **Pony up and pay for a robust tool.** A non-free tool often has a lot of features.
8. **Regularly reflect on completed tasks.** This aids in setting goals and priorities.

Another form of time management that humans can benefit learning from is the way processors handle tasks. CPU scheduling affords computers a way to manage different tasks and keeping the CPU busy as possible while maintaining the fair allocation of its resources. GeeksforGeeks (2017) lists the different scheduling algorithms, some of which might mimic real-life task management.[[32]](#footnote-33) These may be used to suggest optimal ways by which a person might go about in performing tasks.

* **First Come First Serve (FCFS):** Schedules according to arrival times of processes.
* **Shortest Job First (SJF):** Processes that have the shortest burst time are scheduled first.
* **Shortest Remaining Time First (SRTF):** A preemptive mode of SJF algorithm in which jobs are scheduled according to the shortest remaining time.
* **Round Robin Scheduling:** Each process is assigned a fixed time in cyclic way.
* **Priority Based scheduling (Non Preemptive):** Processes are scheduled according to their priorities, i.e., highest priority process is schedule first. If priorities of two processes match, then schedule according to arrival time.
* **Highest Response Ratio Next (HRRN):** Processes with highest response ratio are scheduled. This algorithm avoids starvation.
* **Multilevel Queue Scheduling:** Processes are placed in different queues according to the priority of process. Generally, high priority process are placed in the top-level queue. Only after completion of processes from top-level queue, lower level queued processes are scheduled.
* **Multilevel Feedback Queue Scheduling:** It allows the process to move in between queues to separate processes according to the characteristics of their CPU bursts. If a process uses too much CPU time, it is moved to a lower-priority queue.

Task management and time management are both very helpful in managing both individual and group tasks, as they aim for efficient use of time by planning and organization of tasks for the accomplishment of these tasks and the achievement of goals (Sima 2017) (Ravenscraft 2015). Important tasks should be prioritized; however, other tasks that are urgent but not so important may be delegated or shared with others while unimportant items that are also non-urgent could even be eliminated so as not to waste time (10 Tips For Better Time Management 2017) (Cox 2014) (Savara 2018) (Covey 2012). Likewise, organizing everything and using appropriate and flexible tools can also be a great help in managing tasks as effectively as possible, especially for teachers who have a lot of lesson planning and classroom management to do (Cox 2014) (Cooper 2015) (Sima 2017).

## Task Management Software in the Market

The following is a list of 12 good currently available task management apps that can be adapted for use by teachers (12 Good Task Management Apps for Teaching 2017).[[33]](#footnote-34)

1. Microsoft To-Do
2. Things 3
3. Wunderlist
4. Totoist
5. Google Keep
6. Any.do
7. Simpli
8. TickTick
9. Workflow
10. Trello
11. Remember The Milk
12. Google Calendar

The apps mentioned appear very functional and has very useful features, however, none are specifically designed for teachers. Various apps for teachers can also be found in software app stores; however, these appear to be very specialized for use by teachers only. Likewise, extensibility is quite rare.

## Related Studies

Various studies and special problems were reviewed in order to gain further insight about time and task management, stress, work, classroom management, recordkeeping, and mobile app development, among others.

A published local study (Mingoa 2017) explores the stress level, vulnerability to stress, and the most common sources of stress, and the coping strategies of teachers. It has found that the top five most common sources of stress for teachers includes: (1) having too much paperwork; (2) high cost of living; (3) insufficient salary; (4) oversized classes; and (5) being too busy, although a combination of work-related, personal, and economic factors are at play. Additionally, having too much paperwork can possibly be a consequence of oversized classes. The study has found out that the teachers’ stress levels and vulnerability to stress are relatively high. It has also found that the most common ailments the teachers in the study complain about are: (1) fatigue; (2) aching neck and shoulder muscles; (3) lower back pain; (4) sleep disturbances and insomnia; and (5) migraine headaches and menstrual distress or irregularities. Complaints on aching neck and shoulders and lower back pain are associated with the nature of the work. Coping strategies include: (1) watching television; (2) windows shopping at malls; (3) watching sports on television; (4) going to movies; and (5) doing deep breathing and relaxation exercises. Although the methods mentioned are positive, most are sedentary.[[34]](#footnote-35)

The foreign study, Sahito, et al. (2016), explores and investigates the importance of time management in the professional life of teachers and the performance of the students. It uses a qualitative research design to collect data from the sample through interviews. The proponents compared public schools and private schools in their locale and found the performance of students in the private schools better because of better time management and good system of planning lessons.[[35]](#footnote-36)

Another foreign study (Khan, et al. 2016) aimed to explore the relationship of time management with teacher’s performance:

This study was conducted to measure the relationship with teachers’ time management techniques and their class performance... A positive relationship between teachers’ time management techniques and their class performance was found. The study also inferred that teachers’ lesson planning technique were very effective for their class performance due to affective time management. It was recommended that time management skills may be included in teacher training programmes to improve teachers’ managerial and administrational activities.[[36]](#footnote-37)

It is also interesting to note that Khan, et al. also reflected on why the most important tasks should be prioritized:

In managing the time, prioritizing the daily tasks is also an effective method of time handling. For this purpose, one should have to separate and categorize his all activities according to their importance. It is more suitable to handle less important tasks intermittently in order to complete the major tasks... For most important tasks, suggestion is that do them in your best time. The reason for this is quite clear. This is because most important task requires more energy and the less important tasks require less energy or to finish the intended goals.[[37]](#footnote-38)

Teachers have a lot of work on their hands that, when combined with personal and economic factors, can cause them stress and health issues that come along with stress (Mingoa 2017). Teachers are still able to cope with stress with various ways, albeit sedentary; however, valuable strategies like time management can help teachers and even the classes they teach have better performance (Sahito, et al. 2016) (Khan, et al. 2016). Through categorization and prioritization of tasks according to importance, time and energy can be spent more meaningfully and managed more effectively to achieve intended goals (Khan, et al. 2016).

Several unpublished studies and special problems were also reviewed:

Ros (2016) is a study that aimed to develop an Android-based college planner that is customized for college students. It also aimed to integrate different organizational apps in order to provide additional features related to scheduling. The application was tested successfully according to overall ease of use, user interface design, satisfaction, and usefulness. The study pointed out that there are underlying problems with the use of paper planners in terms of efficiency. Creating a software version of the paper planner would obviously afford more features for the user. The features added allowed a user to: (A) create a list of instructors and a timetable of consultation schedule; (B) create a list of courses taken for the semester; (C) record the number of absences for each course; (D) create a note for each course; (E) create a photo note taken from camera or gallery for each course; (F) create a task/to-do-list for each course; and (G) import, export, and Bluetooth transfer of a database file.[[38]](#footnote-39) Of all the features listed, the task list is the main feature. This can be used to create a task for every course. There would be three lists where tasks would go, depending on marked status: upcoming, late, and completed tasks. The student can filter the tasks by course, due date, weight (assignment, exam, quiz, group meeting, etc.), or priority. Once a task is completed, the students must then mark it as done. The users can also view a status bar and setup an app widget for easier access.[[39]](#footnote-40)

Garcia & Lapitan (2012) to develop a personalized and user-friendly Android application that will improve the organization of tasks of users by employing a modified Earliest Deadline First Scheduling Algorithm to handle cases with same deadline tasks. The application should also be able to generate a schedule either manually or automatically based on user input and task deadlines:

Time management has always been a problem especially for most students as they often tend to forget, cram, or fail to finish up a given task. Using the most common belonging of students, a mobile phone, an application that would serve as an aid to the time management problem will be developed. The application is to be developed specifically for smartphones running on Android OS and through the Earliest Deadline First algorithm, tasks would be scheduled and viewed in a tabular form. With the user being able to visualize the weight of his workload and notified of his upcoming tasks, it is expected that there would be a lesser risks of time management problems and tasks left unfinished.[[40]](#footnote-41)

Aside from a choice between manual and automatic schedule generation, the system also features a tabular schedule generation, showing schedules generated manually or automatically. Different colors signify the differences in priorities or difficulties of each task. As the proponents recognized that proper time management is the key to keeping in sync with one’s daily activities, they have suggested that a way to achieve proper time management is through task scheduling[[41]](#footnote-42), similar to how computers manage CPU time for running tasks. If tasks are treated like OS tasks, existing algorithms for task scheduling can be used for schedule generation. However, they also note that, as of the time of their writing, there is not much literature available for scheduling real-world tasks. They also note that applications, both in the mobile devices and over the internet, are available for this need, although there are not enough documentation on which algorithm they used and how they are developed.[[42]](#footnote-43) As such, the proponents imply that there is a lot to be desired when it comes to the use of algorithms in real-world tasks.

Garcia & Gocoyo (2016) states that “Information has now attained its rightful place as a strategic resource... x x x Information is very decisive in any and whatever decision-making an organization has to make in dealing with all the transactions that are transpiring inside and within its bound...”[[43]](#footnote-44) One of the decisions that a university needs to make is the class schedule. As such, it presents a system that can be used in class scheduling in a university. It makes use of Genetic Algorithms (GAs) combined with the Queen Bee Algorithm (QBA) for a more efficient and effective scheduling.[[44]](#footnote-45) In generating the specifications of the scheduling system, the hard and soft constraints that could affect the scheduling are first determined. These includes University policies, instructors’ preferences, the number of classrooms, and the total number of students. Significant features have been added such as allowing users to print or download a specific schedule in PDF format, to merge classes, to manage rooms and building, to detect class schedule conflicts, manage room types, assign faculty, and manage subject specialization.[[45]](#footnote-46) The proponents of the study have used several frameworks and development tools which include NGINX for the server side, Silex PHP as the primary programming tool and back-end software, Semantic-ui and uikit for the front-end, and AngularJS via AJAX and JSON for communicating with the current system’s Application Programming Interface (API).[[46]](#footnote-47)

Comia, et al. (2013) develops a class record for Android to help the instructors manage their class records based on their desired strategy. The system provides student profiles for the ease of access in student’s information. The application also affords both a seat plan view and a recitation view. It also allows an efficient way of recording and computing student grades as opposed to manual recording and calculation. To proceed with the development, the proponents first surveyed for other similar systems and analyzed their design and development according to interface and the database management components. After implementation, the system is then evaluated according to functionality, compatibility and user acceptance.[[47]](#footnote-48)

In the foregoing special problems, different issues such as time management, task planning, class scheduling, and class record maintenance are all addressed through Android-based or mobile-device-based apps. The developers all look to the currently commonplace smartphones as functional management tools. All apps feature at least a sort of automation, especially in generating schedules or maintaining records. Each app also affords different views of the same information and different ways in manipulating them. Some of these studies have carried out surveys of similar systems in order to analyze their design and development. The apps are also evaluated after their implementation. However, it will be interesting to note that, in the design endeavors, CPU scheduling algorithms are considered for scheduling real-life tasks and special algorithms describing real-life, naturally-occurring events or processes, such as genetic algorithms and the queen bee algorithm, are applied to automation. Another thing worth mentioning is how the developers paid attention to personal, organizational, and activity-related factors in the design of their respective systems.

Regarding development tools, a list of frameworks on the web can be found at the page Mobile Frameworks Comparison Chart (n.d.).[[48]](#footnote-49) Many frameworks and development tools are listed, but the proponents of the current study deem Xamarin as a very suitable option, particularly as Xamarin can be used with Visual Studio and C# to produce apps that can target Android, iOS, and Windows UWP (Universal Windows Platform) while sharing code among the different platform implementations. However, there are other tools that might still be worthy of consideration during the design phase of this study, such as Google’s Android Studio and Embarcadero’s RAD Studio.

In order to select the best framework for the purposes of the proponents, the proponents also reviewed the suggestions of Srivastav (2015). The article points out the importance of choosing the programming language that the programmers prefer especially when there are time constraints. Likewise, the user interface, the UX, and the responsiveness of a resulting app should also be another consideration in choosing the appropriate framework particularly as these can directly affect the app structure, usability, and overall user experience. Finally, a framework that has ample documentation and a large community of developers can provide more benefits than a framework that has otherwise.[[49]](#footnote-50)

## Plugin-Based Architecture

As the proponents are planning to create an extensible system, a plugin-based architecture will be most suitable as the system’s main architecture. According to Paul (2011), a plugin architecture app has three components: (1) the plugin container, (2) the plugin interface, and (3) the plugins. The plugin-enabled application also provides the following flexibilities: (1) reduced size in initial deployment; (2) incrementing the modules as plugins; and (3) customers can benefit from choosing plugin modules, thus, reduction in cost.[[50]](#footnote-51)

## Ergonomic Design and Emotional Design

In designing a system that is meant to fit the needs and characteristics of target users, it is very important to first understand the user. This is the role of ergonomic design.

The website of the International Ergonomics Association defines ergonomics as “the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.” It also identifies three domains of specialization:[[51]](#footnote-52)

* **Physical ergonomics** is concerned with human anatomical, anthropometric, physiological and biomechanical characteristics as they relate to physical activity.
* **Cognitive ergonomics** is concerned with mental processes, such as perception, memory, reasoning, and motor response, as they affect interactions among humans and other elements of a system.
* **Organizational ergonomics** is concerned with the optimization of sociotechnical systems, including their organizational structures, policies, and processes.

Wikipedia defines Human Factors and Ergonomics as the application of psychological and physiological principles to the engineering and design of products, processes, and systems. The term “human factor” is a physical or cognitive property of an individual or social behavior specific to humans that may influence the functioning of technological systems. When taken to refer to the field, the terms “human factors” and “ergonomics” are often used interchangeably. The goal of human factors is to reduce human error, increase productivity, and enhance safety and comfort with a specific focus on the interaction between the human and the thing of interest. In essence, it is the study of designing equipment, devices, and processes that fit the human body and its cognitive abilities. It accounts for the user’s capabilities and limitations in seeking to ensure that the tasks, functions, information, and the environment suit that user. Some of the methods for evaluation of human factors include ethnographic analysis, focus groups, surveys and questionnaires, task analysis, user analysis, time studies, cognitive walkthrough, and HITOP (High Integration of Technology, Organization, and People), among others.[[52]](#footnote-53)

In the book, *Introduction to Human Factors and Ergonomics for Engineers* (Lehto and Buck 2008), ergonomics was defined as the study of people at work. The field got its name in 1949 when a group of interested individuals assembled in Oxford, England to discuss the topic of human performance. The group decided to adopt the term ergonomics from the Greek words *ergos* (work) and *nomos* (natural law) and called themselves the Ergonomics Research Society. Sometime later, the term *human factors* was coined in the U.S. for a society of similar purpose. Ergonomics can also be described as the study of human-machine systems, with an emphasis on the human aspect. Ergonomists study people and the way they operate equipment in the home, in commerce, in factories, and in governmental activities.[[53]](#footnote-54)

Lehto & Buck (2008) also identify some traditional principles in ergonomic design:[[54]](#footnote-55)

1. Eliminate unnecessary elements. Unnecessary design features add to the cost of the design without benefitting the user.
2. Simplify elements. Simple solutions to a design problem are elegant because they satisfy the need at lower cost and frequently produce longer life cycles.
3. Keep things natural. Natural activities are compatible because people intuitively avoid actions that feel awkward.
4. Combine compatible elements where possible. Combining activities can often improve operations, provided that the activities being combined are compatible.
5. Group elements in their sequence of use. Revise operational sequences to reduce incompatibilities between successive activities.
6. Locate those elements with the most frequent use in the most favorable locations. Keep the flow of work moving long smooth curves over space, minimizing backtracking, extra movement, delays, and needless inventory.

In many cases, the designer needs to determine the attitudes, concerns, objectives, and goals of various subpopulations of people on the use of a particular product. In most cases, the questionnaire can be used to gather such information economically. In other cases, questionnaires are used after experiments to collect subjective opinions of the experimental subjects during or subsequent to the experiment.[[55]](#footnote-56)

Nielsen (1993) defines five usability attributes: learnability, efficiency, memorability, errors, and satisfaction. He also identifies ten usability principles that should be followed by all user interface designers. These are as follows:[[56]](#footnote-57)

1. Simple and natural dialogue
2. Speak the users’ language
3. Minimize the users’ memory load
4. Consistency
5. Feedback
6. Clearly marked exits
7. Shortcuts
8. Good error messages
9. Prevent errors
10. Help and documentation

In formulating preference tests, Karlin (as cited in Lehto & Buck, 2008) provides many practical suggestions in order to determine what customers wanted:[[57]](#footnote-58)

1. Preferences and opinions from people without actual use experience are unreliable.
2. Users should try out equipment under normal, real-life conditions in order to find out what their preferences really are.
3. Initial preference opinions based on brief experience with the product may be reversed by subsequent experience.
4. Many people have preconceived biases. Experience with a new device should be extensive enough to overcome those biases, enabling the user to evaluate all of its important properties.
5. Experience with a new device should duplicate the field situation as closely as possible.
6. People cannot artificially generate or imagine needs that are not real. Users should not be expected to ignore certain features in an experimental device that the tested experimental device does not possess but which would be present in the planned future device.
7. Users in an experiment should be allowed to use the device the way they want to use it.

Norman (2013) proposes human-centered design:

… an approach that puts human needs, capabilities, and behavior first, then designs to accommodate those needs, capabilities, and ways of behaving. Good design starts with an understanding of psychology and technology. Good design requires good communication, especially from machine to person, indicating what actions are possible, what is happening, and what is about to happen... Designers need to focus their attention on the cases where things go wrong, not just on when things work as planned. xxx

Human-centered design is a design philosophy. It means starting with a good understanding of people and the needs that the design is intended to meet. This understanding comes about primarily through observation, for people themselves are often unaware of their true needs, even unaware of the difficulties they are encountering.[[58]](#footnote-59)

Wikipedia also provides some insight on Activity-centered design, an extension of the Human-centered design paradigm in interaction design. ACD features heavier emphasis on the activities that a user would perform with a given piece of technology. When working with activity-centered design, the designers use research to get insights of the users. Observations and interviews are typical approaches to learn more about the user’s behavior.[[59]](#footnote-60)

Emotional design is concerned with how emotions have a crucial role in the human ability to understand the world and how they learn new things. Emotional design is an important element when generating ideas for human-centred opportunities. People can more easily relate to a product, a service, a system, or an experience when they are able to connect with it at a personal level.[[60]](#footnote-61)

Norman (2004) suggests considering human emotions for design. He proposes three levels of design, which form the foundation of emotional design:[[61]](#footnote-62)

1. **Visceral design** - all about immediate emotional impact, where the appearance, shape, form, size, texture, and feel of products matter.
2. **Behavioral design** - all about use, where appearance and rationale doesn’t matter but performance does; the focus of practitioners in the usability community.
3. **Reflective design** - all about message, culture, and the meaning of a product or its use. For one, it is about the meaning of things, the personal remembrances something evokes. For another, very different thing, it is about self-image and the message a product sends to others.

Technology is developed to afford its users better ways of doing things. However, to fully achieve this goal, technology should be designed according to its target users’ needs, preferences, tasks, abilities, and, possibly, limitations. The field of human factors and ergonomics helps designers deal with this need. Still, as the use of technologies is also influenced by human behavior, it will also be very helpful to design technology in the visceral, behavioral, and reflective levels of emotional design so that the developed technologies will not only be functional and usable, but acceptable and more preferable to its users, as well.

# Methodology and Design

The following sections describe the methods and tools of research and software design for use in the development of CASSY, the proposed personal task management and toolkit system for teachers and academic professionals.

## Software Development Life Cycle (SDLC)

The model chosen by the proponents for the development of the proposed system is a lightweight integration of three development mindsets as proposed by Johnny Schneider. Design thinking shall fully explore and understand the tasks and needs of teachers at work and exert efforts to meet these needs. Agile software development shall help the development process to take up speed while ensuring the release of a truly working system. Lean management shall guide the continuous improvement of processes all throughout. The proponents have also chosen to incorporate some elements of the Scrum method of agile software development for better management of the software development process.

The selected model includes four steps for actionable strategy (see Figure ‎3–1). To diagnose the current condition, information are gathered and facts are determined to identify the problems and opportunities. Then, the next step creates choices and explores possible solutions. A course is then set by making choices and prioritizing actions. The last step is taken to implement choices, measure outcomes, and refine strategies.

Figure ‎3–1 An Actionable Strategy

A team with rotating roles shall be formed based on the Scrum method. The proponents will form the development team. Although a Scrum master is traditionally a part of a bigger Scrum team, members of the development team may instead be assigned to fulfill the Scrum master’s roles from time to time. A customer representative or “product owner”, preferably a teacher, shall also be included as part of the Scrum team to bring in-field insights for the development of the system. As teachers, by the nature of their work, cannot afford frequent disturbances in many aspects of their work, the customer representative shall be assigned fewer management roles in the software development process than usual.

The following subsections describe all the activities and specifics related to each phase of the development model employed.

~~The following subsections describe all the activities and specifics related to each phase of the software development life cycle according to the Waterfall model and the relative schedule allotted for each phase and sub phase (see~~ [~~Appendix A~~](#Appendix_SDLC) ~~for a complete Gantt chart of the SDLC scheduling. In addition, Figure ‎3–1 summarizes the workflow of the entire software development endeavor. For a complete list of tools to be used for each phase, please refer to Table ‎3‑1.~~

### Step 1: Diagnose the Current Situation

This step is important in gaining a full understanding not just of the target users’ needs but also of the current capabilities of the development team as related to the development of the proposed system. Methods to employ for situational analysis include the following:

1. Customer research
   1. Interviews
   2. Observations
   3. Documentary analysis
2. SWOT analysis (for the software development project)
3. 5 Whys

The proponents intend to use the aforementioned methods in the current steps, but these can also be employed in other steps whenever necessary to handle the evolution of the project.

#### Sources of Data

The primary sources of data for the software requirements shall be the “respondents”, which include teachers who volunteer from schools that agree to participate in the study.

The secondary sources shall include documents that may define school and work policies and practices (e.g., memorandums, legislations, manuals, reports, etc.), documents or forms that may contain or can be used to gather work- or school-related data (e.g., lesson plans, class records, school forms, student lists, seat plans, worksheets, etc.), and information systems being used for work.

Figure ‎3–2 The Software Development Life Cycle Workflow

Table ‎3‑1 Tools for Software Development



### Requirements Definition

In order to create a system that is tailor-fit to the target users’ needs, it is imperative to first understand the users themselves. During this phase, the proponents shall attempt to understand the user and system requirements by examining the general nature of the work of the target users, as well as their characteristics, habits, and preferences. Data regarding these requirements shall be gathered using specific tools and methods. These requirements shall then be compiled and summarized in a software requirements specifications (SRS) document.

#### Sources of Data

The primary sources of data for the software requirements shall be the “respondents”, which includes teachers and office personnel who volunteer from schools and offices that agree to participate in the study.

The secondary sources shall include documents that may define school and work policies and practices (e.g., memorandums, legislations, manuals, reports, etc.), documents or forms that may contain or can be used to gather work- or school-related data (e.g., lesson plans, class records, school forms, student lists, seat plans, worksheets, etc.), and information systems being used for work.

#### Tools and Instruments for Requirements Definition

To gather from the respondents the data needed to define the requirements properly, the proponents shall hold focus group and individual interviews, user surveys, and field observations. For these reasons, the following data gathering instruments shall be prepared and utilized:

1. Interview questionnaire – A questionnaire that will serve as a guide during the interviews for gathering valuable in-depth knowledge regarding the work and the work environment of the respondents.
2. Survey on user characteristics, habits, and preferences – A survey questionnaire for gathering user information that can influence software design.
3. Observation guide – An observation form that will guide the proponents in observing the respondents as they perform their actual work.
4. Survey on functionality, usability, and acceptance – A survey questionnaire for gathering user feedback.

The fourth item on the preceding list is included for gathering user feedback regarding functionality, usability, and acceptance after software deployment. Although its purpose is for system testing before and during deployment of the software, it is to be prepared as early as requirements definition and shall be modified accordingly during the course of the software development life cycle until its use during the system testing and operation phases. As for the results of surveys, these shall be treated and summarized according to mean scores.

Among the secondary sources, documents and forms used at work offer another qualitative perspective of the respondents’ nature of work. Descriptive data regarding these sources will be valuable to the design phases. To make the documentary analyses more objective and organized, a document analysis guide shall be prepared to identify the following pieces of information, whenever applicable:

1. Document name
2. Document type
3. Purpose of the document
4. Content summary
5. Structure (for forms)
6. Kinds of information contained (for forms)
7. Manner of accomplishment and/or submission (for forms)
8. Data format
9. Points of interest

Information systems are information technology tools used in teachers’ everyday work. As a guide, these shall also be analyzed by collecting the following pieces of information:

1. System name
2. System type
3. System purpose and functions
4. Kinds of information handled
5. User privileges/levels of access
6. Available interfaces

The focus of requirements definition is to understand target users’ needs, as can be seen from the necessity for several data gathering tools. However, other tools such as an IDE and a presentation software are also needed to create prototypes and presentations that feature any proposed features. For a complete list of requirements definition tools, please refer to Table ‎3‑1.

#### Requirements Definition Procedures

During this phase, requirements shall be gathered from the target users through interviews and surveys. Interviews will be conducted to understand the nature of work and organizational environment and policies that the target users deal with every day. Surveys will be used to gather data regarding the habits and preferences of the target users. In order to gather respondents and participants in the surveys and interviews, schools and offices will first be consulted and the institutions who agree to participate in the study until the system is finished will be tapped as sources for the participants. Likewise, a prototype should also be developed to elicit requirements from the target users further.

Interviews shall be conducted individually or, more preferably, in focus groups, depending on which will be more applicable to the existing work settings. Candidates for individual interviews should be randomly selected from among the target users. Focus groups, on the other hand, will be more formalized and they shall consist of at least five (5) members, preferably the school head, the guidance counsellor, the ICT coordinator, a computer-proficient volunteer, and a non-computer proficient volunteer. The characteristics of the interviewees are thus defined in order to gain a broader perspective regarding teachers’ work from varying points of view. Questionnaires will be designed to facilitate interviews. Interview topics will range from the daily tasks performed by teachers to the policies, practices, and issues in the education sector that affect the work of teachers in any way.

Alongside the interviews, field observations of the day-to-day activities of teachers and personnel in consenting schools and offices shall also be done. The activities to observe shall include but not be limited to actual classes, faculty meetings, and lesson planning. Observations shall be done either personally or indirectly via video recording, whichever is more likely to yield better observation results or more likely to reduce the Hawthorne effect. However, considerable care shall be undertaken to avoid unnecessary infringement on the privacy of non-consenting parties.

After the interviews, a design prototype shall be prepared to show a preview of the proposed system. A non-plugin-based prototype may also be developed to demonstrate further the base functionality of task management. These prototypes will be shown later on in this phase to target users, especially to those previously interviewed, for comments, suggestions, and feedback.

Surveys shall also be held to further understand the target users, particularly their habits and preferences. Survey questionnaires shall be designed by taking into consideration the ergonomic principles of usability, activity-centered design, and emotional design. The respondents will be composed of volunteers. The volunteers for the surveys should also agree to participate in the final system-testing phases.

A software requirements specifications (SRS) document shall be concurrently created and maintained during the requirements definition phase. The SRS document shall be created and updated accordingly once data is made available. Once concluded, it shall be presented to stakeholders who wish to see it for review before it is finalized. The SRS document shall form a basis for the software design specifications of the next phase. It shall also be used to design tests for acceptance and usability, including test cases for validating functional system requirements, to be used in the system-testing phase. After finalization, the SRS document may only be modified to correct errors or to realign implementation and design with the requirements.



Figure ‎3–3 Time Allotment for Requirements Definition

### System and Software Design

The creation of a software design specifications document shall commence once the SRS documentation is in its final stages. The software design specifications shall describe how the system shall be implemented in the subsequent phases. Models of the proposed system in different perspectives such as architectural and use case perspectives shall be made to guide or complement the design. As each functional design specification is stated, corresponding test cases shall also be formulated.

As this phase focuses on design and less on actual coding, the tools to be used are likewise geared for design. Please refer to Table ‎3‑1 on page 49 for the complete list of tools, including those used for system and software design.



Figure ‎3–4 Time Allotment for System and Software Design

### Implementation and Unit Testing

The implementation and development stage of any software development life cycle is usually the longest and, likewise, the most volatile stage, as it can be prone to change as software development advances. As such, this section will attempt to describe the schedules of the implementation and unit-testing phase in tentative terms. For instance, if particular subsystems change in relevance or previously unplanned subsystems are determined as necessary during the requirements definition phase, these subsystems may be added or removed from the development schedule or their priorities and scheduled durations may be modified to reflect the changes.

Some test cases become more evident once a system’s implementation has begun. As such, the coding and actual development phase shall commence after the formulation of test cases has begun. Testing of each unit shall be done alongside the development of each.

Aside from the implementation of the software design, an online user manual shall be concurrently written. It shall be stored using the HTML format for maximum portability.



Figure ‎3–5 Time Allotment for Implementation and Unit Testing

### Integration and System Testing

It is very important to first test the finished software product and validate whether it can fulfill its intended purpose. For the proposed system, the integration and system-testing phase shall begin with the installation of the proposed system on several target devices, including Android-based and Windows-based devices, to test for device and platform compatibility. Afterwards, test cases and other in-house tests will be used to verify the functionality of the proposed system. Once the proposed system has passed the in-house tests, it shall then be subjected to user tests coinciding with the system’s operational deployment in order to validate the system’s functionality, usability, and acceptability in the users’ perspective. The results of each test will be summarized and analyzed in the next chapter.

#### Data-Gathering Tools and Sources of Data

During the system-testing phase, the data needed will be concerned with the respondents’ perceptions on the functionality, usability, and acceptability of the software product. These data shall be gathered from the same respondents who have agreed to participate during the requirements definition phase. The survey for functionality, usability, and acceptance shall be used for this purpose.

As for the other tests in this phase, a checklist, which includes all the hardware used for testing, shall be used for hardware compatibility tests and peer reviews shall also use the survey for functionality, usability, and acceptance.



Figure ‎3–6 Time Allotment for Integration and System Testing

### Operation and Maintenance

The operation and maintenance phase begins with the user tests. The results of the tests will not only conclude this study, but will also provide pertinent data for improving and evolving the proposed system in the future.

As part of the operation and maintenance phase, the proponents shall maintain a web server on the Internet that will serve both as a repository for the proposed system’s installation packages and plugins and as an online error-reporting facility. Data received through the error-reporting facility will also aid in evolving and maintaining the proposed system.



Figure ‎3–7 Time Allotment for Operation and Maintenance

1. Software Development Life Cycle for CASSY



1. User Stories

The following fictitious stories represent situations of actual teacher work. These stories serve as basis for user and system specifications.

## Task Management

Theo is a very busy person. Whenever he wakes up in the morning, he refers to the task list suggested by CASSY, makes some modifications when necessary, and proceeds with his work. Upon arriving at school, he discovers a few documents in his IN tray for his perusal and signature. He creates a task in CASSY to remind him of these paper works later in the day.

During his break time, a notification from CASSY sounds off. Upon opening the notification, he is reminded of an appointment with a parent. He goes to the office to meet the particular parent in order to discuss about his student’s class performance. The parent, satisfied with news about her child’s class standing, bids the teacher farewell. The teacher then opens the task management feature of CASSY and picks up from the list a lesson planning item to do while waiting for his next class.

After an hour, CASSY notifies him of the next class, in which he needs to collect project submissions by students. Had CASSY not reminded him of the project, he would have forgotten about the deadline that he has set for the project. He proceeds to teach the class after collecting student submissions. He continues teaching until CASSY reminded him of lunchtime. He dismisses the class for lunch and himself goes to the canteen to join his co-teachers for lunch.

A few minutes before the end of his lunchtime, CASSY reminds him of the documents on his IN tray. He picks up the documents and reads them. He signs two of them and puts them into the OUT tray. He puts the remaining one on his PENDING tray so he can use it in a meeting later. He then gets his things and proceeds to his next class.

After his last class, CASSY notified him of a meeting with parents that will start in half an hour. He expands the notification and reviews the attached agenda on the task item. He also picks up the documents he set aside a while ago and reviews its contents as he needs to discuss them to the meeting attendees. As the meeting began, he uses the agenda as a guide on the proceedings of the meeting. He also adds a note to the task item, listing down significant details that he needed to remember from the discussion. The meeting is short but concludes successfully.

A few minutes later, he joins his co-teachers in the conference area, waiting for their school head to lead their meeting. Upon arriving, their school head initiates a meeting session through his CASSY administrator extension. The teachers then connect their devices to the same network. Theo, along with his co-teachers, are notified of the meeting session and tap on the notification to synchronize their CASSYs to their school head’s CASSY, in effect signing each one as attendees to the meeting. The school head then proceeds to “assign” task items to Theo and some of his co-teachers through CASSY, pushing these task items to the intended devices. The groups and committees are then given an opportunity to plan their tasks after the meeting is dismissed. Theo, who leads one of the groups, plans the project with his team colleagues. He opens the assigned task, creates and attaches related sub-tasks, and assigns these sub-tasks to group members, himself included. He also schedules a follow-up meeting with his group members to update on the progress of the project and attaches this meeting task to the assigned task. He pushes these task items to the respective assignees, dismisses the group, and heads for home.

## Lesson Planning

Lourdes is a primary school teacher. She has been suffering for her conflict schedule due of plenty of her paperwork and her time to manage the task. Teacher Lourdes eventually started to use CASSY application to organized and manage her schedule to make the lesson plan finish as early as she can. She can make to think ahead of time and getting organized much easier than before. As a veteran, Teacher Lourdes easily managed her schedule for doing the lesson plan.

## Grading

Grace is a secondary school teacher. She make the grading system but the problem is the adequate time she spent for computing grades are not sufficient to record the grade of the students. Because of the lack of tools for computing the grading system. But eventually she used the CASSY mobile applications to help her for the grading students. She can easily compute the grades of the students and manage the other task.

## Classroom Management

Timothy is a primary school teacher. As a professional schoolteacher, his job is to maintain the facility of the classroom is organized.

## Record Management

Jude is a secondary school teacher. He make the records of the students. The adequate time he spent for the records is not enough to finish the record of the students. Because of his problem about the record of the students he used CASSY mobile application to help his task. For easily to finish the task of records of the students.

## Non-Teaching Assignments

Marcos is a primary school teacher assigned to work in different roles outside the classroom. For one, he is the adviser of the Filipino Club. He meets the club members in the regular meetings. The same also goes true of his position as coordinator of the GPP (Gulayan sa Paaralan Project), wherein he coordinates the efforts of both parents and faculty in tending the school vegetable gardens. He uses CASSY to remind himself of the said meetings at least a day in advance in order to make any necessary preparations. He also uses CASSY to prepare agendas for such meetings. CASSY also helps him in planning by allowing project plans to be broken down into steps for easier progress monitoring.

## Plugin Development

Ada is an ICT Coordinator in a school. Having a background in computer science and programming, she occasionally teaches ICT whenever a TLE subject has an ICT module scheduled for the particular grading period. During her time outside the classroom, she often takes care of ICT-related matters while managing the school’s computer laboratory. Her school head also often assigns her to check for DepEd and division memorandums and other communique.

One day, her school head approaches her, requesting for assistance in creating a simple CASSY extension that will allow integration of a particular data service. She starts gathering the requirements for the extension and reviews the existing interface of the web service. She then uses CASSY’s SDK (software development kit) to write a CASSY plugin that connects to the requested data service. Upon completion of the CASSY extension, she installs the new extension to CASSY installations that need the additional feature.

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