

# A CLOUD-BASED OMNISCIENT STUDENT-TEACHER WORK SYSTEM

## Technology in Practice Strand

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### 1. ABSTRACT

This past academic year saw the implementation of structured OneNote notebooks throughout the middle and high school campuses, across all academic departments and extracurricular activities. Dynamically provisioned, stored and secured server-side, teacher notebooks are visible to all students (and their parents) in the course with integrated student notebooks that are visible by the author, parent and teacher; collaborative team-based notebooks were created as needed. An assignment dropbox and digital portfolio were included in each course for each student. There were enormous increases in teacher's use and adaptation of OneNote along with parallel increases in the embedded technologies, including audio & video resources, and improvement in parental involvement and awareness of classroom progress. The community had a breadth of opinions on the growth in use and potential of always-connected students' notebooks; this feedback informed changes for the following school year.

### 2. PROBLEM STATEMENT AND CONTEXT

In a 1:1 tablet computer environment that strives to be paper-less, teacher and student work are completely encapsulated within the tablet; teacher content is created and distributed to the students, who then modify that content or create their own work and re-distribute it to the teacher and other students. Since this material is typically user-driven and unstructured, software that allows the user to freely input content of any type, including text and ink, is required: in this case, Microsoft OneNote2010. OneNote works under a binder metaphor, with each Notebook comprising sections (or groups of sections), and each section made up of any number of pages and subpages; each page can be of any length. The content of the pages can be text, images, embedded files of any type and links to external materials. In particular, users can ink on the page at any point (although there are templates that provide graph or lined page structures around which they can work).

Previously, each user created their own Notebooks for each course on the hard drive of their tablet. Content (including outgoing notes or incoming homework) was distributed via a Learning Management System (LMS) or via email. This process consumed considerable time in the classroom when material had to be distributed; there were issues with email size limitations and students efficiently moving files from the LMS to the OneNote structure (whose working metaphor doesn't translate well to "files" since a file could be a notebook, section or page).

In terms of classroom pedagogy, there was no easy way for teachers to observe or comment on the student's Notebook without taking physical control of the student's tablet and they were thus limited to classroom time in which to engage with the student's work. Emailing or placing

the OneNote pages in an LMS-based dropbox folder was cumbersome and didn't allow for students to continue or revise work on the page that was being sent to the teacher. When material was returned, filing the sheet in the appropriate place within the student Notebook was equally challenging and as a result often not done, leaving gaps. While emailing allowed for the distribution of OneNote material, it didn't reflect the dynamic nature of the OneNote content since the original page could still be changed while the teacher held a copy. When the material was returned, again the dynamic nature of OneNote allowed for students to edit (or delete) teacher feedback. Teachers often fell back to printing out student work and then assessing and returning it physically.

An attempt was made to have each student create a two-person shared Notebook (a feature of OneNote) with their teacher for each of their courses but that required each teacher to have a shared Notebook for each of their student, for each of their classes; this was difficult to set up with individual students, and a challenge to manage for the teacher and student on an on-going basis. Since the files were stored on the student (and teacher) tablet, the backup of material was inconsistent and student work was often getting lost through misadventure. There were also difficulties with the built-in synchronization feature of OneNote that hindered this kind of implementation. Synchronization between independent laptops was haphazard and subject to the vagaries of user ability.

### 3. METHOD EMPLOYED

To avoid the challenges of individual Notebook synchronization, the decision was made to store the Notebooks for each class within a Sharepoint database and route the synchronization process through the Sharepoint system. Permissions were then set using the community's already defined Active Directory.

The provision of OneNote Notebooks on a campus-wide basis followed a basic structure: for each class section (say, Grade 11 Math Section 2) a single OneNote Notebook was created in which a OneNote Section Group (a collection of Sections, or tabs) was made for the Teacher and for each student in the class.

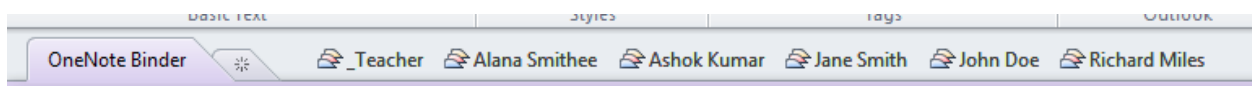


Fig. 1: A typical class Notebook made up of a visible-to-all Teacher section group and private Student Section groups

Inside the Teacher section group (its name prefaced with an underscore to ensure it appeared first in any alphabetical listing) were any number of sections (or tabs) that corresponded to the Units of the Academic year, projects, exam revision, etc. Teachers could create as many sections as they wanted to organize their coursework.

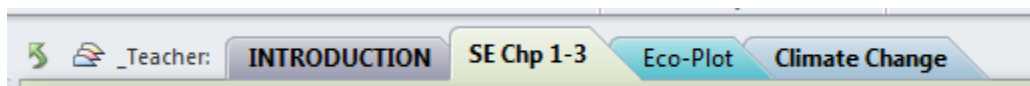


Fig 2: A teacher section group can be made up of any number of sections

The permissions were set on the server so that teachers had (near) complete control over their entire Section Group; the students could read all of the content but could make no permanent changes to it; any changes they did make would disappear when OneNote synchronized back with the server's copy. Students could copy pages or whole sections from the Teacher Section Group to their own sections as needed. Depending on their approach to classroom planning, some Teachers would publish their entire unit and have the students copy it into their Section Group; others would publish on a page-by-page basis each day.

Teachers were unable to delete sections from their Notebook from within OneNote; they had to go to the server to delete the file that represented it. This produced several cases of the never-say-die tab, as teachers would attempt to delete it from within OneNote but the server would re-create it as soon as the next sync cycle began.

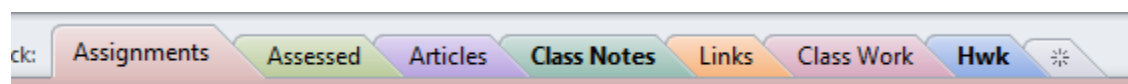


Fig 3: A student section group can also have as many sections as the student wants but the Assignments and Assessed are provisioned by the network. For convenience, OneNote will **bold** the Notebook, Section and Page names when new information is in a synchronized Notebook that the user hasn't yet seen.

Each Student Section Group was initially provisioned with two sections: Assignments & Assessed: "Assignments" formed the dropbox for student work so that the teacher was not required to look throughout the entire student notebook for submitted material. When work was ready to be submitted the student could drag & drop a copy from another section into Assignments to be collected by the teacher. The teacher then dragged it into the Assessed section. The student only has read privileges in the Assessed section so they can see the teacher's feedback but not modify it; Assessed becomes a digital portfolio for the course.

Parents were given permissions to read all the content in the Teacher's section group as well as their individual student's section groups, although they had not write access. Parents with OneNote at home could see all content in the same format as their students; parents without OneNote were limited to the web version of the OneNote program which allowed users to see everything except any inking done on the page.

Another Section Group was made in particular classes called Teams, and within this section group, additional section groups were made. Each section group was provisioned so that a predefined group of students had read/write access to it to allow for collaborative work. As always, the teacher had full control over all content.

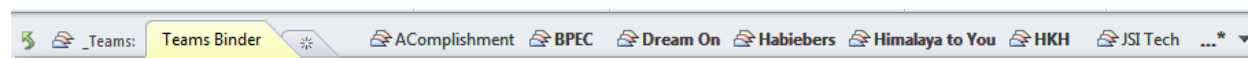


Fig. 4: The Teams section, in which predefined groups of students get access to share Section Groups.

The teacher of each individual course was given the ability to attach other teachers to the OneNote either on a temporary basis (for coverages of absent teachers) or on a permanent basis,

in the case of team teaching. This also gave mentors of novice teachers and department heads the ability to observe teacher and student notes for professional development processes.

#### **4. RESULTS AND EVALUATION**

The teachers were introduced to the OneNote Binder system a month prior to the start of school through the use of video tutorials. There was immediate and enthusiastic buy-in expressed even before they began the face-to-face introduction to the system; many teachers began the structuring and loading of content from home before beginning planning meetings at the end of the summer. Most rewarding was the interest in using the system that was expressed by departments, such as visual & performing arts and physical education, that were not known to use OneNote or tablets extensively. The sentiment most often expressed was that the new Binder system had produced that largest increase in technology usage in the classroom since the 1:1 program had been put in place fifteen years ago. Students expressed an appreciation that the use of OneNote had become universal; some teachers had opted for a paper & pencil in the past.

Feedback from the teachers focused a great deal on the knowledge the synchronized Notebooks provided them about their students. They not only knew immediately which student had done homework, but could also see what the student had done. Several teachers expressed how this awareness improved the conversation between student, teacher and parent about responsibility and preparedness.

Because the synchronization occurs so long as the student or teacher is connected to the internet, teachers and students engaged in commenting on each other's work outside of class time, and students often remarked on how teachers' added notes provided support on the work that they were finding challenging. Students also liked the organization the Notebooks provided; middle school Notebooks could be organized by the teacher should the student get overwhelmed without the teacher having to physically access the student computer.

During class, teachers could share individual student work with the class from the projector-connection teacher laptop by going to that student's Section Group and displaying the Page. It was also easy to add new content to student's Notebooks, either by the teacher adding it themselves or merely posting it within their Teacher Section Group for the students to pick up when they were ready. There has been some negotiation and discussion about the privileges teachers now have with respect to a student's notebook; student concerns about privacy are serious and reasonable and only those designated by the teacher can see student content. Within the classroom situation mentioned earlier, teachers ask for the student's permission before their work is publicly displayed.

One of the immediate clues that the students and teachers engaged quickly with the new format was the massive increase in storage that was required on the network. Since each of the tablets only held a synchronized copy of the notebook, the full notebook rested on the school's storage devices. For the first few weeks of school, data grew by an average 12 Gigabytes each day; over time, this has slowed to an average rate of 5 Gb/day. By the end of the third month, the IT Department ran against a database limit size of 200Gb per file; they successfully broke the file apart to accommodate any future growth.

OneNote has an internal limit of 50 Mb per Section. Fortunately, both text and ink consume very little memory due to rather impressive compression techniques on the part of OneNote. However, since embedded content can be very large (images, files, sound and video) both teachers and students had to be instructed to use a shared network drive location or a cloud based service in which to offload the content (Dropbox.com proved most popular). Users would upload their content to a Dropbox folder, copy the public link and paste it in to their note. For teachers used to posting their Powerpoints or Smartboard files to the LMS, they used this process to avoid distributing these (often quite) large files. If there were no necessary dynamic components to the Powerpoint or Smartboard files, the teacher would “print” the file to the OneNote page, a process which creates a page of screenshots the student can then mark up.

Because OneNote had a native sound recorder and a native video recorder (using the tablet’s webcam) there was considerably more use of audio and video content produced by both the student and teacher. It was used not only for the creation of content in the classroom in the form of knowledge work by students but also for feedback. Instead of writing comments on a student’s work, teachers would either record or video record themselves, speaking their commentary rather, or in addition to, writing it. Teachers would also turn their tablet webcam on to a group discussion to capture the conversation for later discussion and analysis.

OneNote synchronizes almost continuously; it only sends and receives any changes that have been made rather than the whole file so it is efficient in terms of network and server usage. Bandwidth has only been an issue after holidays; the network came close to overload after the first four-day weekend when the entire community returned and began a synchronization. That incident required us to work with faculty and students to proactively encourage synchronizing during the weekend while off campus. OneNote has occasionally had issues with connecting to the Sharepoint server when switching wireless networks and seems to require being closed when wireless networks are changed.

This growth in data obviously caused concern at the network level; not only did all this data need to be stored, it also needed to be backed up. Each night the database was backed up, and these copies were kept for 30 days. That said, this mirroring of data also considerably reduced lost student work; OneNote synchronized at least once every minute so damage or the loss to the student laptop was rendered almost inconsequential, in terms of data. This was a major improvement to the student and teacher experience; far too many students lost their work when their laptop was damaged or lost. This is no longer an issue as students are provided with a replacement laptop and re-connect to their data within minutes.

In the same manner that teachers could observe student work and progress, department heads and curriculum leaders also had the opportunity to see how student and teacher work developed in class. This has improved the conversation for mentoring teachers and encouraged resource sharing amongst teachers in team situations.

Parents were very pleased with the ability to see all of their student’s work without necessarily having to be sitting next to the student. Being able to also see the Teacher’s notes permitted them to help their child more effectively with homework. The digital portfolio of

assessed work provided them with a way of bringing meaning to their student's progress throughout the year.

Teachers were eager to use a similar setup for their extracurricular work such as debating, Model United Nations or mathematics contests preparation. As extracurriculars do not meet with the same regularity as classes, it allows the discussion and preparation for their meetings to expand into the synchronized environment.

The use of the LMS as an LMS was impacted; students no longer went to Sharepoint for any reason other than their initial connection to the OneNote Notebook. The class calendar was already synchronized with Outlook in a separate process and many teachers used the synchronization available between Outlook and OneNote in terms of tasks and dates. Otherwise, all the other content was organized, stored, distributed and assessed within the OneNote ecosystem automatically and invisibly. Weblinks to external resources and discussions were incorporated within the OneNote pages.

## **5. FUTURE WORK**

The present set-up of the OneNote notebooks is based on the course section; it has meant that teachers with several sections of the same course had to copy and paste materials between them. Teachers of the same sections would like an umbrella course so that materials could be created, edited and shared across all the sections of the course, invisible to the students. This would also improve collaborative work amongst the teachers of the same course and an increase in consistency of expectations between sections.

Almost immediately upon implementation, it was realized that there needs to be a temporary section within the student notebook to store assignments that have been submitted but not completely marked. Teachers did not want to place assignments in the Assessed notebook and then mark it; students had the possibility to see the teacher's marking in almost-real-time. By creating a temporary marking area, students couldn't see the material but teachers could take their time to mark it, even over several days, and then drag it in to Assessed when marking was complete. In the meantime, teachers have created their own Notebook to which they drag the assignment, mark it and then return to the student's notebook. This procedure is dangerous, as teachers can inadvertently drag and drop student work into the wrong Section or Notebook.

Overall the implementation of the shared & synchronized OneNote Binders has improved the teaching and assessment processes in our classes and expanded the use of OneNote to departments that still relied on paper, Powerpoint or Smartboard. It has allowed more communication and collaboration between teachers, students and parents. The availability of assessed work throughout the term has allowed easier articulation of the student's progress and, it is hoped, improved student reflection and preparation for summative exams. While there are additional features that would improve the experience for participants, as a first step this has been an extraordinary improvement on the day-to-day functioning of the relatively mundane task of content creation and organization by both teacher and student.