PAPERLESS OMR SYSTEM IMPLEMENTATION IN UMS

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ABSTRACT

It is vital that less paper be used in the running of the education system in order to manage a university in a sustainable way. OMR is a very important system of marking and evaluating students objectively and therefore vital for the management of a university education system. The OMR system should therefore be implemented in a sustainable way but without compromising the quality of education offered and if possible to enhance the educational aspect of the sustainable system, instead of deteriorating the quality of education as a result of the sustainable implementation. A system using OMR was successfully implemented at University Malaysia Sabah virtually without using any paper compared to previous OMR implementations. The paperless implementation is not only sustainable, but is so efficient that it can be adopted to detect lateness and absenteeism. The only sheets of paper that were used were the OMR sheets that were recycled. The collection of the OMR sheets was finally done using envelopes that were arranged according to the first letter of the names of students. It eases the collection and later recycling of the OMR sheets. To optimise the value of the recycling process, a feedback system was implemented in the tests and therefore enhances the pedagogical impact of the OMR system.The discipline required for the sustainable implementation of the paperless OMR system is treated as part of the practical aspects of ethics and law in real life situations, which is part of the course of Ethics and Law for Engineers for which environmental sustainability is part of the curriculum.

Keywords: attendance, evaluation, feedback, lateness, paperless, OMR

1.   INTRODUCTION

OMR (Optical Mark Recognition)(Wikipedia, 2015) is a computerised objective based marking system. It is used in marking multiple choice type of questions (MCQ). It is most useful when a large number of students are to be examined in an objective and speedy way.

The opportunity to use such a system was encountered in conducting a faculty-wide course called Ethics and Law for Engineers at the First Semester of the 2014-2015 sessionat the Faculty of Engineering of the Universiti Malaysia Sabah. The number of students taking the course was 258 but only 256 students finally registered and took the OMR type final examination.

The OMR system was used not only for the final examination which consisted of 40 questions for 40 marks out of 100 marks. It was also used for the quizzes during every lecture which were

used to detect lateness and attendance of each student. The course with the code of KT40103, consisted of 2 hours of lectures every week and 1 hour of tutorial sessions per week for 14 weeks.

The decision to use the OMR was made right from the first lecture but in the first lecture, the OMR was used only to detect attendance because only one OMR quiz session was carried out. Subsequent lectures usually had two quizzes, an early quiz to detect lateness and a later quiz to detect attendance. The exceptions were during tests which were conducted for one hour at the later half of the lecture timetable so that only one OMR quiz was carried out just to detect the lateness of students.

The system was developed stage by stage. Only at the last few lectures were the system completely paperless, except for the OMR sheets of course. The OMR sheets were recycled and this recycling opportunity was used up to refresh students of the correct answers for the previous quizzes.

The final paperless OMR system that was used during that session of the KT40103 course will be explained in the Methodology section. The actual results during the developments of the methodology will be published in the Observations section. The conclusion and recommendations will be published in the Conclusion section.

2.   LITERATURE REVIEW

There are a few suppliers of OMR systems that can be found in the internet via search engines such Google. Wikimedia(Wikipedia, 2015) has a section of OMR that is titled as Optical mark recognition. The article there provides more references.

A book written by Romesh Verma and Suresh Sharma, published in 1998(Romesh Verma, 1998) describes Optical Mark Readers. The authors describe OMR as a useful tool in combination with microcomputers which is still true nowadays.

Modern textbooks on education do not appear to describe OMR much, preferring online resources.

Digital pens had been shown by Konstantinos Banitsas, Georgios Eliopoulos and Linda Murray, to provide faster results for 30 students(Konstantinos Banitsas, 2010) compared to OMR for MCQ (Multiple Choice Questions). This may not be true for a large number of students because it takes time to process and send the results for larger number of students. The environmental saving is also not much because it still requires a paper sheet to show the questions and options. Digital pens only replace the pencil marks with special digital pens that can read special marks pre-printed on the paper. The environmental financial costs of these pens will be much higher than pencil based OMR systems. They are also not useable for detection of lateness and absenteeism that can be done by the traditional OMR system. To incorporate the memory in order to remember previous answers and their corrections will also be much harder.

OMR system is also reported to be used for large classes(Gibbs, 2014).

3.   METHODOLOGY

There were two OMR based quizzes. The first quiz was conducted at 8:00 AM in the morning and lasts at the latest 8:30 AM. Since this was the early quiz, the number of questions was limited to less than five. Students were required to submit their OMR paper sheets at the same time at around 8:30 AM. For each session, each student must put a signature at the place of the OMR sheet that is to be determined during each quiz. Their signature must match with the first signature at the top right of the OMR sheet during the first OMR sheet filling during the first lecture. In the first lecture, only the details of the students will be entered because there were no questions to be answered.

Students are asked to submit into 6 groups based on the first alphabet of their names, arranged in such as way that there would be equal number of students, of roughly 60 students in each group. Each group of OMR sheets will be marked using the OMR system and returned to students with the grouping still intact by putting them in recycled envelopes. There were 12 recycled envelopes used. Six for the early quiz and six more for the late quiz. The early quizzes were put into envelopes that were labelled as "Early". The late quizzes were put into envelopes that were labelled as "Present".

The late quizzes were conducted after 9:30 AM. The number of questions for the late quizzes tend to be around six. The questions were just displayed on the screen using an LCD projector, two questions at a time. It was an open book style of quiz. Students were encouraged to refer to their notes and textbook so a lot of time was given to them. The early quizzes were for previous lectures where possible. The late quizzes were for the current lectures. They served two purposes. The early quizzes encourages students to prepare before coming to the lecture. The late quizzes were to encourage students to pay attention during the lectures.

The 12 envelopes were sent to Mr. Harmizul Sabudin for him to scan and give the results. The results were in the form of text files. There were also reports of the scanning process and some pictures taken from parts of the OMR sheets. These reports were printed to files into the XPS format. All these files were sent via email to the lecturer.

3.1   Exporting Results

The lecturer will then export the results to the Excel spreadsheet. The result file is actually a text file but ending with .mrk so that normal text editors may not recognise it as a text file. The easiest way is to rename the result files to a new name ending with .txt instead of .mrk.
KT40103 EARLY.mrk ->KT40103 EARLY.txt

In an empty sheet, import the data using the menu data\From Text(Carl Townsend, 1994)(Microsoft, 2014). Refer to Figure 1.
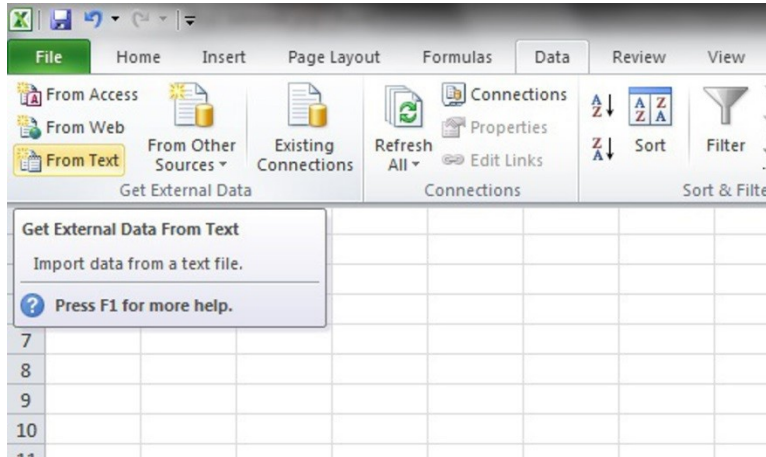
Figure 1 Excel 2010 Text Import Menu

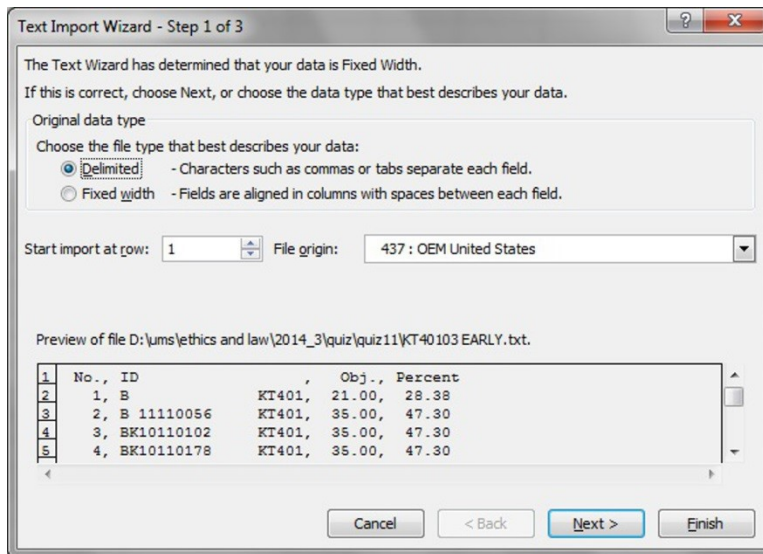Choose Delimited as shown in

Figure 2.

Figure 2 Excel 2010 Text Import Wizard

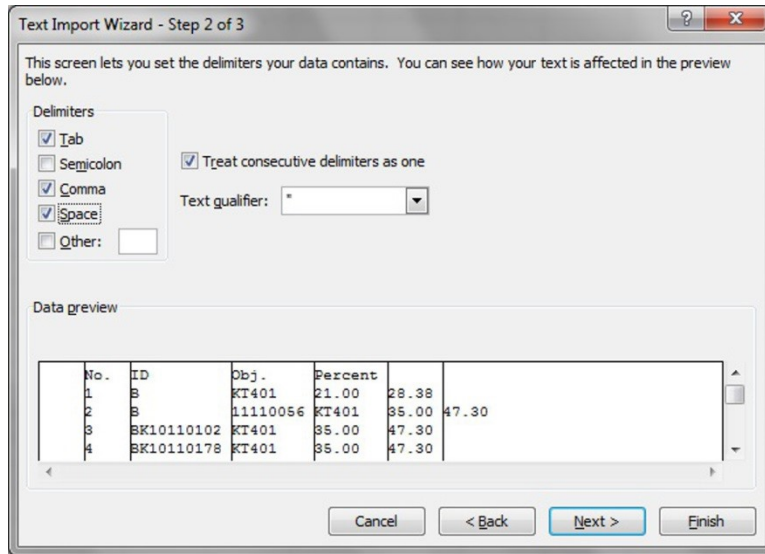Choose Space and Comma as delimiters as shown in

Figure 3.

Figure 3 Example result of using selected delimiters

After all the above steps, the entry need to be beautified. It could be in the format as shown in

Figure 4. The sheet was labelled as "early". Similar steps were conducted for the "present" mark results which were put into a sheet labelled as "present".

Figure 4 Text Import result

The sheets were copied to other sheets labelled as "early (2)" and "present (2)" before being edited by deleting those IDs that were invalid and combined with the list of all IDs of all the students who had intended to register with the course, part of which was as shown in Figure 5.

	A	B	C	D	E	F	G
202	204	BK11160398	KT401	35	47.3		
203	205	BK11160402	KT401	35	47.3		
204	206	BK11160403	KT401	34	45.95		
205	207	BK11160411	KT401	35	47.3		
206	208	BK11270429	?401	33	44.59		
207	209	BK11270430	KT401	34	45.95		
208	210	BK11270431	KT401	34	45.95		
209	211	BK11270440	KT401	34	45.95		
210	212	BK11270441	KT401	35	47.3		
211	213	BK11270442	KT401	31	41.89		
212	214	BK11270444	KT401	34	45.95		
213	215	BK11270445	KT401	35	47.3		
214	49	BK09110209					
215	22	BK10110029					
216	70	BK10110102					
217	72	BK10110107					
218	136	BK10110175					

Figure 5 After sorting and rearranging data and combining with available students' ID

In new sheets, labelled as "quiz11e" for the 11th Early quiz, and "quiz11" for the 11th Present quiz, insert pivot table using the menu Insert\PivotTable\PivotTable as shown in

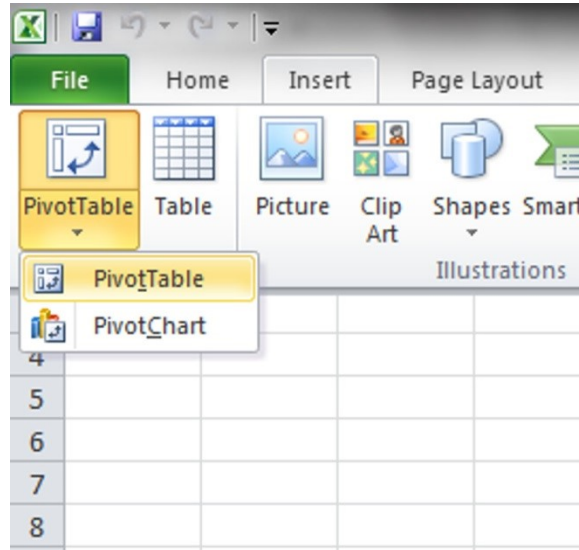Figure 6(Carl Townsend, 1994)(Microsoft, 2014).

Figure 6 Excel 2010 PivotTable menu

For the "range" in the PivotTable opeation, the data in "early (2)" sheet for the quiz11e sheet and "present (2)" for the "quiz11" sheet, were selected. The PivotTable operations combine the data with similar ID and do the selected operations on the corresponding selected data columns. For the Row Lables, the ID column was selected. The Obj column was selected as the Sum column in the Pivot Tables. Refer to
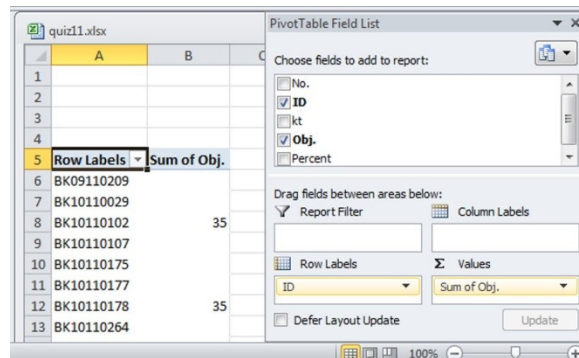
Figure 7 for the sample.

Figure 7 PivotTable settings

3.2   Checking Results

Some checking were done by looking at the reports and pictures taken of the OMR. The reports were in the form of xps files. Microsoft Windows Operating Systems starting from Windows XP can print to files to the XPS format using the printer Microsoft XPS Document Writer. This printer only saves to files ending with .xps.

There are many reports but the one shown in

Figure 8 is the most detailed. In this sample, the Student No. cannot be scanned so they remained blank. The result will also be blank but it is possible to correct the error because of the picture located at the top right corner of each page of the report. The picture shows the name written by the student.
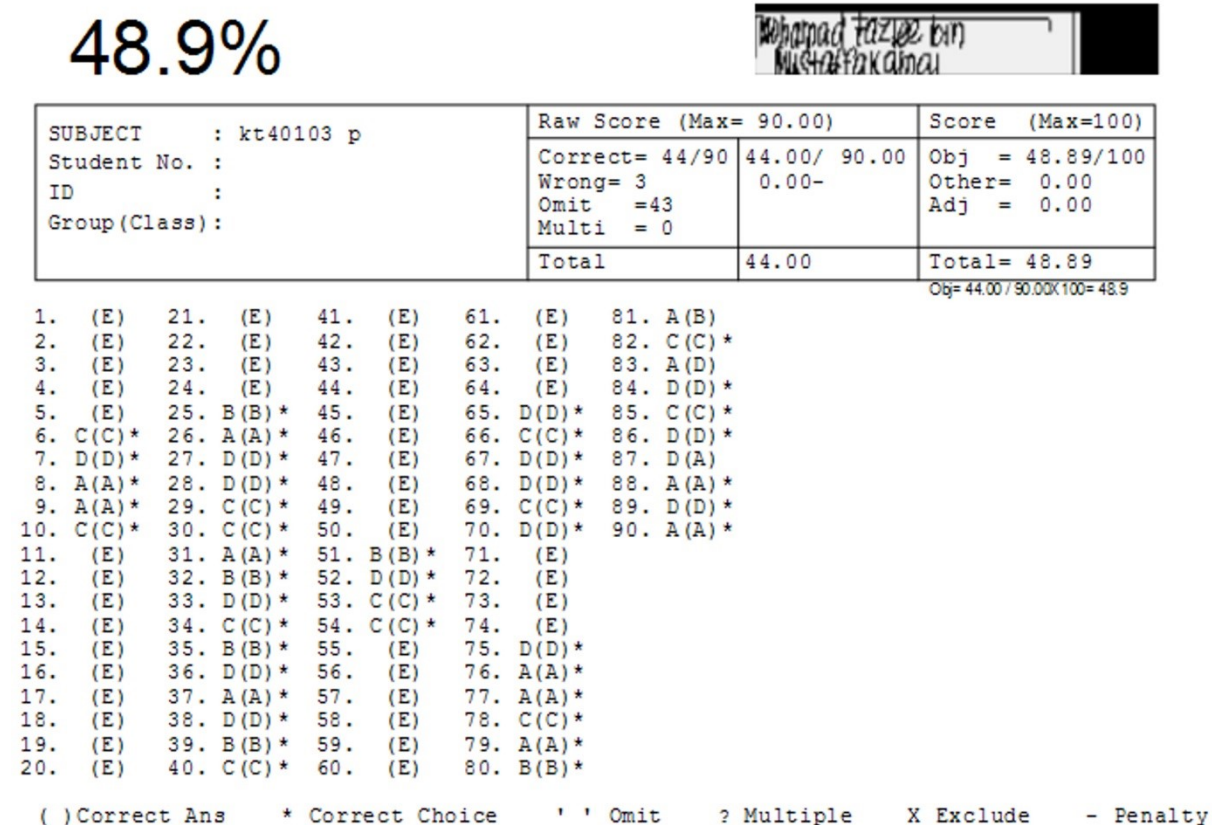

Figure 8 Example of the detailed report

3.3   Observations

The quizzes managed to be conducted virtually paperless as described in the methodology, by the 11th quiz. Earlier quizzes were full of challenges.

4.   THE OMR SYSTEM IN UMS

It was allocated with an asset identification number of UMS/01/0202/2008/S0501 (1/2). It meant that it was bought in the year 2008. It was developed by a Malaysian company, Intelligence Systems SdnBhd(Intelligence Systems Sdn Bhd, 2003). The system is called Smartscan V3.1a and it still uses Windows XP and the same PC as provided in 2008 as shown in

Figure 9 The OMR system used by UMS in 2014. This system is scheduled to be replaced by a paperless system but the time of implementation is still not determined.

Figure 9 The OMR system used by UMS in 2014

4.1   OMR errors

The first challenge was the errors committed by students in filling the OMR forms. The common errors were informally observed to be:
i) students did not use pencil of the recommended type, the 2B pencil,
ii) students did not mark the OMR properly
iii) studentscorrupting some of the important marking symbols by writing signatures there
iv) students getting the wrong OMR forms that were not of the correct format and sizes.

There are many other unknown errors right to the end. Making things worse, students don't check their results until at the last few lecture sessions. Since this was an ethics course, less attempt was made to correct the OMR errors by reading the reports except at the early stages only. Students that made the mistakes were told officially but most of the time the quiz marks should indicate the errors that had been committed. The uncorrected OMR results were treated as penalties to these students for not making much effort in identifying and correcting their errors.

4.2   OMR sheet distributions

There were up to 258 students attending the course. It meant that there were 516 OMR paper sheets that needed to be distributed. If the OMR sheets were not sorted, it would be difficult for students to get back their OMR sheets.

Many students do not bother to reclaim or bring back their OMR sheets so they requested for new OMR sheets. Sometimes there were not enough replacement OMR sheets so manual mark entry need to be done. There was a need to discourage manual marking by giving penalties for those students who opted for manual mark entry, even unintentionally.

It was good that there were many exercises in filling the OMR sheets so that by the time the Final Examination was carried out, the number of errors were reduced to around 5 which were easily manually corrected.

By using the envelopes, students rushing to submit their OMR sheets were reduced tremendously. Still, many students tend to delay submitting so the lecturer had to forcefully reject the OMR sheets that were submitted late. Since it was a long way to collect all the six envelopes, there was some unfairness in this aspect.

Although the students are supposed to place their OMR sheets in the correct envelopes according to their names, many misplacements occurred so it caused students to lose time looking for their OMR sheets.

The OMR sheets were returned to their students before the next lecture so that they can recycle their OMR sheets. They can change their answers to the correct ones because all the answers will be marked. Those who do not correct their answers will be penalised. The procedure is complicated so many students do not understand the system fully.

The marks given out by the OMR system is the total marks for the current quiz as well as all the previous quizzes. The lecturer's OMR answer template need not be changed completely. New answers were just appended. The subsequent quizzes were numbered in sequences that the numbers do not clash with the numbers of the previous quizzes. The capacity for the OMR answer sheet is 150 questions so it was sufficient for all the 11 quizzes at a total of 10 questions per quiz. The numbering for both the Early and Late quizzes were such that they were lumped together as one set of quizzes. In this way, the Early and Late quizzes have different numbers. Therefore, it was possible to determine which OMR sheet was for the Early quiz and vice versa. There were some confusions in order to determine which quiz number belonged to either the Early or Late quizzes. Fortunately, the system of using different numbers for all quiz questions for the two OMR sheets for each student, managed to sort out the confusion.

4.3   Pedagogical Impact

Out of the two hours allocated to lecture time, up to one hour is needed to conduct the two quizzes. The KT40103 course was based on a textbook by Joseph W. Wise(Weiss, 2009). The law aspect was based on online sources. The first two weeks were reserved for law studies so that they can form a basis for the ethics part of the course.

Because of the use of the OMR, quiz results can be given to the students before the next lecture. This allowed students to correct their errors. Many students were found not to have done the correct corrections which showed that we cannot take for granted that all students can correct themselves without much guidance and monitoring.

This course was conducted with the free online eLearning system called Schoology(Schoology, 2015) so it was hard to determine which system made the most impact on the pedagogy of this course.
What is certain was that, the control of the lateness and absenteeism was more reliable by using the OMR. However, there were reports of cheating. Some students were reported to not attend classes but had asked other students to fill in the forms on their behalf instead. They could get away with it because lecturers cannot check all signatures.

The same problem as encountered when only lists of signatures were used. The only advantage of the OMR approach is that it is faster to determine those who did not fill in the OMR sheets and saves paper as well because there is no need for separate sheets of paper to accommodate the signatures.

5. CONCLUSION

The OMR system was finally implemented entirely paperless, except for the answer sheets. This was despite the fact that the OMR system was initially not designed to be paperless. It showed that it is possible to convert an OMR system to the paperless system by applying all the established computer operating practises. The supplier of the original OMR system may not be aware of the possibility but users should be well versed in computer operations in order to adapt anysituation that they face, to a paperless operating procedure.

The computer techniques that were used were not the latest. They were described by a 1994 book(Carl Townsend, 1994). Educators should be able to learn how to import data using Excel by referring to the online documentation provided by Microsoft(Microsoft, 2014).

The OMR system cannot be completely paperless now because paper is still required for inputting data. The best that can be done is to recycle the paper instead of wastefully using new OMR answer sheets for each quiz. The gain is not only in physical savings but also in time savings during mark entry. It can be faster and less prone to errors when processing data in the electronic form rather than manually entering the results from printed sheets of paper. Despite needing to do some corrections, the total time taken to get the marks for 258 students was less than 2 hours.

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