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Open ITEM Systems are Good ITEM Systems

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Abstract: Many educational authorities and third-party developers have, in the past, built ITEM (Information Technology and Educational Management) systems mainly for the benefit of central education authorities rather than schools. In some cases these systems have been designed without thorough consultation with schools. The result has been that many schools have not been able to get as much out of them as might otherwise have been possible.

Experience in designing the hardware and software components of business information systems has shown that *open systems*, in conjunction with formal software standards, are required to produce systems that can meet their full potential. It has also been shown that end-users will make much better use of systems that they have had a part in specifying. An inflexible system imposed from above is much less likely to be used effectively than one that clients are able to modify to suit their own requirements.

In this paper we advocate that future ITEM systems should be built as 'open systems' that can be adapted and modified by their users. In this we are arguing for much more than users just being able to select one of several pre-designed reports. What we are arguing for is systems that can be added to by the user, and that can be adapted to suit the users' own requirements.

1. INTRODUCTION

As the university travel department is running behind schedule, you have to pick up the airline tickets for your forthcoming conference trip yourself. You have driven into the city and parked next to a fire hydrant outside the travel agent's premises. When you come out after collecting your tickets you note a

young woman smartly dressed in a City Council uniform standing next to your car, typing some data into a hand-held device with a short aerial. The device then prints out the parking ticket which she sticks onto your windscreen. It will do you no good trying to catch up with her to protest that you were in a hurry and were only parked there for a minute or two anyway, as your packing infringement has already been radioed through to the City Council's computer system.

A technician from Telstra[1] has just spent twenty minutes connecting your new computer network to a Telstra cable for fast Internet access. Before leaving, he types some numbers into a special device connected to his mobile phone. He then gets into his van and plugs this device and the mobile phone into its cradle before driving to his next assignment. When he starts the engine of the van the mobile phone automatically connects to Telstra's head office and up-loads details of the work he has just done at your site. The device also receives details of new jobs to be done later in the afternoon, and commences downloading another part of the new operating system to be installed in the van's computer next week.

The question we will address in this paper is why don't schools make use of technology like this for tasks like checking student attendance, operating library borrowing systems, running school sports meetings and entering student results? The answer is that to some extent, they do. It is possible to purchase systems using technology like PDA (Personal Digital Assistant) terminals and student swipe-cards for this purpose, but what tends to be missing from these systems is the link to the central database in the school administrative system. Our research has shown that although quite a number of Australian schools do use technology like this, they normally have to use it as a *separate system* unconnected with the school's main administrative system. These special systems operate separately largely due to the inflexibility of central ITEM systems, and the difficulty of using data from one system in the other, with the result that the same data is stored in multiple locations in each school.

2. SYSTEMS FOR RECORDING STUDENT ABSENCES

After encountering serious problems with student absences from class during the middle of the school day, Flower Meadows High School[2] implemented a new swipe-card system for recording student attendance. In this system students are issued with their own plastic ID card. Each card has the

[1] An Australian telephone company.
[2] A fictitious name for a real Australian school.

student's name, date of birth and photograph imprinted on the front, and a magnetic data stripe on the back. Each classroom has a card-reader at the door, and students swipe their ID card through this at the beginning of each class during the day. As the card-readers are networked back to the school administrative office, it is not difficult to see how the system could be used to record student attendance. Special software could then compare data from cards swiped though a card-reader each period with a central student database and print an exception report of student absences. The system could easily be programmed to flag special occurrences, such as when a student who is present in first period and absent in second and third periods is present again in period four. The system would then bring this information to the attention of relevant school staff.

Such a system is not new or particularly novel, and schools in several different countries successfully make use of technology like this (Selwood, 1996). In the case we are describing, however, there is a major difficulty, and when looked into further this becomes apparent. Flower Meadows needs to use the attendance system for initial entry of student enrolments as it must have new ID cards printed as early as possible. When enrolments have stabilised, the school then *prints* out class lists from the enrolment system and one of the office staff then *types* these into the main administrative system which is unable to accept external input other than via the keyboard.

Weir High School[3] issued all their teaching staff with a PDA (Palm Pilot III) at the start of the school year. Each PDA is loaded with special software and copies of student class lists for every class in the school, along with a copy of the school timetable. At the beginning of each period, teachers enter student absences (or lateness) into the device; it is presumed that all students not so marked are present. If a teacher is away then the replacement teacher who gets the 'extra' simply uses their own PDA which, like all the others, has been loaded with *all* the class lists. At the end of the day, or when a teacher has no more classes, they upload the absences into one of the PC data entry stations in each staffroom. As these PCs have been fitted with a special cradle to accommodate a PDA for data transfer, this is quite a simple task that normally takes only about 10 seconds.

During upload the system also checks to see when this PDA last had an update of its class lists, and whether there have been any changes since that time. If there have been changes a message appears on the PC screen asking the teacher to be patient and wait until new class lists have been downloaded to their device (Harper, 2000). After all teachers have uploaded their data, the central system is able to print out a series of reports, and lists of absences each period of the day.

[3] Another real Australian school with a fictitious name.

Although this is still a developing technology, some schools are also making use of this system on the portable PDAs on school excursions to ensure that no student gets left behind when the bus leaves. Others are entering disciplinary data such as when a student has been caught smoking, or fighting. Like the swipe-card system, however, the problem is that this system operates entirely separately from the school's central administrative system.

3. PROBLEMS WITH NON-INTEGRATED FUNCTIONAL SYSTEMS

Not only is the re-entry of data, required when using either of these systems, a waste of time and resources, but it also violates one of the main principles of database management (Date, 1983): that data should be stored in one place, and one place only. (It should be noted that there should always be a back-up copy of any database. What we are pointing out here is that there should only be one copy of the database *in use*.)

At this point a comparison with business information systems is useful. Traditionally, businesses have often been organised along *functional* lines. From early times, information systems were designed to support business functions such as accounting, manufacturing, finance, human resources, marketing and so on. In the early function-specific information systems, data was typically stored in file format, with data of a given type being stored in a particular file independently of all other data (Tatnall *et al.*, 2000). While these systems had their benefits, they also had problems (Reyes, 1998). For instance, data collected for use by one function-specific information system would typically not be available to another. This made systems of this type potentially quite inefficient. Specific information systems can, however, be designed to act together to produce an *integrated information system* whose purpose is to provide for the flow of information across all levels and functions of the organisation (Tatnall *et al.*, 2000). Data is stored once only, without duplication, and is able to support all activities relevant to the organisation, so improving communication between parts, or functions, of the organisation.

Using function-specific systems that are not integrated with the central database means that there will need to be multiple copies of the student database (for example), each of which must be frequently updated (Tatnall *et al.*, 2000). The difficulty is that when there are two or more different, unrelated student databases, any changes, such as new enrolments, changed student details and so on that occur, must be made to *each* database *every* time they occur. Human weakness means that with almost complete

certainty, there will be a time when this does not occur and only one of the databases is updated. This means that the other database then becomes inaccurate.

The reason that Flower Meadows and Weir High Schools are unable to transfer the data from one system to the other is that the school administrative system that they both use has been designed as a function-specific system. It has been designed *not* to allow the importation of data from other systems, and not to allow other systems to directly access its own database. Presumably the designers of the school administrative system, provided by the Ministry of Education, had concerns about data security and integrity and so designed it that way. This system allows *download* of data, but nothing more.

4. WHO 'OWNS' THE ITEM SYSTEM?

In several Australian states, schools' administrative computing systems were built by central educational authorities and issued free (or at low cost) to schools. The primary motivation for doing this was to provide a reporting mechanism from schools back to the centre. Schools' administrative computing needs were not the main consideration (Tatnall, 1995). The general distribution of these systems to schools meant that schools could then be *instructed* that they *must* use them to provide the required reports back to the central authority.

While understanding why this approach was adopted, and not wanting to denigrate the needs of central educational authorities for information, we would argue that in future it would be much better if *individual schools*, rather than *school systems*, were seen as the prime clients by systems developers.

At issue here is who should be seen as the client. Who should the systems developers speak with about the systems requirements? There is a great deal of information systems literature that points to the necessity of involving users in the process of designing information systems (Fuller & William, 1994; Lindgaard, 1994; Alter, 1996; Lawrence *et al.*, 1997) if we want those systems to be used to their full potential. Lawrence *et al.* (1997) stress the need to consult with users, and Lindgaard (1994) notes that a large body of research has shown that potential users do not make best use of information systems unless they feel that these systems have been designed with their involvement and in their interest. Fuller and William (1994) point out that when business users think that central computing departments have been unresponsive to their needs they often take application development into their own hands, do their own thing, and ignore the central authority. If the

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