At the Heart of the Next Generation of Information Technology in Educational Management

Don Passey

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Data Driven Discussion for Decision Making

Don Passey

Department of Educational Research, Lancaster University, UK
d.passey@lancaster.ac.uk

Abstract. Handling data in schools has moved from recording data in repositories, to reporting data to different stakeholders, to decision making using specific types of data. There are clear arguments that decision making functions require access to data, but the research literature indicates that discussion about points and issues is an important pre-requisite. This paper looks at evidence that highlights discussion as a fundamental need, offers two case study examples of schools integrating discussion that contributes to curriculum decision making with data, reviews a new data management system integrating features supporting discussion, and in conclusion highlights key points for future development.

Keywords. Data handling; data management; new data management systems; discussion making; decision making.

1 Introduction

Both data management systems and data handling processes in schools have changed over the past thirty years – starting with largely static systems allowing data to be recorded, moving through more widely accessible systems allowing data to be reported to different stakeholders, to access to data handling and analysis facilities enabling and supporting data driven decision making. A more detailed account of these shifts over time is discussed by Selwood and Drenoyianni [1] and Passey [2] in the context of data management systems in schools in England.

The term and concepts of data driven decision making (DDDM) are commonly associated with uses of data management facilities and applications when considering school needs. The term and concepts are often used in the context of schools and districts in the United States (US), where systems collect together distributed data through interoperability framework techniques, enabling different stakeholders to access and use these data through data mining techniques. A useful overview of research conducted across the US in terms of DDDM (Marsh, Pane and Hamilton [3]) states that: "DDDM in education refers to teachers, principals, and administrators systematically collecting and analyzing various types of data, including input, process, outcome and satisfaction data, to guide a range of decisions to help improve the success of students and schools." This report goes on to discuss ways in which different data can identify school strengths and weaknesses, and put interventions in place

to support school improvement. Ways in which different forms of data are used in school improvement practices in a number of countries across Europe are also discussed in Visscher and Coe [4]). On a cautionary note, however, a report from the national inspection agency in England (Ofsted [5]) highlighted the need, when considering school performance and improvement, to understand the statistical background and validity when using different forms of primary and processed data.

Whilst uses of different forms of data supporting decision making are often clearly identified in advice and research literature, the roles of discussion in leading to appropriate thinking about and decision taking are explored far less. There is limited reference in the educational literature that explores this topic. It is not always clear, for example, how discussion is established when data is used to make decisions, or what processes are involved to account for influences of the data on critical thinking about curriculum concerns and issues. The fact that discussions happen is certainly not disputed. For example, Marsh, Pane and Hamilton [3] stated that: "In monthly calls with supervisors, these staff members rated schools and discussed strategies to address the problems in schools receiving the lowest ratings," Kirkup, Sizmur, Sturman and Lewis [6] stated that: "Schools reported that effective use of data resulted from meaningful dialogue between staff, and was supported by user-friendly systems," and the government department for education in England as a part of their early advice to schools (Department for Education and Skills [7]) stated that: "teams of teachers can learn from the good practice of each other, sharing strategies for dealing with individual students or analysing performance by using diagnostic marking. Discussions at planning meetings can produce action plans and targets for the team and individual students." Some educationalists have highlighted the critical importance of discussion in decision making; Treadaway [8] found issues arising in some schools where subject targets were given to students on the basis of data reports alone, without adequate discussion, and Hirokawa [9] found in a study outside the educational context that, for groups investigated, fulfilling critical task-achievement functions (or requisites) was a better predictor of decision-making performance than the discussion procedures employed in arriving at a decision.

The importance of data for informing discussion processes is not limited to stakeholders within schools. Advice from the government agency for e-strategy in England, Becta [10] stated that: "Research over the last decade has consistently shown that all children achieve more highly when their parents talk to them about their experience of school and learning. .... Technology can inform and enrich this engagement by enabling parents to receive and access information about their children's work, progress, attendance and behaviour when and where they want, using, for example, secure online or even mobile access." Byron [11], from a survey of 1,000 parents, confirmed the positive potential role of technologies, stating that: "Time-saving technology for online reporting, lesson-planning and homework (accessed by school websites and other online resources) make parents feel much more a part of their child's learning". But schools need not only to put in place systems that will provide levels of information and discussion between teachers, parents and learners, but also need to think about forms and nature of information to provide bases for useful dialogue, and while in-school data systems are common in schools across England, fewer use sys-

tems to report online to parents. A national survey conducted by Infogroup/ORC International [12] stated that: "Technology was used for reporting to parents at least once a term in over three quarters of secondary schools (77 per cent), just over half of special schools (55 per cent) and less than a quarter of primary schools (23 per cent)." Basic online reporting to parents by primary schools is not yet common.

2 Methodology and case study approaches

In this paper, issues concerned with relationships between discussion and decision making, and the ways that data management systems support these, are explored. To do this, two case studies are used to provide evidence of discussion processes involved when student data is used to inform curriculum and achievement processes. These case study schools were selected on the basis of being identified by independent school reviews and the data system providers as effective users of data management systems, and effective in terms of using these systems to support school improvement. From the case studies, key points where discussion is involved, the purposes of those discussions and the stakeholders involved are identified. In terms of potential future development, a new data management system that seeks to integrate discussion opportunities is reviewed in terms of the facilities it offers. How these match with the needs of the case study schools is highlighted, and future implications for development are subsequently considered.

The two schools, a mainstream secondary and a mainstream primary school, both located in the north of England, use data routinely and integrate its use with processes that involve discussion with different stakeholders. Evidence was gathered from these schools, and is reported in the form of case studies, using elements suggested by Yin [13]. In each case, the field work identified and detailed: the aims and objectives for using data in the school; the data management systems that were used; some background context to the school itself; the ways that data were used and how these related to processes of performance and improvement in the schools; what lessons the schools learned; and what issues arose. The field procedures involved discussions with key teachers and senior managers in the schools, and with some classroom teachers and heads of department. Background documents (national Ofsted inspection reports, not referenced to retain anonymity) provided an independent perspective on the overall achievements and performance of the schools. In discussions, key teachers and managers were asked open-ended questions, about their background contexts, aims and objectives for using data and data management systems, details of the data they used, what performance and improvement systems operated in the schools and how these involved the key stakeholders (managers, teachers, students and parents), what issues arose, and what they felt they had learned in terms of the outcomes, usefulness and future directions for the processes they had in place. The case study findings are presented in the next two sub-sections. Following these, there is an analysis of results (in terms of relevance and relationship to the issue of uses of discussion when data is used in performance and improvement processes in schools).

3 A secondary school case study

This secondary school uses its data management system to track student performance. Its main intention is to support and maintain high standards of student progress, by providing timely information to the wide range of interested parties at certain times throughout the school year. This involves using integrated and appropriate tracking and monitoring systems from the time students join the school at 11 years of age. Ofsted (the independent inspection service that reports publicly on standards in schools) described the school as a place: "where standing still is not considered as an option. … Self-evaluation procedures are based on detailed analysis of information and resulting priorities and areas identified for further improvement are tackled resolutely. … The tenacious analysis by staff of pupil performance data ensures that work is well matched to their needs and interests. Senior leaders and middle managers are successfully held accountable for their pupils' performance."

The school, designated by the government department for education as a high performing specialist college in technology and applied learning, has some 1,100 students of mixed gender on roll, aged from 11 to 18 years. Teachers have online access to a school data management system in all classrooms and in all staff areas. A key member of staff initially ran an evening session for all staff, and a day session for pastoral staff on how to use the system. Use of the system by teachers is embedded within the wider school review system; a calendar of meetings is set up to discuss targets and progress, and to report to students and parents. Teaching staff maintain up-to-date records; they enter subject attainment assessments, behavioural and attitudinal grades and written comments on each student. Using the same data platform, they both view and analyse existing data. The system produces reports that go out to students and parents three times a year in paper-based form.

Two main sets of test data provide baseline information when students come into the school: national subject attainment test (SAT) results in mathematics, English and science; and commercial cognitive abilities tests (CATs). CATs are used to assess overall ability, and importantly, to identify significant differences from SAT results. Exploring reasons for differences often yield important information about an individual student that subsequently helps teachers to secure progress. A student may have used well-known test techniques to achieve well in SATs, but underlying cognitive abilities requiring on-hand non-revised skills may be somewhat weaker. The converse is also felt to be true; for a variety of reasons a student may not have made sufficient past progress, but have substantial potential that needs to be harnessed.

All subject teachers have access to background data sets no matter what their subject is (this is especially important as national SATs results are not available for subjects beyond mathematics, English, and science). Teachers access this information alongside their own subject specific data. Information in the data system is presented in columns, ordered by class groups and year groups. Further general details about students, those who gain special educational needs support, dates of birth, and gender are included. Teachers report specific details every term about learning skills, behaviour, organisational skills and completion of homework.

Based on background data, every student has clear targets in levels (up to 14 years of age) or grades (beyond this age), for each subject area. These are unique to the individual and derived from assessments of their starting points for learning at the beginning of each school year. When students are 14 years of age, all baseline data are reviewed and each subject department enters targets that are challenging, based on projected upper quartile levels taken from national data on past progression in individual subjects, an approach used for some years. Teachers have to offer strong evidence if they wish to set targets that are not recognised as a challenge. It is felt to be crucial that students are part of the target-setting process if they are to have ownership of the targets and work towards achieving them. Before finalising them, targets are discussed with each student and are agreed, rather than students being given the targets. Chances graphs from CAT tests are used to encourage high aspirations and teachers discuss with individual students the likelihood of success of achieving differing grades using agreed targets as measures. Actual attainments recorded by teachers are compared against targets at least once each term.

Tabular forms of presentation are the main forms used by teachers, and a traffic light system is used to indicate progress (indicators used by the school are 'Before' – lower than the starting point, 'Static' – still at the same level as the starting point, 'Towards' – moving towards the target, and 'Met' – the target is achieved or exceeded). Traffic lights allow colours to be selected, and columns can be ordered so that groups within classes or year groups can be identified. Graphical representations are also used to display average point scores by class and year group, to look at quartile ranges, and progress each half-term across a period of 3 to 5 years. Changes from year to year, and trends over time are reviewed every year with the leaders of each curriculum area and senior management.

The school finds that using baseline data, agreeing targets, and monitoring progress status (above or below the target) allows a case study approach with individual students, maintains tracking, picks up any issues regularly, and allows ways to address issues to be identified. The school recognises that having a system in place means that it is necessary to act on what is found; otherwise it is felt it would not be worthwhile. It is also recognised that ownership at this level can create stress, since clear statements are being made about expectations. Teachers can recognise progress or lack of it; curriculum leaders can identify whether lack of progress may be due to student, course, or teacher. They examine progress closely three times a year, looking for dips and reasons for those dips. They pick up on topics that need to be rechecked or revisited, if performance is low. Teachers can identify variations in progress across specific groups of students (for example girls or boys, or vulnerable students).

The use of progress grades ('before', 'static', 'towards', 'met') is recognised as a powerful way to identify real issues and ensure that all students are focussed on future aims. Students and parents understand the level and grade systems, but using progress grades means that value is placed on effort, hard work and diligence. All are felt to make progress according to their ability and this is celebrated at every opportunity.

The system in place means that information for teachers is available readily and quickly, so that teachers can see progress levels and grades across all subjects. Although teachers now find the system easy to use, and find it beneficial overall, they

also feel it places some quite heavy demands upon them. It was necessary for the school to invest time and support effort initially to ensure that teachers knew what to do when things went wrong, and how to appropriately level subject attainment so that there was parity across a department, consistent with national norms. After some years it is felt that all staff approach testing, assessment and monitoring similarly, offering a cohesive approach across the school.

4 A primary school case study

The primary school had used a management information system for over 10 years, to help manage student attendance, behaviour and performance. The school sought to ensure highest possible performance for its students, looking for positive ways to maintain a consistently supportive learning environment. Keeping track of student data supported staff using systems that aimed to address any 'student disengagement' (movement away from positive behaviour, attendance and achievement). The system informed about current and historic 'drifts', but then allowed the impact of behaviour interventions to be seen through on-going data collection.

The data management system was supported by the local authority. The school benefited also from another local authority system, which collated attainment and other data, such as behaviour data, entered by teachers through a web interface.

The school had some 420 students of mixed gender on roll, aged from 4 to 11 years. There were a high number of students with special educational needs (in the order of 170), but many were gifted and talented (in the order of 50). Behavioural issues did arise; four specialist staff picked up these issues, and used an on-site unit that provided a supportive environment. It was found that the system was easy to use, and was used by all staff. Limited training was found to be effective. Time to develop practice was found to be relatively low; about an hour and a half to develop use of the attendance elements in the system, for example, while no training was needed on a new register facility. Staff found it easy to access information, and they could use the information provided. All teaching and support staff used laptops for entering registration, behaviour and achievement data (appropriate to different staff roles).

Three main sets of data provided on-going information: student attendance, recorded by teachers at the beginning of each day, by 9.05 a.m., to be viewed by the head teacher; issues with behaviour, recorded by all staff as they arose; and teacher assessments, recorded at intervals across the year. Both the head teacher and deputy head teacher tracked attendance and behaviour, to pick up on any issues very quickly. They found that this was particularly important for a highly mobile student population. At the same time, they found that the management system provided all teachers with a very rapid overview, a 'big picture' showing a summary of behaviour, attendance and achievement, which supported informed discussion and decision-making. They found that this could lead to improved teaching, as information at this level could enhance and empower support staff as well as teaching staff.

Different key teachers acted on different aspects of information provided: all teaching and support staff had access to the three basic data sets, which were presented in

tabular form; the head teacher acted on attendance information; team leaders acted on behaviour, attendance and achievement information; and the head teacher used trend data to consider future strategy and actions. The head teacher accessed trends over a 3-year period, and could see graphically what had happened in terms of behaviour, attendance and achievement. He used the system to calculate and measure progress on the basis of combined scores in mathematics and English, and identified target groups for curriculum support from these results.

In order to use teacher assessments in these subjects, and to know that they could be used reliably, the school had to do a great deal of in-service discussion and moderation, looking at how to level assessments on students' work. The head teacher found that the system was flexible enough to allow the recording and reviewing of data associated with particular curriculum interventions, such as 'Big Writing'. Subject co-ordinators found tracking grids (grids showing a progression of results over time in tabular form) were very useful, for monitoring what was happening across their subject areas. Subject targets for specific students in subject areas were entered into the local authority data system.

The system was used to produce reports that went out to parents in paper-based form. Reports for parents were generated using the management information system; teachers put in their comments first, then they had access to comment banks where they could choose additional comments to include in reports. The head teacher and deputy head teacher proofread reports before they went out to parents.

The school found that the system and the data allowed team leaders to engage more readily with parents, class teachers, teaching assistants and behaviour improvement specialists. The school would have liked to have developed closer use of the system by students, however; encouraging students to discuss targets would have been an avenue felt to be worthwhile.

It was found that the management information system provided important avenues of communication. Bulletins and reminders were used by the special educational needs co-ordinator, reminders of meetings were sent out, and all staff had access outside and inside school for adding data to the system and for writing reports. The head teacher found that access at home often allowed undisturbed time to be given to reviewing data. It was found that having behaviour data on the system allowed discussion about the facts in an objective way; the school had no student exclusions, whilst previously there were up to 4 each year.

The head teacher felt that the system was flexible enough to support different approaches to the curriculum. At the time details were gathered, the curriculum in the school was totally topic-based, and there were five topics run across a year in each class. A portfolio of student work was collected at the end of each topic, and these portfolios demonstrated the creative and practical achievements of students, as well as their subject achievements. The curriculum had a practical, creative and visual focus. This form of curriculum (not the same as the subject-based approach adopted in many schools in England) was nevertheless supported by the management information system. Assessments of creative, practical, social and emotional outcomes, for example, could be entered readily within the system.

5 Key points arising

It is clear from both of these case studies that discussion plays crucial parts at certain points in the curriculum review processes using data to support school and curriculum needs. The crucial points where discussions were involved are shown in Table 1.

Table 1. Crucial discussion points arising in the two case studies.

Discussion point	Secondary school case	Primary school case
Knowing about the data system	Teachers are shown the system and can ask questions about it	Teachers are shown the system and can ask questions about it
Levelling subject attainment	Teachers meet with curriculum leaders to discuss and agree levelling of subject atainment to ensure parity	Teachers meet with senior leaders to discuss and agree levelling of subject atainment to ensure parity
Setting targets for students	Teachers discuss targets with individual students in meetings across the year, focusing on chances of gaining different potential grades	-
Monitoring student progress	Teachers discuss any issues about progress at least three times a year with students	Teachers discuss any issues about behaviour, attendance or achievement with students as these arise
Considering curriculum content	-	Teachers and support staff review behaviour, attendance and achievement results to consider appropriate curriculum content
Monitoring course progress	Curriculum leaders discuss with course teachers any issues about progress at least three times a year	Senior leaders discuss attendance and behaviour issues with teachers as these arise
Reporting to parents and students	Teachers report to parents and students in face-to-face meetings across the year, referring to attainment results, learning skills, behaviour, organisational skills, completion of homework and regular written comments	Team leaders, senior leaders and teachers talk to parents about achievement, behaviour and attendance
Reviewing trends and changes over time	Teachers discuss changes and trends once a year with curriculum leaders and senior managers	-

The discussion points can involve a number of different stakeholders, which might be: teachers and senior managers in schools; teachers and students; teachers and parents; and teachers or school managers and inspectors or advisors. The involvement of stakeholders in different discussion points is shown in Table 2.

Table 2. Stakeholders involved in key discussion points.

Discussion point	Secondary school case	Primary school case
Knowing about the data system	Senior managers, subject leaders and teachers	Senior managers, team leaders, teachers and support staff
Levelling subject attainment	Senior managers, subject leaders and teachers	Senior managers, team leaders and teachers
Setting targets for students	Senior managers, subject leaders, teachers and students	-
Monitoring student progress	Teachers, students, subject leaders and senior managers	Team leaders, teachers, support staff, students, and parents
Considering curriculum content	-	Team leaders, teachers and support staff
Monitoring course progress	Senior managers, subjects leaders and teachers	Senior leaders and teachers
Reporting to parents and students	Senior managers, subject leaders and teachers	Team leaders, senior leaders, teachers and parents
Reviewing trends and changes over time	Senior managers and subject leaders	-

Different schools are likely to use curriculum review processes that will occur at different times across the school year, and also different stakeholders depending on specific school contexts and needs. The discussions involved, which could be concerned with making decisions to intervene or set targets, for example, are likely to be crucially important. So, maintaining records of the discussions themselves, and the backgrounds to decisions, could be just as vital as maintaining a record of the background or underlying data themselves. How does a data management system provide for this type of need, and how does its functionality fit with the overall process of school monitoring and improvement practices?

6 Features of a new data management system

In the past, records of discussions, whether between teachers, or a teacher and senior teachers, or a parent and a teacher, or a student and a teacher, have been likely to be kept in a separate register or document store. The facilities now available within software that create data management systems can provide for levels of such record

keeping, at times that individuals can choose far more, rather than only needing to rely on times determined for specified meetings.

The specialist company Different Class has created a new data management system, called DCPro, which provides features to support both synchronous and asynchronous communication and discussion between stakeholders. In this system, when a teacher or school manager either enters a data record or views a record, then they can include a comment to accompany that record. A box appears when the cursor is placed over a cell containing data, allowing the user to enter a comment, as well as enabling supporting documents to be added. The DCPro system further allows the user to identify those stakeholders who should see or have access to those comments. When other users access the system, they are alerted to the fact that comments or attachments are added, and they can then also add their own comments or documents to continue further discussion, should they feel that that is required.

In terms of the facilities that this system offers, and comparing these to the discussion needs of the two case study schools, in the context of the secondary school: initial discussions following a presentation of how the system could be used (involving senior managers, subject leaders and teachers) could be continued and followed up, although this would probably require a copy of the data set to be accessible for this specific purpose, to separate this activity from review process activities; discussion about reasons why different tests indicate different potential abilities (involving senior managers, subject leaders and teachers) could certainly be taken up by teachers commenting on individual student results; discussions across the year about targets (involving senior managers, subject leaders, teachers and students) could be taken up, but the facilities in the system do not currently allow the crucial element of student involvement; discussion across the year about progress (involving teachers, students, subject leaders and senior managers) could be taken up, but again the facilities do not enable student engagement in this discussion; discussions about reporting to students and parents (involving senior managers, subject leaders and teachers) could be undertaken, but it is not clear that details of agreed elements in reports would be held separately in the system to allow separate and restricted dialogue; and discussion annually about trends over time and any changes that are identified (involving senior managers and subject leaders) could be taken up with the system as it stands. In the context of the primary school: discussions about behaviour and attendance (involving senior managers, teachers, support staff, students, and perhaps parents) could be taken up, but there is no facility currently to enable student and parent involvement; discussion about trends over time and any changes that are identified (involving senior managers and team leaders) could be taken up readily; discussions about achievement (involving team leaders, teachers, teaching assistants, students, and parents) could be taken up, but facilities do not enable engagement of students and parents currently; discussions about the levelling of teacher assessments (involving senior managers, team leaders and teachers) could be taken up using the facilities; and discussions about subject attainment (involving subject co-ordinators and teachers) could also be taken up readily.

7 Conclusions

As Milkman, Chugh and Bazerman [14] said in their review of improving effective decision-making: “People put great trust in their intuition. The past 50 years of decision-making research challenges that trust.” These authors argue that there is a need to move from intuitive decision-making processes to overcome decision biases, “replacing intuition with formal analytic processes. For example, when data exists on past inputs to and outcomes from a particular decision-making process, decision makers can construct a linear model, or a formula that weights and sums the relevant predictor variables to reach a quantitative forecast about the outcome.” Research exploring uses of data management systems in schools indicates that discussion to understand what data are describing is an important part of the process, and that in some cases reduced discussion can lead to demotivation of students, which in turn is likely to lead to reduced rather than improved outcomes (Treadaway [8]).

8 Future needs for data management systems

Undoubtedly data management systems that provide for forms of discussion are already able to support fundamental needs for involvement and interactivity required at certain stages of the monitoring and decision making processes. The fact that individuals with a variety of roles across a school can now do this remotely, and can continue a discussion asynchronously to meet their time needs as well as those of others has been highlighted already as positively supporting school and stakeholder needs. A key element that has been highlighted, however, is that discussions involving two crucial groups of stakeholders, parents and students, are not yet integral to the system explored in this study. The data management system examined in this study now provides for discussions for school teaching and support personnel. The development of facilities for discussion by students and parents is perhaps a next step. Indeed it can be argued that a discussion without students and parents will have limitations (and that the level of limitation could be determined by and could be directly related to the level of discussion that happens). However, it could also be argued that an online discussion medium is not ideal for these purposes.

What is needed next is to assess the discussion needs of school performance and improvement practices much more widely, to ensure that the different elements of discussion that are involved, by different stakeholders at different times, are able to met through continued technical developments of systems themselves. From the analyses of the case study schools, additional features identified at this time are: for profesional development purposes, a copy of the data set to allow discussions following a presentation of how the system could be used; for discussions across the year about targets, features to involve students; for discussion across the year about progress, facilities to enable student engagement; for discussions about reporting to students and parents, facilities that hold separate report details for parent and student engagement; and for discussions about behaviour and attendance, facilities to enable student and parent involvement.

Technologies now allow audio and video to be readily captured, added as files, and accessed by others. Although text comments can be useful, audio or video files could enhance certain practices. This aspect of development has not been taken forward at this time, but clearly its potential is worthy of further exploration. Digital technologies now offer the potential to enable discussion to be built into data management and handling processes. The fundamental positions of discussion within important performance and improvement practices need to be identified and accommodated in future systems that serve the needs of all stakeholders.

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