RESEARCH AREA & SOURCE	DESCRIPTION & MAIN FINDINGS/ARGUMENTS
Leadership / Using data *American Journal of Education Vol. 112, pp. 549 - 571*	**Wayman, J. & Stringfield, S. (2006) Technology-supported involvement of entire faculties in examination of student data for instructional improvement.** This research reports case studies (primarily using interviews and focus groups of administrators and teachers) of three schools attempting to involve entire faculties in the examination of student data supported by data systems. **Main Findings:** **Factors that facilitate widespread use of data tools to inform practice** • *District support* • *Principal involvement* - interviewees at all levels highlighted the fact that principal leadership was a key factor • *Non-threatening triangulation of data* - data drawn from multiple sources, but used for non-threatening, diagnostic purposes • *Efficient data access* - faculty at every school noted increased efficiency from the use of data management software. Technology was key to facilitating data use. • *Time to examine data* **Changes in faculty practice as a result of data use** • *Increased sense of teacher efficiency* - many teachers cited an increased sense of teacher professionalism and pride that their school was participating in data initiatives. Teachers noted increased efficiency supported by the use of data software and systems. • *Better response to student needs* – teachers reported that the data systems enabled them to get a more rounded view of student performance. The possibility of accessing detailed information relating to contradictions and consistencies helped avoid the misdiagnosis possible from a single data source. Many teachers reported they were better able to group students as a result of data. • *Reflecting on practice* – teachers often reported that data enabled them to examine their own practice. The data often enhanced differentiation of instruction. Teachers in all schools, however, reported some difficulty in connecting data to instruction due to a lack of preparation. One principal was leading teachers in a process of writing their own assessments to reinforce the connection and teachers felt this initiative was successful. Some teachers (often those who also reported that data had helped them improve practice) were dubious about whether there had been an overall improvement in practice. This was often related to concerns about the amount of time used assessing that took away from instructional time. • *Collaboration* – teachers reported that using data had helped them establish a 'common language', that data created more opportunity and need for collaboration and was a respected conversation starter. Some teachers noted that collaboration had become more academic and professional.
Using Data *CRESPAR Technical Report 67. John Hopkins University, Baltimore,*	**Wayman, J., Stringfield, S. & Yakimowski, M. (2004) Software enabling school improvement through analysis of student data.** This is a report which outlines criteria which schools should consider when selecting software for storage and analysis of student data and then evaluates the various software packages on the market in light of these criteria. **Main Findings:** **Important issues on software implementation** The authors recommend that schools or disctricts considering implementing a software package for data storage and use consider the following:

http://www.csos.jhu.edu/crespar/techReports/Report67.pdf	1. *Assessment of data needs* – This should include*:* • Data inventory and preparation - an inventory of all data currently stored and where it is located • Data 'cleaning' - assess the quality and accuracy of the current data and estimate what it would take to 'clean' it. • Software needs - assess the types of data, presentation and analyses that will be most helpful in making the kind of decisions you want to make based on data. • Outside help - evaluate what services you can perform in-house and what you require outside help with. 2. *Time to implementation* – rapid, successful implementation is important to sustain interest and improve education sooner rather than later. Schools should aim to 'get data up and running' quickly even if the initial system does not do everything that is desired 3. *Cost* – Cost evaluations should include 'opportunity costs' such as the time lost by internal people in designing systems and inputting data if it is decided that the system should be developed internally. 4. *Choosing a vendor* – there is currently no 'best product'. Different companies have focused on different aspects when producing software, so schools should carefully choose a product that meets their needs and a vendor that provides the kind of extra services they require. 5. *Schools Interoperability Framework* - a framework exists for ensuring that software packages are able to communicate with each other. Schools can check if the product they are interested in fits the standards outlined in the Schools Interoperability Framework (www.sifinfo.org) A full list of compliant applications can be found at: *www.opengroup.org/sif/cert/cert_prodlist.tpl* **What should good software for student data analysis look like?** The authors have compiled the following criteria for evaluating software: 1. *User friendliness* • Software is intuitive and easy to use • Software requires little training • Presentation is familiar to user • Access speed is fast and efficient 2. *User features* • Comprehensive query tools available for every level of user • Flexible drill-down capability from any form of data aggregation • Data can be accessed from anywhere 3. *Information access* • Multiple ways to access information • Varied methods of representing information (eg. tables, graphs) • Wide range of data available for analysis • Interface provides immediate access to relevant information • Pre-formatted reports are clear, varied, relevant and comprehensive • Longitudinal presentation of data available at every user level 4. *Creating and sustaining quality data* • Provides capacity to enable clean data • Company accepts responsibility to facilitate data process with schools • System allows for expansion past initial implementation

- System provides proper security for data transmission
- Integration of different areas of information is seamless to the user
- Software accepts many common data formats

5. *Additional features*
   - *Online student work samples available*
   - *Software exports into common programs*
   - *Users can access electronic discussion groups*
   - *Easy access to learning standards information*
   - *Software offers capacity to link individual teacher data to student data*

Software reviews

A table containing a summary of the reviews is included as an appendix after these summaries.
The authors maintain a website that contains updates of product reviews:
www.cos.jhu.edu/systemics/database.htm

APPENDIX - SUMMARY OF SOFTWARE REVIEWS FROM WAYMAN, STRINGFIELD & YAKIMOWSKI

Software & company	Account from SchoolNet	Data Miner from Chancery	Data Point from NSSE	Ease-e from TetraData	EDsmart	eScholar	QSP from CRESST	Sagebrush Analytics, pwrd by Swift-Knowledge	SAMS from Executive Intelligence	Scholar Suite from SCHOLARinc.	Socrates Data System from CRM	STARS from SchoolCity	Virtual Education from Edmin
Company Focus	Educational Technology	Student Info Systems	Educational Research	Educational Technology	Educational Research	Data Warehousing	Educational Research	Data Analysis & Reporting	Educational Technology	Mngemnt of Assessment Data	Educational Research	Educational Technology	Learning Mngemnt
Version	4	4.1	n/a	4.5	3.2	5	4.3	5.1	3.4	2	2.2	2.6	5.5
Pre-formatted reports	x	x		x	x	x	x	x	x		x	x	
Query tools for less advnced users	x		x	x	x		x	x	x			x	x
Stored queries		x	x	x	x	x	x	x		x	x		x
Online student work samples			x				x						x

User discussion brds or user mtings	x			x	x	x	x		x		x		x
Accepts data formats in addition to ASC II	x	x		x	x	x		x	x		x	x	x
Variable set customized to fit school needs		x	x	x	x		x	x	x		x	x	x
Company will house data	x		x	x	x	x		x	x	x	x	x	x
School may house data	x	x		x	x	x	x	x			x	x	x
Company helps collect data	x	x	x	x	x	x		x	x		x	x	x
Reports SIS compliance	x	x		x	x	x			x	x			x
SIF-certified	x	x		x		x							
No. of districts in use	40	83	15	464	27	750	100	35	20	15	92	28	110

Curriculum Development *European Journal of Education 42.2.235 - 254*	**Tuomi, I. (2007) Learning in the Age of Networked Intelligence.** This article gives a fresh perspective on the changes society has undergone in moving from an industrial age to an age of knowledge / information. The author outlines a theoretical perspective on innovation and follows this with ten theses about the future of education based on this perspective. **Main Arguments:** • We will soon be living in a world where knowledge is available wherever and whenever we need it. • The economy of the future will be increasingly distributed geographically (based on global networks rather than physical proximity of resources or human capital) and innovation will be the key source of economic value (because globalization leads to greater cost competition). • It is possible that education systems are optimized for yesterday's world and may be dysfunctional in tomorrow's. • A traditional model of innovation assumes that an original creative insight is followed by product development and dissemination. In practice, this is rarely the case. Studies on innovation show that the key to innovation is the social adoption (which could more appropriately be termed user-centric innovation, knowledge creation and learning) of new technological opportunities. • Innovation increasingly occurs in multidisciplinary projects where complementary bodies of knowledge are brought together. • The creative act that makes an innovation 'real' occurs when user communities change their social practices. • Education policies that follow a traditional model of innovation emphasize specialization and industrial application of knowledge by individuals. A more 'downstream' model would emphasize social learning and knowledge creation within communities of potential users. • The demand for 'innovativeness' has created tensions in education systems. In its socialising function, education has often made use of 'transfer' of knowledge from teacher to student. Innovation requires that knowledge that is new to society be generated. • Innovation in the future will require that new products and technologies need to be designed so that potential user communities can easily create the innovative adaptations necessary for their use, which will include designers including pedagogic models into their design. Ten theses about learning in the future: 1. Education becomes global 1. Blogs become more important than formal certificates • Individual capabilities often have their origin in the individual's ability to mobilize social resources - knowing the right expert rather than being an expert. Electronic track records will prove peoples' 'social capital'. 6. Immersive social games replace the textbook • Play has a critical function in cognitive development. Pedagogies aimed at transfer have emphasized disciplined learning and the textbook was the artifact that synchronized a group of learners in a mass-production learning environment. Innovation requires the development of cognitive capabilities and this will mean the dynamics of play will need to be integrated into educational practices. Play can simulate the real world and provide a platform for skill and knowledge creation. Play can create social micro worlds that can increase skill in mobilizing social resources and socially distributed knowledge. 1. Educational programmes become integrated with real social change • There is growing evidence of a disconnect between school learning and performance outside school. The innovation economy demands that students gain the capacity to change social and economic realities since development is not so much driven by new technology as it is constrained by the capabilities of social institutions to change. In the global economy, the speed of change will become an absolute competitive advantage. Skills and knowledge from inside and outside school must become

	increasingly integrated.
Curriculum Development *MultiMedia Schools 10,2,14 - 18*	**Murray, J. (2003) Contemporary Literacy: Essential Skills for the 21st Century.** This article quotes the White Paper resulting from the 21st Century Literacy Summit in March 2002 as stressing the importance of competence in information literacy and the use of information and communication technologies. **Main Arguments:** • Knowledge is changing so fast that no traditional curriculum can provide students with fact-based learning adequate for the challenges they will face. • The Big6 Skills for information problem solving (http://www.big6.com) were endorsed as exemplary practice at the 21st Century Literacy Summit and by the National Technology Plan (released by the U.S. Department of Education in December 2000). • The Big6 Skills enable students to 'purposefully access information from a variety of sources, analyze and evaluate the information, and then integrate it to construct a personal knowledge base from which to make intelligent decisions. • Some schools have created information literacy curricula. • Library media specialists are best placed to implement information literacy skills in the curriculum.
Instructional Strategies Science Daily, January, 29, 2009	**Is technology producing a decline in critical thinking and analysis?** Patricia Greenfield, professor of psychology at UCLA and director of the Children's Digital Media Center analyzed more than 50 studies on learning and technology. **Main Findings:** • Over the past 50 years our skills in critical thinking and analysis have declined. Professor Greenfield links this to a decline in reading for pleasure in recent decades. She claims that reading engages the imagination and enhances thinking in a way that visual media do not. • Studies have shown that reading develops imagination, induction, reflection, critical thinking and vocabulary. Since visual media such as video games or movies are real-time media, they do not allow as much time for reflection, analysis or imagination. • Over the past 50 years our visual skills have improved. Greenfield links this to increased use of technology. • While video games have been shown to improve the ability to multi-task, multi-tasking during a task requiring undivided attention can prevent students from gaining a deeper understanding of the information • Greenfield claims that as people spend more time with visual media, assessment tasks that involve the use of visual media will give us a better picture of what students actually understand. • Overall Greenfield claims that "no one medium is good for everything" and that in order to develop a variety of skills we need "a balanced media diet".
Curriculum Implementation + Assessment ***The Curriculum Journal 16, 193-206***	**Jones, A. & Moreland, J (2005) The importance of pedagogical content knowledge in assessment for learning practices: a case-study of a whole school approach.** A case study of the implementation of a new technology curriculum in a New Zealand Primary School. The researchers found that teachers did not have sufficient pedagogical content knowledge to implement the new curriculum and as a result of this were providing technology 'activities' with no conceptual substance and were unable to give feedback to students beyond praise-based feedback. Interventions included reflection on case studies of classroom practice, using a specific planning framework, workshops, classroom support, teacher agreement meetings, using student portfolios. **Main Findings:** ● There was significant change in teacher practice over the three years of the study including a shift from an 'activity' focus to providing

	for specific learning outcomes. This enabled teachers to give more specific feedback which in turn enabled students to identify their own knowledge gaps. ● As teachers understood the subject and the intended outcomes better they were able to provide more relevant and specific feedback to students. ● The use of specific planning frameworks forced teachers to articulate intended learning outcomes, and over time this helped them develop a framework for decision making. ● Communicating clear purposes to students communicated to students what was important in the subject and helped them know whether they were meeting intended outcomes. ● Teachers were keen to become involved as they saw other teachers achieving results and being recognized for it. ● The ongoing reflection / action research was crucial to the success. ● The long time frame of three years allowed for the development of relationships and for the ongoing reflection necessary to bring about change.