

# Working Paper

Regional Center for Educational Planning

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## Turning Data into Wisdom

Effective and Ethical Data Use in Educational  
Planning





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## Disclaimer

This paper was commissioned by the UNESCO Regional Center for Educational Planning (RCEP) in Sharjah, United Arab Emirates. The paper falls under RCEP's second strategic objective, which is to produce and disseminate knowledge in support of education policies to enable planning of educational systems. The views and opinions expressed in this paper are those of the authors and should not be attributed to RCEP.

## Regional Center for Educational Planning

The Regional Center for Educational Planning (RCEP) is a regional educational organization with an international vision established through an agreement signed in 2003 between the government of the United Arab Emirates and the United Nations Educational, Scientific and Cultural Organization (UNESCO). Under this agreement, the Center is tasked with developing national and regional capacities in the areas of education planning and policies, educational leadership and management, and the production and dissemination of educational knowledge at the regional level. It places special emphasis on the Gulf Cooperation Council countries and Yemen, as well as consultations and technical support to enhance the efficiency, effectiveness, and quality of education systems in the Gulf Cooperation Council and Arab countries. These improvements aim to ensure that education is closely aligned with the demands of real-life situations and the workforce. RCEP collaborates with UNESCO and receives technical support through partnerships in numerous programs, projects, and initiatives related to education.

## Abstract

In an era of increasing digitization, educational institutions are becoming progressively data-rich but not necessarily data-wise. The effective use of data is critical to improving educational equity, planning, and personalized learning. However, the challenges of data overload, poor data quality, lack of educator data literacy, and ethical concerns undermine its potential. This paper explores how education systems can convert raw data into actionable wisdom using the DIKW model (Data-Information-Knowledge-Wisdom), highlighting the importance of context, human judgment, and ethical practices. Through examples and research insights, it proposes frameworks for ethical, inclusive, and impactful data use.

## Introduction

The discourse around data use in education has grown significantly in recent decades, driven by the increasing availability of digital technologies and standardized assessments.

Initially, from the 1990's, the focus was on 'data-richness', focusing on the availability of data in schools and the system, and their use in accountability and target-setting (e.g. Reynolds, 1998), with challenges at this time still including availability of and access to data in forms that schools and education professionals could actually use. Typically data would be standardized tests of pupil attainment, which would then be used to look at, for example, the performance of a school in comparison to others in the locality. As the availability of data has grown, not least in terms of its accessibility and manipulability, the focus has shifted to a focus on more effective and systematic uses of that data. As, while education systems are increasingly "data-rich," the challenge lies in translating that data into informed decision-making (Schildkamp et al, 2019). Data alone does not constitute wisdom—contextual interpretation and human agency remain essential.

Data is a powerful tool, but it requires careful application, ethical frameworks, and professional judgment to be genuinely transformative in educational contexts.

Data can be highly valuable in education as in other aspects of society, and many examples exist of effective use of data in education. When effectively leveraged, data has the power to:

- Identify learning gaps and equity issues by highlighting disparities among student groups, enabling targeted interventions (Reeves, 2010);
- Enable evidence-based policy, by, for example, identifying areas in need of new school places or educational interventions. From curriculum planning to staff allocation, reliable data supports rational decision-making.
- Support early intervention and personalized learning, for example by using data analytics to adapt instruction to individual pupil progress; and
- Optimize resource allocation by allowing targeting of public funds to areas of need.

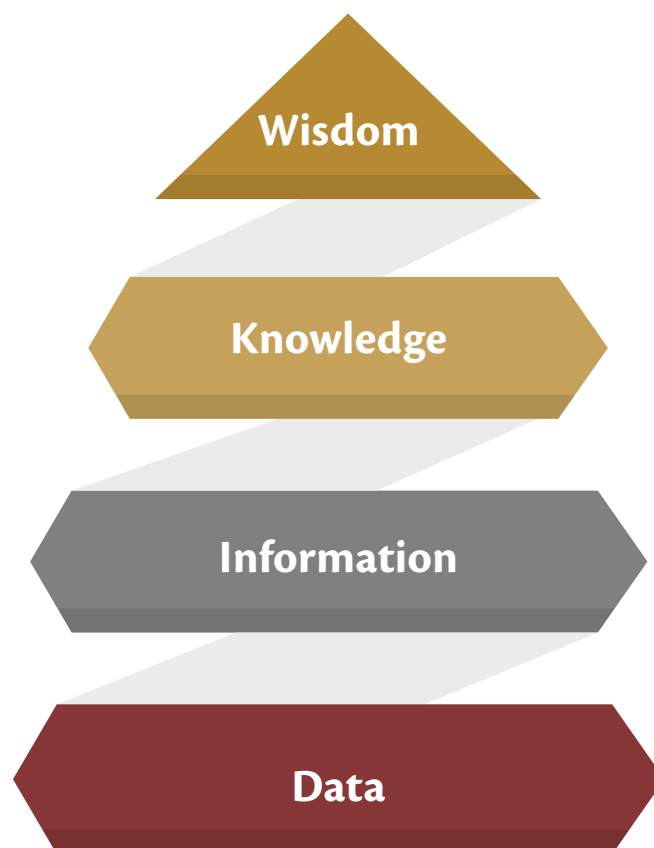
However, these benefits depend on the quality, relevance, and interpretation of data.

As well as being useful at the system level, schools and groups of schools can use data for various strategic functions, including policy decisions (for example by using standardized assessments and longitudinal tracking to test the value of particular interventions or strategies); budgeting and infrastructure planning (to account for changes in local demographics, for example), and to identify pupils and pupil groups in need of additional support by analyzing socio-economic indicators and educational outcomes.

These applications require more than just data and software tools; they demand a professional culture that values evidence and continuous improvement, in which policies and approaches are questioned and reviewed in an ongoing cycle and staff are supported in improving their practice (Hawlitscheck et al, 2024).

### **The DIKW Framework: From Data to Wisdom**

To conceptually frame how we can use data effectively the DIKW model is useful (Ackoff, 1989; Rowley, 2007). This presents data as a set of layers building in cognitive complexity but also in value to the user.



1. **Data** is raw and unprocessed (e.g., student test scores).
2. **Information** results from processing and organizing data (e.g., school-wide performance trends).
3. **Knowledge** integrates information with understanding and context (e.g., why certain groups underperform).
4. **Wisdom** involves judgment, experience, and ethical insight in applying knowledge (e.g. what can we do to support those underperforming groups).

Educational systems can falter by acting at the data or information level without progressing to knowledge and wisdom. There is often a lack of attention to context, differences and in many cases insufficient thought as to how the data can be used to inform action. A good example of this lies in the use of data from international student assessments such as PISA, which too often lead to simplistic forms of policy borrowing which do not take into account different educational and societal contexts.

## Challenges to Effective Data Use

Despite its promise, several barriers hinder the effective use of data in education:

### **1. Data Overload**

As the volume of available data has grown, schools, teachers and education administrators can feel overwhelmed by the sheer volume of data from multiple systems—attendance records, test scores, behavior logs, and more (Datnow & Hubbard, 2015). This sometimes leads to an element of inaction, in which data are presented and discussed, but quickly passed over for the next set rather than being acted upon. This leads to a cynical view of data among staff, who may no longer fully engage with it.

### **2. Poor-Quality or Incomplete Data**

Inaccurate or inconsistent data can lead to false conclusions and ineffective interventions. This can be a major issue in education, as data can be of variable quality. For example, where use is made of data from teachers self-developed tests care must be taken not to overinterpret small differences and to overstate the reliability of such data. Care must also be taken with demographic data, for example the use of indicators of social background such as eligibility for free meals, which can be crude

and quite undifferentiated. Missing data can be a major issue, with even highly sophisticated tests such as the international PISA assessments seeing levels of missingness that can differ significantly between countries, items and pupil groups, making comparisons harder (Marcq & Braeken, 2025).

### ***3. Lack of Data Literacy***

Many educators and administrators lack training in data interpretation, statistical reasoning, and research methods (Mandinach & Gummer, 2016; Schildkamp, et al, 2019). This can lead to over- or misinterpretation of data, such as a lack of attention to confidence intervals that mean that small differences are often meaningless, or a lack of understanding of the issues discussed under point 2 above. This is also in some cases an issue among policymakers and civil servants, who in many countries come primarily from humanities backgrounds with limited quantitative skills (Hetzner, 2017). While some advocate training for all those involved, it is in many cases more efficient to provide support for this function in the form of analytical units in e.g. education ministries that can provide education professionals, administrators and schools with pre-analyzed and interpreted data. The overreliance on test scores that is often encountered in education systems can also mean that other important and valuable sources of information, such as qualitative data on student voice and teacher observations may be missed.

### ***4. Ethical and Privacy Concerns***

The handling of student data raises issues around consent, surveillance, and data security (Williamson, 2017). These are not always well understood in schools in particular. Regulation such as the European Union's General Data protection Regulation has led to an increased understanding of data privacy issues, but consent and other ethical issues such as quality of data are not always taken into account.

### ***5. Misinterpretation and Political Misuse***

Data can be selectively used to support political agendas or make unjustified claims about school performance (Ball, 2003). For example, over-reliance on high-stakes testing may marginalize non-academic aspects of education or lead to unintended consequences and behaviors such as teaching to the test, the exclusion of pupils thought less likely to succeed in high stakes tests such as those with special educational needs, and narrowing of the curriculum (William, 2010;). International tests

such as PISA are sometimes used as justification for national policies in ways that are not always justified (Volante & Mattei, 2024). Top-down mandates based on generalized data can also be blind to local realities, where a growing body of research on place-based approaches is showing that the latter are crucial to improving education and life chances of children and young people. Data should be a mirror, not a mask—reflecting reality rather than concealing or distorting it.

## **Toward Ethical and Contextual Data Use**

Therefore, while data can inform decisions, it cannot replace human judgment. Effective data use must be:

### ***Ethical***

Grounded in respect for student privacy, autonomy, and wellbeing. Ethical frameworks such as the GDPR in Europe set minimum standards, but schools must go beyond compliance to foster a culture of responsibility.

### ***Contextual***

Data must be interpreted in light of school culture, community values, and historical context. Quantitative data alone cannot capture the lived experiences of learners.

### ***Inclusive***

Decision-making processes should include voices from across the school community, including students, parents, teachers, and support staff.

These principles will grow in importance, as we are likely to see an increasing emphasis on data use in education, not least a growing role for artificial intelligence (AI) and real-time feedback systems. These technologies promise to enable adaptive teaching through tailoring tasks to individual learning profiles, and provide real-time diagnostics which will include immediate feedback loops to inform instruction. These are exciting developments, but the growing autonomy of these tools should not lead to a reneging on the principles of ethical data use mentioned above, as they also intensify ethical dilemmas around surveillance, algorithmic bias, and teacher autonomy. As such, educators must be involved in the design and governance of these systems (Selwyn, 2021).

## Some examples of effective use of data

In this section we will highlight a number of examples of effective data use, looking at the system and school levels:

Area	System level	School level
<p>Identify learning gaps and equity issues by highlighting disparities among student groups, enabling targeted interventions</p>	<p>The English government identified coastal towns as areas of educational disadvantage through a combination of data analysis and reports highlighting persistent underperformance in education compared to other regions.</p> <p><b>Key factors included:</b></p> <ul style="list-style-type: none"> <li>• <b>School performance data:</b> Coastal towns often had lower GCSE and A-level results, poor Ofsted ratings, and higher rates of school absenteeism.</li> <li>• <b>Social and economic indicators:</b> These areas showed higher levels of deprivation, unemployment, and limited access to higher education or skilled jobs.</li> <li>• <b>Geographic isolation:</b> Limited transport links and fewer opportunities for cultural and educational enrichment contributed to the challenge.</li> </ul> <p>These insights led to targeted policy initiatives to address educational inequality in coastal communities.</p>	<p>A secondary school in a coastal town in England, reviewed its Key Stage 4 performance data and found that boys from disadvantaged backgrounds were consistently underachieving in English Language GCSE compared to national averages.</p> <p><b>How the issue was identified:</b></p> <ul style="list-style-type: none"> <li>• Internal tracking data showed that only 35% of disadvantaged boys were achieving grade 4 or above in English, compared to a national average of around 60%.</li> <li>• Progress 8 scores for this group were significantly below average, indicating poor progress from Key Stage 2.</li> <li>• Attendance records revealed that this group also had higher-than-average absence rates, especially in the run-up to assessments.</li> </ul> <p><b>Response:</b></p> <p>The school used this data to implement targeted interventions, such as small-group English tutoring, mentoring programs focused on motivation and attendance and parent engagement efforts</p>

Area	System level	School level
<p>Support early intervention and personalized learning, for example by using data analytics to adapt instruction to individual pupil progress</p>	<p>In Estonia, data analytics are used to help schools target interventions effectively.</p> <p><b>How Estonia uses data analytics in education:</b></p> <ul style="list-style-type: none"> <li>• National digital infrastructure: Estonia has a highly digitized education system. Every student’s academic progress, attendance, and assessments are tracked through a central platform called eKool (e-School).</li> <li>• Real-time data for schools and teachers: Teachers and school leaders can access up-to-date data to monitor student performance, identify learning gaps, and spot patterns like declining attendance or subject-specific struggles.</li> </ul> <p>Schools use this data to Identify students at risk of dropping out or falling behind, offer targeted tutoring or counselling, adjust teaching methods or curriculum pacing</p> <p>The Ministry of Education uses aggregated data to identify underperforming schools or regions and allocate support or training accordingly.</p> <p><b>Outcome:</b></p> <p>Estonia consistently ranks high in international assessments (like PISA), and its use of data analytics is credited with helping reduce inequality and improve educational outcomes across different student groups.</p>	<p>A school in London uses data analytics to improve teaching and learning, especially for students from disadvantaged backgrounds.</p> <p>Data are collected through Regular formative assessments - Students took short quizzes every 2–3 weeks in core subjects like Math and English.</p> <p>This data is then uploaded to a central system that visualized performance trends by class, subject, topic, and individual student (the data dashboard).</p> <p><b>Instructional adjustments:</b></p> <ol style="list-style-type: none"> <li>1. Teachers identified which concepts students were consistently struggling with (e.g. fractions in Math).</li> <li>2. They re-taught those concepts using different methods (e.g. more visual aids, slower pacing, peer explanations).</li> <li>3. In English, writing errors were analyzed to shape grammar instruction across classes.</li> <li>4. Based on analytics, small groups were formed for catch-up sessions or extended homework support.</li> </ol> <p><b>Outcome:</b></p> <p>The school saw steady improvements in student progress scores, and teachers reported feeling more confident about tailoring instruction to meet students' needs.</p>

Area	System level	School level
<p>Optimize resource allocation by allowing targeting of public funds to areas of need</p>	<p>In 2008, Chile introduced the <b>Preferential School Subsidy Law (Ley SEP)</b> to reduce educational inequality.</p> <p><b>How data is used:</b></p> <ol style="list-style-type: none"> <li>1. Student-level socioeconomic data: The government collects detailed data on students' backgrounds, including income level, parental education, and vulnerability indicators.</li> <li>2. School performance metrics: Standardized test results, attendance, dropout rates, and other indicators are collected annually.</li> <li>3. Using a data-driven funding model schools receive extra funding per vulnerable student, based on national criteria. Performance data helps determine if additional support programs (like teacher training or infrastructure investment) are needed. Funds are tied to school improvement plans, which must address specific weaknesses revealed in the data.</li> </ol> <p><b>Outcome:</b></p> <ul style="list-style-type: none"> <li>• Schools in disadvantaged areas receive more targeted support.</li> <li>• Transparency in data and funding has improved accountability.</li> <li>• Over time, learning outcomes in low-income communities have shown gradual improvement.</li> </ul>	<p>In a multi-academy trust (grouping of schools) in England, data was used to target resources to schools in greatest need of improvement.</p> <p>The trust collects performance data, financial data, and staff workload metrics from all its schools into a centralized system. This allows the trust to benchmark schools against each other and national standards.</p> <p>It was found that one secondary school in the trust consistently shows low progress scores in Math, high staff turnover and below-average attendance</p> <p><b>The trust responded by:</b></p> <ul style="list-style-type: none"> <li>• Deploying experienced specialist teachers or senior leaders from stronger schools in the trust.</li> <li>• Providing intensive CPD (professional development) funding for math teachers.</li> <li>• Investing in an attendance officer or pastoral team to improve student engagement.</li> <li>• Offering additional tutoring or intervention support, funded through central reserves.</li> <li>• Follow-up data is used to evaluate whether the interventions lead to improved outcomes, and funding can be adjusted accordingly.</li> </ul> <p><b>Outcome:</b></p> <p>Resources are not distributed evenly, but equitably. This ensures schools facing the biggest challenges get the support required to close gaps in attainment and opportunity.</p>

Area	System level	School level
Using qualitative data to include the voice of pupils and staff	<p>Under the <b>Curriculum for Wales</b> (rolled out from 2022), pupil voice is a key principle. Schools are encouraged to involve students in shaping their own learning and school culture.</p> <p><b>How qualitative data is used:</b></p> <ol style="list-style-type: none"> <li>1. Student focus groups and interviews. Schools regularly conduct structured conversations with pupils to gather insights on their learning experiences, wellbeing, and opinions about school life.</li> <li>2. Surveys with open-ended questions. National and school-level surveys often include qualitative prompts (e.g., "What helps you learn best?" or "What would you change about your lessons?").</li> <li>3. School self-evaluation. The Welsh Government encourages schools to include pupil feedback — including quotes, stories, and reflections — in self-evaluation reports. Estyn (the Welsh education inspectorate) considers the quality of pupil voice when inspecting schools.</li> <li>4. Curriculum planning. Some schools co-design learning projects with students based on their interests and feedback. Pupil voice panels contribute to decisions on school rules, wellbeing policies, and even budgeting for enrichment activities.</li> </ol> <p><b>Outcome:</b></p> <p>The aims of this approach are to ensure that students feel more engaged and respected, schools gain richer, context-specific insights into student needs and motivations, and that qualitative data complements test scores and attendance to give a fuller picture of school effectiveness.</p>	<p>In an urban primary school a photo voice project was set up to develop an understanding pupils' experiences of the school environment and wellbeing</p> <p><b>How photovoice was used:</b></p> <ol style="list-style-type: none"> <li>1. Year 5 pupils were given cameras (or tablets) and asked to take photos around the school of places and objects that made them feel safe, happy, or stressed. Pupils then annotated the photos or discussed them in small groups with a teacher or teaching assistant.</li> <li>2. A number of themes were identified. Students highlighted calm outdoor spaces and colorful classrooms as positive. Crowded corridors and noisy lunch halls were linked to anxiety. Some pupils shared photos showing where they felt isolated or where they saw unfair behavior.</li> <li>3. The school leadership used these insights to: <ul style="list-style-type: none"> <li>○ Create quiet zones and sensory corners in classrooms.</li> <li>○ Improve supervision in specific areas.</li> <li>○ Adjust the lunchtime routine to reduce noise and crowding.</li> </ul> </li> </ol> <p>The project also helped teachers understand how pupils interpret their surroundings emotionally.</p> <p><b>Outcome:</b></p> <ul style="list-style-type: none"> <li>• Pupils felt genuinely heard and involved in school improvement.</li> <li>• The school used rich, contextual data to make targeted changes.</li> <li>• The process strengthened relationships between staff and students.</li> </ul>

## Recommendations

Based on this analysis, the following principles should guide the effective use of data in educational planning:

1. ***Invest in Data Literacy***

Train educators not only in data collection but in interpretation, skepticism, and ethical application.

2. **Balance Quantitative and Qualitative Data**

Incorporate teacher judgment, student reflections, and ethnographic insights alongside test scores.

3. ***Use Data Formatively, Not Just Summatively***

Shift from data for accountability to data for learning improvement.

4. **Ensure Transparency and Inclusivity**

Make data processes open and include diverse stakeholder voices in analysis and action.

5. **Monitor for Unintended Consequences**

Regularly review data use practices to avoid reinforcing inequalities or misdirecting resources.

Data is a powerful tool, but only when used wisely. Data systems must evolve from merely storing and processing data toward generating wisdom. That journey requires ethical safeguards, contextual awareness, and professional judgment.

As education continues to embrace AI and data-intensive technologies, it is essential that the human remains at the center—not just as a data subject, but as an interpreter, decision-maker, and ethical actor.


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