sustainability

MDPI

Article

Promoting Sustainable Data-Based Decision-Making in the Korean Educational Information Disclosure System

Young Hyeo Joo

Department of Education, College of Education, Gyeongsang National University, Jinju, Gyeongsangnam-do 52828, Korea; youngmonet@gnu.ac.kr; Tel.: +82-55-772-2136

Received: 3 August 2020; Accepted: 17 August 2020; Published: 20 August 2020

Abstract: This study investigates the Korean Educational Information Disclosure System (KEIDS) and suggests sustainable development policies for KEIDS to improve school-level data-based decision-making (DBDM) from the educational administration's perspective. It also raises the following questions: What are the barriers impeding effective data use by the KEIDS? How do school teachers, who are directly involved in using data, effectively prepare for DBDM using the KEIDS? How can the KEIDS be improved for DBDM concerning quality data, school context, and institutional support? To answer these questions, the study reviewed KEIDS-related documents and interviewed 24 school teachers through an interpretive case study approach while using a research framework of data quality, school contexts, and institutional support. Its results highlight important issues with the KEIDS and sustainable DBDM, in other words, teachers and administrators are not always conscious of the need for using data; the lack of data use understanding creates issues among principal leadership and teachers' involvement and cooperation; the quality of the student data in the Schoolinfo system is questionable; and the central education authority focuses on simply disclosing student data rather than pursuing the goal of the KEIDS. The study suggests facilitating DBDM through the KEIDS in terms of data quality, school context, and institutional support.

Keywords: sustainable development policy; Korean educational information disclosure system; data-based decision-making; student data; interpretive case study

1. Introduction

Under the Elementary and Secondary Education Act (ESEA), 2001, nicknamed No Child Left Behind, US accountability policies mandated that educators, administrators, and policymakers significantly employed standardized test results for improving student achievement and teaching and learning [1–5]. Similarly, the Korean government has pushed educational autonomy and accountability policy since Kim Young-sam's administration began in 1993 [6], a critical year that included the end of the military government and a starting point for the democratization and liberalization of the Korean society. In this context, the Kim Young-sam administration implemented government-mandated educational reforms to promote educational marketization, democratization, liberalization, and decentralization when it released the 5.31 Education Reform Plan in 1995 [7]. Meanwhile, since 1995, the Korean government has continued to implement various educational policies, such as school and teacher evaluation, national standardized testing, high school choice, open recruitment system of principals, and a teacher merit pay system, focusing on client-oriented education, school autonomy, and educational excellence.

On 25 May 2007, with the Act on Special Cases concerning the Disclosure of Information by Education-Related Institutions (ADIE), the Korean educational authority established the Korean

Educational Information Disclosure System (KEIDS) to enhance school autonomy and raise educational accountability [8]. On 1 December 2008, it mandated the disclosure of both elementary- and secondary-school information and university information through divided dual data systems (Student and school information in Korea is disclosed through two separate data systems: web systems for disclosing elementary- and secondary-school information (www.schoolinfo.go.kr) and for disclosing university information (www.academyinfo.go.kr)). The policy can be summarized as a historical product to enhance Korean school autonomy and its educational accountability; it is also an example of the path dependence referenced in the theory of historical institutionalism [9,10]. As stated in Article 1 of the ADIE and suggested in the master plan of the KEIDS published by the Ministry of Education (MOE) [11], the primary aim of the KEIDS is to protect the right of the public to know and to participate in education, to guarantee the improvement of efficiency and transparency in school management, and to promote scientific and policy research. Moreover, the MOE suggested that the data system will allow autonomous reform efforts on the basis of freely disclosed school information, which should improve schooling and solve the education gap among schools [11]. On the basis of this statement, we know that the policy aims to help educators, administrators, and policymakers use data to better facilitate decision-making.

The KEIDS is based on the ADIE. The ADIE defines information as "a document (including an electronic document), drawing, photograph, film, tape, slide, or any other similar medium prepared or acquired by an education-related institution for its business in connection with school education" (Article 2, Paragraph 1). The ADIE suggests publication, which means "an education-related institution notifies or provides information held and managed," as a method of disclosure (Article 2, Paragraph 3). The ADIE also mandates that "the head of a school that provides elementary or secondary education shall publish each of the following information which is held and managed by the school, at least once a year" (Article 5, Paragraph 1) to the superintendent of the office of education. However, the ADIE clearly stipulates that "no information published or provided pursuant to this Act shall include personal information of students and teaching staff" (Article 3, Paragraph 2). ADIE Article 1 clearly suggests the purpose of disclosing school and student data as follows:

> ... To guarantee citizens' right to know and promote academic studies and research on policies by providing for the duty to disclose information held and managed by each education-related institution ... in order to encourage participation in school education and enhance the efficiency and transparency of educational administration.

The KEIDS aims to actively disseminate the educational information (see Table 1) managed by education-related institutes (ADIE, Article 2), and it functions as a main mechanism to form a data-based decision-making (DBDM) culture [12]. However, few studies have comprehensively discussed both DBDM and the policy and reform direction of the KEIDS for improving school effectiveness and management in Korea. Therefore, this study aims to investigate the present status of the KEIDS and explore a sustainable reform and policy direction for the KEIDS to promote DBDM at the school level. The research questions are as follows: (1) What are the barriers impeding effective data use by the KEIDS? (2) How do school teachers who are directly involved in using data effectively prepare for DBDM using the KEIDS? (3) How can the KEIDS be improved for DBDM using the perspectives of data quality, school context, and institutional support? To address these questions, the author first reviewed the literature on DBDM and then analyzed the KEIDS through the key features of data quality, school context, and institutional support suggested in Wayman et al. [4,13]. Second, the research included interviews with school teachers. Third, the author considered the problems and reform directions of the KEIDS using the theoretical frameworks and the concepts addressed in the current literature regarding DBDM from the educational administration's perspective. Although the KEIDS employs dual data systems, the scope of this study is confined to the elementary- and secondary-school information system. Moreover, the research will use limited data disclosed through the KEIDS. Therefore, instead

of focusing on the Korean accountability policy, this paper scrutinizes the scope and content of the published data within the KEIDS.

Table 1. Categorization for the Korean Educational Information Disclosure System (KEIDS) data.

Data Classification [1]	Paragraph for the KEIDS [2]	Data Content [3]	Frequency of Publication [4]	Timing of Publication [4]
Input data	Paragraph 1. Regulations concerning school operations, including school regulations	School regulations and school management regulations, excluding school regulations	Rolling basis	Rolling basis
	Paragraph 2. Matters with regard to the organization and operation of educational curricula	Status of organizing, operating, and evaluating school curricula; plan for subject and extracurricular activity and experience program outside school; status for the number of school days and for the number of classes and instructional hours	Once a year	May
		Plan for open classes	Once a year	April
	Paragraph 3. Number of students per grade and class and status changes of students, including numbers of students moving in and out, as well as discontinuance of studies	Number of students by each grade and class and number of students for transfer and dropout	Once a year	May
	Paragraph 9. Matters with regard to school meals	Status of school lunch service	Once a year	May
	Paragraph 10. Matters with regard to health management, environmental sanitation, and safety management of schools	Status of healthcare, public hygiene at school, and safety management	Once a year	May
	Paragraph 11. Matters with regard to the status and treatment of school violence	Status of school violence and its handling	Once a year	May
	Paragraph 13. Matters with regard to the entrance status of students and careers of graduates	Status of newly enrolled students	Once a year	May
	Paragraph 15. Matters with regard to the educational conditions and school operation status	Status of club activities, plan for distinctive business in educational management, status of school library, status of after-school management and support, performance for counseling students and their parents, and status of enhancement of students' physical strength	Once a year	May
Output data	Paragraph 4. Status of studies by grades and subjects of the school	Evaluation items and the result for teaching and guidance by school	Once a year	February
		Fact for student achievement by each subject	Twice a year	February, September
		Plan for operation of subject progress	Twice a year	April, September
		Fact for evaluation plan by each grade and subject	Once a year	April
	Paragraph 12. Matters with regard to fundamental materials for academic research on the evaluation of educational achievements at the level of the nation, city, or Do	Status of national-level student achievement test; ratio for national-level student achievement test: above average, basic achievement, below average; degree of improvement of national-level student achievement test compared to last year	Once a year	November
	Paragraph 13. Matters with regard to the entrance status of students and careers of graduates	Status of the careers of graduates	Once a year	May

Note: [1] Student data among the information that the Act on Special Cases concerning the Disclosure of Information by Education-Related Institutions (ADIE) regulates in Article 5 can be divided into input and output data. [2] Indicators are categorized by the regulations of the ADIE. In this table, paragraphs that are unrelated to student data are excluded as follows: Paragraph 5 on matters with regard to school facilities, including school site and school buildings; Paragraph 6 on matters with regard to the status of faculties by position and qualification; Paragraph 7 on matters with regard to accounting of the school and foundation, including the budget and settlement of accounts; Paragraph 8 on matters with regard to the operating committee of a school; and Paragraph 14 on matters with regard to the correction orders specified in Articles 63–65 of the ESEA. [3] Refers to the Schoolinfo website (http://www.schoolinfo.go.kr/). [4] The content is based on the enforcement decree of the ADIE.

2. Theoretical Background

Data use has been identified as a critical factor in improving schools and ensuring school effectiveness in the era of educational accountability [8,14,15]. In this sense, DBDM, which has been used interchangeably with several terms such as data-driven decision-making, research-based decision-making, and evidence-based decision-making, stands for not only using data to determine

educational policies but also striving to improve educational and leadership practices through sustainable inquiry [16–18].

DBDM generally means that educators and policymakers recognize the value of data as well as utilize and analyze school and student data to provide educators and policymakers with scientific evidence to determine educational policies at both school and national levels, develop teachers' professional development, and improve student learning [2,18,19]. This research focuses on data quality, school contextual factors, and institutional support [4] (pp. 15–17) as key characteristics for facilitating DBDM.

2.1. Data Quality

Data quality is critical to promoting fruitful decision-making in schools [1,15,16,20,21]. However, it is difficult to define the concept because quality is a subjective notion that is "judged by the user in terms of its credibility and usefulness" [1] (p. 609). In addition, the concept of data quality involves various factors, characteristics, and attributes [22–24], as shown in Table 2. For example, Côrte-Real, Ruivo, and Oliveira [25] (p. 4), who conceptualize data quality as "explicit knowledge," included "formal, precise, easily codified, documented, transferred, or shared" types of knowledge. Similar to the definition of quality in Luo [1], Attard, Orlandi, Scerri, and Auer [26] (p. 403), who briefly define data quality as "fitness for use", believed that the concept of data quality implies objectivity and subjectivity. Finally, Vetrò et al. [23] (p. 331) presented a framework for measuring data quality in six categories such as understandability, time aspects (currentness and expiration), completeness, traceability, and compliance. This tool of Vetrò et al. [23] is meaningful in that it includes multidimensional elements of data quality and can be measured statistically. However, there are limitations because each element of the quality of data is focused on numerical evaluation and is not clearly defined.

Table 2. Comparison of data quality dimensions.

Author	Categories/Approaches	Dimensions
Fox et al. [27] (p. 17)	Objective category	Accuracy, completeness, consistency, and currentness
Wand and Wang [24] (p. 92)	Internal category	Data-related accuracy, reliability, timeliness, completeness, currency, consistency, and precision System related reliability
	External category	Data-related timeliness, relevance, content, importance, sufficiency, usableness, usefulness, clarity, conciseness, freedom from bias, informativeness, level of detail, quantitativeness, scope, interpretability, and understandability System-related timeliness, flexibility, format, and efficiency
Fisher and Kingma [28] (p. 110)	Subjective category	Accuracy, timeliness, consistency, completeness, relevancy, and fitness for use
Pipino et al. [22] (p. 212)	Subjective and objective categories	Accessibility, appropriate amount of data, believability, completedness, concise representation, consistent representation, ease of manipulation, free-of-error, interpretability, objectivity, relevancy, reputation, security, timeliness, understandability, and value-added
Luo [1] (p. 612)	Subjective category	Believable, accurate, and reliable and good data sources
Attard et al. [26] (pp. 410–411)	Subjective and objective categories	Usability, accuracy, completeness, consistency, timeliness, accessibility, and openness
Geisler et al. [29] (p. 10)	Metadata-driven approach	Completeness, data volume, timeliness, accuracy, consistency, and drop rate
Vetrò et al. [23] (p. 331)	Objective category	Understandability, currentness, expiration, completeness, traceability, and compliance
Heinrich et al. [20] (p. 17)	Economic approach	Timeliness, completeness, reliability, correctness, and consistency
	Intrinsic category	Accuracy, objectivity, believability, and reputation
Juddoo et al. [30] (p. 8)	Contextual category	Value-added, relevancy, timeliness, completeness, and appropriate amount of data
	Representational category	Interpretability, ease of understanding, representational consistency, and concise representation
	Accessibility category	Accessibility and access security
Kubler et al. [31] (pp. 15–16)	Data openness category	Complete, primary, timely, accessible, machine processable, non-discriminatory, non-proprietary, and license-free data
	Data transparency category	Reusability, understandability, and authenticity
Côrte-Real et al. [25] (p. 6)	Explicit knowledge category	Completeness, accuracy, format, and currency

In summary, the concepts and elements of data quality are presented in various ways so that it is difficult to clearly define them. In this context, it is essential to derive elements that include a clear definition for the policy evaluation of data quality of a specific data system. Therefore, three elements of Thomas [32] who divided the value of data into three categories such as relevance, sufficiency, and veracity and who specifically defined the categories of data quality are useful. According to Thomas, relevance means "the information constitutes information for (or against) some proposition". Sufficiency involves "corroboration with other instances of the same kind of evidence or other kinds of evidence". Veracity is defined as "evidence has been free from distortion and as far as possible uncontaminated by vested interest" [32] (p. 5). These three concepts establish quality student data for DBDM as information gathered in an objective and valid way that can provide educators, policymakers, and parents with sufficient and relevant educational evidence to make a decision. On the contrary, Marsh et al. [2] discussed the issue of data quality validity in relation to the concept of veracity as follows:

> Many educators questioned the validity of some data, such as whether test scores accurately reflect students' knowledge, whether students take tests seriously, whether tests are aligned with curriculum, or whether satisfaction data derived from surveys with low response rates accurately measure opinions. These doubts greatly affected some educators' buy-in, or acceptance of and support for the data. (p. 8)

Considering the above discussion, data quality can be understood as a technical factor to evaluate whether the KEIDS keeps high-quality, timely, accurate data [4,13,15,25,33]. Creating and sustaining quality data is an essential prerequisite for facilitating DBDM. High-quality data is a basic element in DBDM. In addition to quality data, important factors, which include calibration, principal leadership, teacher involvement, and collaboration, as well as institutional support [4] are important for evaluating the present conditions for operating the KEIDS.

2.2. School Context

2.2.1. Calibration

Calibration describes "how aware individuals are of what they do and do not know" [34] (p. 437). Calibration is related to how educators define teaching and learning with respect to data use, determine how teaching is conducted under these definitions, know how to assess student learning, and consider how they react to results [4,35]. It is a critical concept in evaluating whether the KEIDS promotes DBDM. In addition, one of the key reasons for using student information is to implement differentiated instruction for students [3,36].

2.2.2. Principal Leadership

Existing research recognizes the role and function of the principal as a key factor in improving school effectiveness and student academic achievement [37–39]. The principal is also a primary agent in facilitating data use [1,2,4,5,16,18,35]. However, as Luo [1] discussed, empirical research within DBDM has treated principal leadership lightly, even though the role of principals and principal leadership can affect the extent to which DBDM is implemented at the school level. Therefore, this study focuses on principal leadership and the extent to which principals support the use of data systems [4,15,18]. In addition, teachers' collaborative activity and involvement seem to be important factors because school leadership roles, functions, and responsibilities need to be distributed to a broader group of stakeholders [19,39,40].

2.2.3. Teacher Involvement and Collaboration

Teacher involvement and collaboration are critical factors in successful schools [39,41]. According to Marsh et al. [2] (p. 8), data use expands when teachers are intrinsically motivated to utilize data. Teacher involvement is often the driver of DBDM and a critical element in the extent to which teachers use school and student data [4,16,18] to conduct differentiated instruction for improving student achievement [3]. Collegiality is critical to teacher involvement [39,42] because it is an important element for building a democratic learning community [43].

Furthermore, collaborative activity and inquiry among schoolteachers are considered sine qua non for making professional learning communities to improve teaching and learning [37,44]. In this sense, the element of collaboration involves whether educators closely collaborate with each other to facilitate data use [2,4,35,45]. Collaboration for DBDM at the school level is closely related to the organizational culture and principal leadership. In other words, a positive school culture likely eventually results in effective DBDM, and principals who emphasize the use of data inspire cooperation among school educators [2,16] as the principal acts as a role model [38].

2.3. Institutional Support

Institutional support is a critical factor in facilitating DBDM in schools [2,33,45,46]. Marsh et al. [2] (p. 8) suggested that government accountability policies, such as incentives and pressures, promote the use of data and DBDM, acting as an important external motivator for DBDM. As the concept of data quality is a question of data itself, and the notions of calibration, principal leadership, faculty involvement, and collaboration are used to evaluate whether school DBDM is effectively conducted, institutional support may be used to examine the external factors for promoting DBDM. In this context, this research evaluated institutional support by analyzing whether education authorities supply in-depth, continuous training for educator data use, specifically training in data systems [46], as well as whether educators have sufficient time to access and examine data [4,15,16]. As the analytic framework (Figure 1) demonstrates, the above concepts are the main factors impacting the KEIDS, and they can be used to facilitate DBDM.

2.4. Theoretical Framework for Facilitating DBDM

This research draws on key characteristics such as data quality, school contextual factors, and institutional support [4] (pp. 15–17) as the theoretical model for facilitating DBDM (Figure 1). Although some theoretical frameworks exist for promoting DBDM [15,35], this study adopts the Wayman et al. [4,13] model because it encompasses school organizational and institutional aspects, including data quality, in terms of educational administration. As Walsham [47] (p. 324) suggested, this theoretical framework also serves as a guide for collecting research data and analyzing the KEIDS for promoting DBDM.

The specific concepts are defined as follows: (1) data quality demands the KEIDS to keep high-quality, timely, accurate data [13,15,20,24,25,32]; (2) calibration addresses educators' data use in teaching and learning and how teachers conduct teaching under these definitions [3,4]; (3) principal leadership requires administrators to invest in and support the use of data systems and addresses whether school leaders encourage educators to directly access data [13,19,33]; (4) faculty involvement and collaboration question whether teachers are enthusiastic about the use of a data system and whether educators closely collaborate with each other for effective data use [2,3,35]; and (5) institutional support addresses the training and time provided to educators for accessing and examining data [2,16,46].

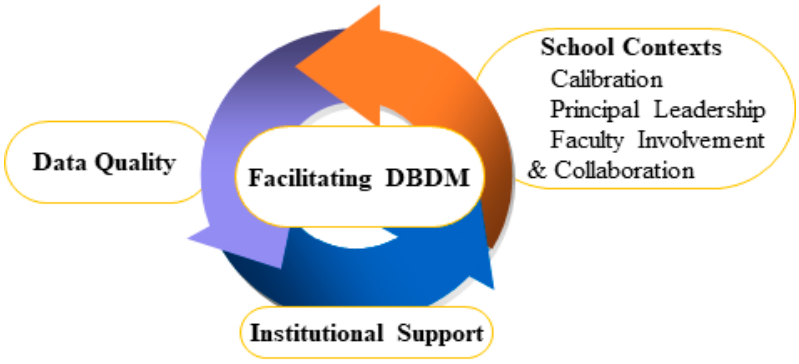

Figure 1. Theoretical framework for facilitating DBDM.

3. Research Methods

This study applied an interpretive case study method to answer research questions. Interpretive case study method is useful for answering research questions such as how, why, and what happens in a particular context [47–49]. Particularly, it is a suitable research method to explain the specific phenomenon in policy research based on a theory, law, or model [50] (p. 692). Collection of various types of data in interpretive case study is important for ensuring qualitative reliability and validity [47] (p. 78). Data for interpretive case study of this study were collected in two forms: literature and interview data.

3.1. Archival Research

The researcher reviewed the KEIDS- and DBDM-related documents, such as research reports, journal articles, and doctoral dissertations, to scrutinize the present status of the KEIDS and to support policy directions for promoting DBDM. As Webster and Watson [51] (p. 13) report, analysis of previous research suggests that problems and directions for improvement in the KEIDS can be a springboard for the integration of theory, knowledge, and practice; the development of new theories; or exploring areas that require further study or further consideration. Given that there is a lack of research on the DBDM and KEIDS in Korea, the analysis of previous studies is a useful method of addressing the questions of this study.

This research applied two criteria to review the KEIDS-related literature. First, previous research should be published after 2008 and the creation of the KEIDS. Second, the literature had to include references to key topics such as the ADIE and KEIDS. This study used Google Scholar and the Research Information Sharing Service in Korea to search and collect literature that met these two criteria. The literature selected for this research included 15 journal articles, 1 research report, and 1 doctoral dissertation. Not surprisingly, the topics of the publications were limited to things such as political and policy analysis in the process of the KEIDS, a theoretical study of the KEIDS, and a critical analysis of the ADIE.

3.2. Qualitative Data Collection and Analysis

This research involved interviews with a structured questionnaire based on the data quality, school contexts, and institutional support within the theoretical framework [4,13]. From 25 October 2012 to 31 October 2014, 12 elementary and 12 secondary school teachers in the Seoul Metropolitan area were interviewed using the questions listed in Table 3. The researcher focused on interviewing school teachers because they are significant agents in implementing education policies [52,53]. These teachers are students in the master's or doctoral degree program at a university in Korea. The researcher explained the purpose and contents of the research in detail before the interview.

The interviews were conducted for approximately one hour with teachers who volunteered for the study, and they were given a letter and number identifier to protect anonymity. The research

participants have more than 15 years of teaching experience: A1–A12 are teachers responsible for managing school information systems; participants B1–B12 are teachers responsible for teaching a particular subject or managing a class. The collected interview data were recorded in Korean and translated into English. The researcher transferred the transcribed interviews onto a worksheet and then compared the contents repeatedly. Finally, as this study used structured interview questions based on the theoretical framework, the participants' responses were classified based on keywords by the interview question, as shown in Table 3.

Table 3. Key factors and question for analyzing the KEIDS.

Key Factors		Interview Questions
School contexts	Data quality	Does KEIDS keep high-quality and accurate data? Does KEIDS keep accurate data?
	Calibration	How do educators define teaching and learning regarding data use? Do educators determine how to conduct teaching under these definitions? Do educators determine how they assess student learning? Do educators consider how they react to results?
	Principal leadership	Does a principal invest and support the use of data systems? Does a principal encourage educators to directly access data?
	Faculty involvement and collaboration	Are teachers enthusiastic about the use of a data system? Do educators closely collaborate with each other for data use?
Institutional supports		Do education authorities supply in-depth, continuous training for data use in the system? Is sufficient time ensured for educators to access and examine data?

4. Research Finding: Problems and Sustainable Development Policies for Promoting DBDM in the KEIDS

This section will suggest policies for utilizing the KEIDS in schools and rethinking Korean schools to promote DBDM by synthesizing the results of the literature review and interview analysis. The analysis of these two research data can enrich the explanation of educational policy phenomena, making the answers to the research questions more valid and [47,49]. It is classified into three parts: data quality, school contexts, and institutional aspects. When we try to facilitate DBDM through the KEIDS, these three aspects are closely interrelated and may be reviewed and reformed simultaneously.

4.1. Data Quality

As delineated previously, data quality and its value can be defined by relevance, sufficiency, and veracity [32] (p. 5). Particularly, data must be timely, accurate, and of high quality for promoting DBDM [4,13,15,20,24,30,54]. In the case of the KEIDS, the main data-related problem is the deficiency of the KEIDS in maintaining and disclosing the latest data [2,20,23,26]. Information disclosed by the Schoolinfo data system for the KEIDS is considered public data, which means that teachers already have access to this information prior to student and school information being comprehensively opened through the KEIDS. The information disclosed by the KEIDS is produced, gathered, and administrated by the National Education Information System (NEIS) (The NEIS data system began in March 2006 to enhance the work convenience of schoolteachers, reduce the work burden, and to improve the quality of education. The area of NEIS can be school affairs, school entrance and progress, and school health (NEIS website: http://neis.go.kr/)), which mainly manages school information [12] (pp. 123–124). Several teachers highlighted concerns with the KEIDS, for example, one teacher suggested the following problems and improvements:

> The information disclosed by the KEIDS is often not the most recent data. The Schoolinfo data system does not provide high-quality information on how school programs for gifted children and children with learning disabilities are implemented, so the KEIDS does not provide educators with data on how students' learning, aptitude, and talent have been improved and developed. (Teacher A3)

These problems are created by both the timeliness of information [2,4,13,15,23,29] and the absence of relevant and sufficient data [22,30,32] on student progress and development, including gifted children and children with learning disabilities. In addition, as reported in Park and Hong [54] (p. 386), data within the Schoolinfo data system is updated very slowly, and the KEIDS does not update the data as an ongoing process [54] (p. 386). Research participants also indicated similar problems regarding the KEIDS; one school teacher revealed the following data quality problems:

> If high-quality data are offered, data use would be promoted more than the present. The reason why teachers do not utilize data is owing to out-of-date information that most teachers already know. (Teacher B10)

Teachers may fall out of the habit of utilizing data because of outdated information. The KEIDS also does not keep accurate data in terms of student mobility, such as newly enrolled students and transfers and grades by each year [55] (p. 240). Therefore, it can be concluded that the data quality issue may not be primarily about a lack of timely data updates, which is a result of data publication requirements listed in the enforcement decree of the ADIE.

Both the scope and the content of data are determined by users, and data quality depends on how users define the purpose of data in education [1,26,56]. This is also related to the goal of education and educational policy to achieve certain outcomes [57]. The right data can ensure relevance, sufficiency, and veracity [32] to facilitate DBDM. In addition to these three properties, this research suggests that data can also show the progress of academic achievement and the relationship between provided curriculum and student achievement in more micro perspectives because it is not sufficient to exactly know how teaching and learning have been practiced within a school [3,5,18]. The KEIDS needs to provide high-quality information on the present status of talented students and underachievers, the programs offered to students, and changes in student achievement.

Moreover, the KEIDS information needs to show how students' aptitudes have been developed and how the achievement of an individual student has improved each year [58]. As these are not currently part of the KEIDS, it is clear that the data system does not provide relevant and sufficient information [59] for educators and policymakers, as well as parents, on programs, test results, and teaching methods related to improving student achievement in a given school year. Owing to this issue, the relationship with teaching–learning and student data thus has remained a black box. In this respect, we need to evaluate the 10 critical elements of data quality, suggested by the Data Quality Campaign [60] (p. 5) to reform and facilitate DBDM in Korea. Among these, keeping in mind the important issues related to student data and excluding the current KEIDS information, the critical items include (1) a unique student and teacher identifier to match teachers to students, (2) evidence to match individual students' test records over time to trace academic growth, and (3) information on nontested students.

The first thing to be considered is that the data system for Schoolinfo needs to be changed to a longitudinal data system that can contribute to calibration and teacher involvement and cooperation. In addition, it needs to give an anonymous identifier to every student and teacher [59,60]. As a result, transcript information, including data such as programs and courses completed and longitudinal student achievement before entering a university and college, could and should be added to the data system for the KEIDS. Additionally, information on whether a specific teacher employs a particular teaching method with students needs to be added to the KEIDS for promoting DBDM. In other words, the data system should provide sufficient information in terms of the progress of student achievement over time and the evidence on whether schools and teachers supply students with an adequate educational program and curriculum rather than only supplying school-based data.

Further, the KEIDS should reveal information about untested students on national-level student achievement tests. This is critical for ensuring the veracity of information [32] because the lack of this data can distort the decision-making related to educational policies. As Amrein-Beardsley and Berliner [61] and Nichols, Glass, and Berliner [62] reported, it is possible for high-stakes testing policies

to exclude low-performing students or lead to many students dropping out of school. In the same vein, Heilig and Darling-Hammond [63], using an example from Texas in the United States, suggested that some schools may use various gaming strategies to boost school ratings, such as employing test waivers, repeatedly retaining students, and manipulating student populations. This phenomenon has also been found in Korea, and as the Korean court's decision to publicize national-level standardized tests results, the gaming strategy has been a hot issue in the area of Korean education [64].

In conclusion, the greatest data quality issues in facilitating DBDM using the KEIDS are whether information is relevant, sufficient, valid, and reliable. The data available through the KEIDS is the same general information given to teachers through the NEIS data system, so it is necessary for the KEIDS to develop and disclose process data through a longitudinal data system [12,54] to ensure the reliability of data and to disclose additional student-specific data. Enhancing the KEIDS in these ways would enhance DBDM.

4.2. School Contexts

The most important and, perhaps, the most serious problem in the case of schools is that educators are not trained for using student and school information for improving teaching and learning [65] (pp. 101–102). This issue begins with principals who do not consider the importance of utilizing data [2,4,16,18,38,60]. However, Korean educators do not consider whether and how teaching is improved by data use, how they utilize student data, and why they should collaborate with each other for DBDM. Moreover, as Park and Hong [54] (p. 370) reported, educators may not be accustomed to DBDM or even know the term. Similarly, most research participants clearly said "No" or "I do not know well" for the eight questions about school contexts shown in Table 3. Particularly, an interviewee in this research evaluated the present conditions and the school contexts regarding data use in the following manner:

> I think the Schoolinfo system is as being used as a mere window dressing. Thus, we did not use school and student data to define teaching and learning. School teachers knew the data which is disclosed by KEIDS; we already shared student as well as school data through NEIS data system. (Teacher B2)

Further, the other interviewee detailed more related problems regarding the KEIDS and DBDM:

> I heard the term DBDM for the first time while interviewing with you. Actually, we (our school teachers), including our school principal, do not recognize the need to use data. In addition, the school principal does not feel that he/she should invest in a data system and urge us to use school and student data. Teacher leaders who manage school data only collaborate with other teacher leaders. (Teacher B4)

The KEIDS is a new educational policy, and poor publicity and lack of institutional support for the use of data at the school and district level mean that educators often do not feel that it is necessary to use data. A more serious problem related to this issue is that principals, who have to play a pivotal role in facilitating data [1,2,4,5,16,18,38], do not encourage teachers to use data. Under these conditions, it seems difficult to implement calibration, differentiated instruction, and cooperation in teaching [3,4,13,18,35,45] and to cooperate with each other among Korean school teachers (e.g., research participants A8 and B10).

At the foundation of the problem are data quality and the lack of institutional promotion and support from educational authorities. However, we need to consider the school culture in Korean schools to effectively facilitate DBDM through the KEIDS. In this sense, principals should motivate and provide incentives to teachers to utilize data [2,16] as a part of creating a school culture that encourages data use [5,66]. However, Korean principals are not only administrative leaders but also instructional leaders [67] (p. 197). This means that Korean schoolteachers, in particular teacher leaders, must be role

models in data use in daily instruction. In relation to this problem, we need to think about the Korean school organization and the culture of isolation among teachers [68].

There is no doubt that the Korean school organization demonstrates the characteristics of Bolman and Deal's [69] structural frame controlled by legitimate authority; the Korean school organizational culture and governance is a closed framework because it dictates that teachers obey directions from their own superiors, and it is based on top–down management. In this sense, Korean school organization also has the characteristics of a "simple bureaucratic structure" [43] (p. 123) wherein a charismatic principal is dominant and directly supervises schoolteachers (p. 123). In other words, the Korean school organizational structure places great emphasis on the seniority systems, structural frames, and simple bureaucracies that have been based on a strong administrative hierarchy and on order and stability [7] and a closed culture that has limited team activities and communication among educators [68].

However, research and overall school contexts suggest that school leaders have to collaborate with teachers and teacher leaders to facilitate DBDM. As a result, an environment needs to be created where teachers work more closely with leaders and other teachers while realizing the importance of student data, participating in a continuous "cycle of inquiry" [38] (p. 381) through practicing distributed leadership [19,70], and creating a professional learning community [71,72]. To encourage distributed leadership in the reality of Korean school organization, it is necessary for principals to think of school staff as co-leaders and to delegate their authority and responsibility to school staff in accordance with the principle of the division of labor and professionals [73].

Therefore, school leaders and administrators, who have substantial authority in school management, need to help organize professional learning communities to promote a data-driven culture [33,35,74]. As Coburn and Stein [52] discussed, in particular, school-based teachers or professional learning communities that have "shared goals, collaboration, a focus on student learning, shared responsibility, and social trust" (p. 27) can considerably influence educational policy implementation and data use. In other words, one of the key activities to facilitate DBDM can be to establish professional learning communities in which educators collaborate with each other to improve student learning by "reviewing, studying, and interpreting data" (p. 42), as well as by sharing responsibility, power, and authority.

To achieve this, school organization may be reconstructed and reframed by subjects or teams to create professional learning communities that foster flexible school organization as opposed to the current bureaucratic organization [15,16,56]. The reframed school structure contributes to active teams and departments for improving teaching methods and activities and using student information for DBDM. When we consider a school as a living organism [75], it is apparent that practicing distributed leadership and developing professional learning communities to develop organizational capacity and improve student achievement can function as meaningful and useful factors in promoting DBDM.

4.3. Institutional Support

Considering that Korean educational policy initiatives often involve government-centered reforms and top–down management [7,9], the most serious problem related to institutional support for promoting DBDM at a school level is the MOE's lack of interest in how educators utilize and analyze data and what the MOE can do to facilitate data usage [8,54]. Particularly, educational authorities are not focused on providing institutional support, such as professional training, to schoolteachers for using data; the only concern is to open student and school data through the data system. Several interview respondents also indicated this problem, and one school teacher particularly explained the current status as follows:

> There was no institutional support from the government or school district, such as professional training, for improving data skills and/or incentives to help educators use data. (Teacher A4)

Moreover, Park [21] addressed that there has been no active promotion for facilitating data use, and there have been no efforts to reduce the work burden for teachers or secure quality data. In one instance,

Korean schoolteachers criticized the KEIDS as mere window dressing, and some teachers did not even know the Schoolinfo web address [65] (pp. 101–102). As Lee [65] suggested, the interview respondents involved in the study reported criticisms. These results show that the impetus for the KEIDS has been placed merely on building the data system and fulfilling the legal requirement mandated by the ADIE:

> We did not know the purpose and content of the KEIDS and that there was no school level and institutional support for work reduction in order to promote DBDM. (Teacher B9)

The more serious problem is that the government does not deal with official documents in a timely fashion. With respect to institutional aspects, the most imminent tasks are to ensure time for using data in institutions [2,5,16]; to establish institutional support, such as a professional training program for improving data skills for interpreting and utilizing test results [15,46,76]; and to try to reduce burdens on teachers, such as miscellaneous work not directly associated with teaching activities [77]. In particular, the issue of time-consuming work may be the most important barrier in relation to DBDM, given that most Korean teachers have a colossal workload and face difficulty in undertaking new tasks. These assumptions are supported by a survey of the Korean Federation of Teachers' Associations [78], in which 39.3% of the respondents spent more than seven hours per week dealing with paperwork; in addition, 68.2% of the respondents replaced their class with self-regulated learning in regular classes more than once a month.

Similarly, the Korean Teachers and Education Workers Union [79] released data revealing that schoolteachers spend 12 h of their work time on non-classroom-related tasks, such as drafting various documents and supporting management; this time accounted for nearly 29.3% of the total work time. Therefore, educational authorities should establish institutional tools to alleviate time-consuming miscellaneous work and should also allocate sufficient time for teachers to analyze, interpret, and reflect on the data. In addition to school leadership and management, there are several institutional school issues. As mentioned before, the most significant problem is that the Korean government has focused on institutional reform without providing institutional support to educators and school-based management. Even though Korean teachers, on average, undertook double the Teaching and Learning International Survey (TALIS) average of professional development days [67] (p. 65), they do not receive sufficient institutional support from educational authorities, and the extent to which schoolteachers are supported by the government ranked lowest among TALIS [73] (p. 336). According to Jensen [80], these results "lead to an important policy issue and one that is critical for teacher development and lifting school effectiveness" (pp. 238–239). In other words, the MOE should support schoolteachers who have a strong aspiration for professional development to use data and facilitate DBDM through the KEIDS [45].

Regarding institutional aspects of facilitating new directions in school management and DBDM, the most pressing tasks are to establish support (e.g., a teacher professional development program) [67] (p. 54), increase the national investment in education, and reduce teachers' tasks not directly associated with teaching activities [21,78]. Finally, in addition to the above improvements, educational authorities need to solve the issues of quality data. It is critical that educational authorities revise the scope and content of the published information and the frequency of publication to ensure the collection and dissemination of quality data.

5. Contributions and Limitations

Considering the lack of research on Korea's KEIDS, this study contributes to the expansion of the knowledge base in the KEIDS' status and suggests policy development directions for promoting DBDM within the theoretical framework comprising data quality, school organization, and institutional support. This study is particularly vital, as a lack of research exists in the DBDM in the field of Korean and international educational administration. Despite its significance, this study has some limitations. First, this study presupposes that the KEIDS should contribute to DBDM [11] and suggests both the problems of the KEIDS that hinder DBDM and educational policy directions in a macro aspect

of educational administration. Therefore, this study did not analyze the reasons teachers are not motivated to use data and why teachers do not link data utilization and learning strategies [56]. It also does not consider whether it is reasonable to expect teachers to download the data from the national repository and analyze it on their own. It is necessary to analyze the issue at the micro schoolteacher level to promote DBDM through qualitative research such as phenomenological or case studies. Second, the focus of this study was student data in the KEIDS. Future research should analyze the role and problem of institutional research at the school or district level and the relationship between student data and school and teacher data (e.g., demographics and teaching style).

Third, although the theoretical framework of Wayman et al. [4,13] is useful as an educational administrative framework for KEIDS development and DBDM promotion, there is a limit to its use as a micro analytical framework mentioned above. In addition, this model is limited in that there is a lack of systematic connection between the micro and macro aspects. Therefore, KEIDS analysis is also necessary through application of a model that complements this limitation [15]. Finally, this study conducted data collection to analyze the reasons and contents of policy phenomena using an interpretive case study method based on theoretical framework. Although the overall policy directions of the KEIDS to promote DBDM have been derived (see Figure 2), both the detailed innovation and effective construction of the KEIDS and the interrelationship between them still remains unclear. Subsequent studies will need to should conduct more systemic "design science research" [81] (p. 80) that can identify the objective and possible problems, create relevant solutions and strategies, and analyze performance through "design evaluation methods" such as observation, experiment, and testing [81] (p. 86).

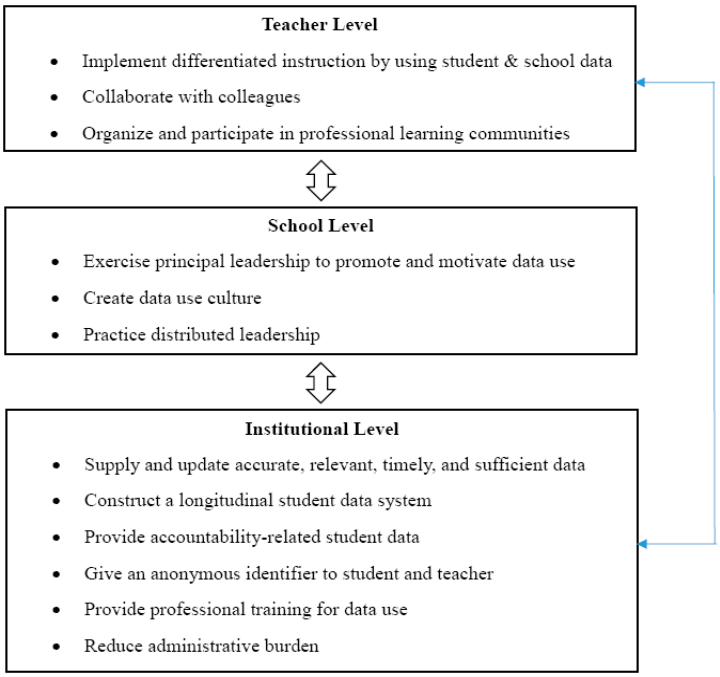

Figure 2. Schematic overview for facilitating DBDM.

6. Conclusions

The aim of this study was to analyze barriers to and facilitation of the KEIDS and to explore sustainable reforms of the KEIDS to promote DBDM. It revealed several important issues. First, a shortage of high-quality and timely student data exists in the Schoolinfo system. Second, many schoolteachers are not trained/educated regarding the need to use data, which leads to a lack of calibration, principal leadership, and teachers' involvement and cooperation. Third, the central educational authority focuses on merely disclosing student data rather than pursuing the policy goal of

the KEIDS. These problems for facilitating DBDM through the KEIDS are closely intertwined; therefore, to achieve the policy goal suggested in the ADIE (Article 1) and the master plan of the MOE, the policy and reform direction for DBDM must also be intertwined.

However, as interview results revealed, it is clear that a disconnect prevails between the policymakers and the schoolteachers who directly implement the educational policies. Disclosing student and school data, to which the public have not historically had access, is certainly significant [12]; however, it is important to achieve the initial policy goal. So far, the Korean accountability policy has focused on reforming school institutions rather than improving teaching and developing teachers' professionalism and leadership. Moreover, the accountability policy has also placed emphasis on changing isolated school cultures to raise educational accountability without considering the reality of the school organization.

As Fullan [53] discussed, previous educational reforms have failed because they have not understood teachers and the reality of school organization. In other words, there are myriad realities in schools, but the government has pursued reforming educational institutions and policies without considering these realities. In this sense, repeated attempts and failures of Korean educational policies may be a result of a fundamental problem that depends on external institutional reforms to improve education and schooling. Considering the above discussion, we need to note that DBDM through the KEIDS means not to merely gather and disclose data but to purposefully interpret and utilize the data [15,82] with the goal of enhancing student learning and achievement and improving school effectiveness. If we recognize that policy agents such as principals and teachers are important to standard-based reform [3,83], substantial education improvement and sustainable reform would be achieved by considering agents, school organization, and institutional support [70,84].

In conclusion, the study suggested that educational authorities should better incorporate daily school realities to facilitate DBDM through the KEIDS and to achieve the policy goals of the KEIDS. Data quality, school context, and institutional support are interrelated factors for DBDM policy success; however, in a government-centered policy environment, a strong MOE must take the lead in the reform process [7]. The MOE needs to thoroughly investigate what educators want to know and need to learn and what is needed to promote DBDM within the current school culture. In addition, the MOE needs to revise the ADIE to provide better quality data through the KEIDS. Data is an essential factor in effective instruction and successful schools for 21st-century learners, and with these reforms, Korean schools can grow to better meet the requirements of all students.

Funding: This research received no external funding.

Conflicts of Interest: The author declares no conflict of interest.

References

1. Luo, M. Structural equation modeling for high school principals' data-driven decision making: An analysis of information use environments. *Educ. Adm. Q.* **2008**, *44*, 603–634.
2. Marsh, J.A.; Pane, J.F.; Hamilton, L.S. *Making Sense of Data-Driven Decision Making in Education: Evidence from Recent RAND Research*; OP-170-EDU; RAND: Santa Monica, CA, USA, 2006.
3. Valli, L.; Buese, D. The changing roles of teachers in an era of high-stakes accountability. *Am. Educ. Res. J.* **2007**, *44*, 519–558.
4. Wayman, J.; Cho, V.; Richards, M. Student data systems and their use for educational improvement. In *International Encyclopedia of Education*; Elsevier: London, UK, 2010; Volume 8, pp. 14–20.
5. Young, V.M. Teachers' use of data: Loose coupling, agenda setting, and team norms. *Am. J. Educ.* **2006**, *112*, 521–548.
6. Lee, H.C. Achievements and prospects of Korea's educational reform. *Korean J. Comp. Educ.* **2004**, *14*, 1–11. (In Korean)
7. Joo, Y.H.; Reyes, P. A political analysis of the policy process of the Open Recruitment System of Principals in Korea. *KEDI J. Educ. Policy* **2010**, *7*, 233–255.

8. Hong, S.C. The policy process of education information disclosure in Korea. *J. Korean Educ.* **2012**, *39*, 235–259. (In Korean)
9. Joo, Y.H.; Halx, M.D. The power of institutional isomorphism: An analysis of the institutionalization of performance-based pay systems in Korean National Universities. *Asia Pac. Educ. Rev.* **2011**, *13*, 281–297.
10. Krasner, S.D. Sovereignty: An institutional perspective. *Comp. Politic. Stud.* **1988**, *21*, 66–94.
11. Ministry of Education. *A Master Plan for the Educational Information Disclosure System in 2008*; Ministry of Education: Seoul, Korea, 2008. (In Korean)
12. Lim, H.N.; Lee, S.H.; Oh, B.H.; Kim, K.S.; Kim, S.H. *Development Plan and Implementing Strategies for Educational Information Disclosure System*; RR2008-27; KEDI: Seoul, Korea, 2008. (In Korean)
13. Wayman, J.C.; Stringfield, S.; Yakimowski, M. *Software Enabling School Improvement through Analysis of Student Data*; CRESPAR Technical Report No. 67; Johns Hopkins University: Baltimore, MD, USA, 2004.
14. Earl, L.; Katz, S. Leading Schools in a Data-Rich World. In *Second International Handbook of Educational Leadership and Administration*; Kluwer Academic Publishers: Dordrecht, The Netherlands, 2002; pp. 1003–1022.
15. Schildkamp, K.; Poortman, C.; Luyten, H.; Ebbeler, J. Factors promoting and hindering data-based decision making in schools. *Sch. Eff. Sch. Improv.* **2016**, *28*, 242–258.
16. Datnow, A.; Hubbard, L. Teacher capacity for and beliefs about data-driven decision making: A literature review of international research. *J. Educ. Chang.* **2016**, *17*, 7–28.
17. Honig, M.I.; Coburn, C. Evidence-based decision making in school district central offices: Toward a policy and research agenda. *Educ. Policy* **2008**, *22*, 578–608. [CrossRef]
18. Wayman, J.C.; Stringfield, S. Technology-supported involvement of entire faculties in examination of student data for instructional improvement. *Am. J. Educ.* **2006**, *112*, 549–571. [CrossRef]
19. Park, V.; Datnow, A. Co-constructing distributed leadership: District and school connections in data-driven decision-making. *Sch. Leadersh. Manag.* **2009**, *29*, 477–494.
20. Heinrich, B.; Hristova, D.; Klier, M.; Schiller, A.; Szubartowicz, M. Requirements for data quality metrics. *J. Data Inf. Qual.* **2018**, *9*, 1–32. [CrossRef]
21. Park, E.S. The Effect of Information Quality on Reliability and Utilization of School Information Disclosure. Ph.D. Thesis, Hongik University, Seoul, Korea, 2017. (In Korean).
22. Pipino, L.L.; Lee, Y.W.; Wang, R.Y. Data quality assessment. *Commun. ACM* **2002**, *45*, 211–218.
23. Vetro', A.; Canova, L.; Torchiano, M.; Minotas, C.O.; Iemma, R.; Morando, F. Open data quality measurement framework: Definition and application to Open Government Data. *Gov. Inf. Q.* **2016**, *33*, 325–337.
24. Wand, Y.; Wang, R.Y. Anchoring data quality dimensions in ontological foundations. *Commun. ACM* **1996**, *39*, 86–95.
25. Côrte-Real, N.; Ruivo, P.; Oliveira, T. Leveraging internet of things and big data analytics initiatives in European and American firms: Is data quality a way to extract business value? *Inf. Manag.* **2020**, *57*, 103141. [CrossRef]
26. Attard, J.; Orlandi, F.; Scerri, S.; Auer, S. A systematic review of open government data initiatives. *Gov. Inf. Q.* **2015**, *32*, 399–418. [CrossRef]
27. Fox, C.; Levitin, A.; Redman, T. The notion of data and its quality dimensions. *Inf. Process. Manag.* **1994**, *30*, 9–19. [CrossRef]
28. Fisher, C.W.; Kingma, B.R. Criticality of data quality as exemplified in two disasters. *Inf. Manag.* **2001**, *39*, 109–116.
29. Geisler, S.; Quix, C.; Weber, S.; Jarke, M. Ontology-based data quality management for data streams. *J. Data Inf. Qual.* **2016**, *7*, 1–34. [CrossRef]
30. Juddoo, S.; George, C.; Duquenoy, P.; Windridge, D. Data governance in the health industry: Investigating data quality dimensions within a big data context. *Appl. Syst. Innov.* **2018**, *1*, 43. [CrossRef]
31. Kubler, S.; Robert, J.; Neumaier, S.; Umbrich, J.; Le Traon, Y. Comparison of metadata quality in open data portals using the Analytic Hierarchy Process. *Gov. Inf. Q.* **2018**, *35*, 13–29.
32. Thomas, G. Introduction: Evidence and practice. In *Evidence-Based Practice in Education*; Thomas, G., Pring, R., Eds.; Open University Press: Maidenhead, UK, 2004; pp. 1–18.
33. Pak, K.; DeSimone, L.M. Developing principals' data-driven decision-making capacity: Lessons from one urban district. *Phi Delta Kappan* **2019**, *100*, 37–42.
34. Stone, N.J. Exploring the relationship between calibration and self-regulated learning. *Educ. Psychol. Rev.* **2000**, *12*, 437–475. [CrossRef]

35. Keuning, T.; Geel, M.; Visscher, A. Why a data-based decision-making intervention works in some schools and not in others. *Learn. Disabil. Res. Pr.* **2017**, *32*, 32–45.
36. Faber, J.M.; Glas, C.A.W.; Visscher, A.J. Differentiated instruction in a data-based decision-making context. *Sch. Eff. Sch. Improv.* **2017**, *29*, 43–63. [CrossRef]
37. Bryk, A.; Camburn, E.; Louis, K.S. Professional community in Chicago elementary schools: Facilitating factors and organizational consequences. *Educ. Admin. Q.* **1999**, *35*, 751–781.
38. Copland, M.A. Leadership of inquiry: Building and sustaining capacity for school improvement. *Educ. Eval. Policy Anal.* **2003**, *25*, 375–395.
39. Reynolds, D.; Teddlie, C. *The International Handbook of School Effectiveness Research*; Informa UK Limited: London, UK, 2002.
40. Dembosky, J.W.; Pane, J.F.; Barney, H.; Christina, R. *Data Driven Decision Making in Southwestern Pennsylvania School Districts*; WR-326-HE/GF; RAND: Santa Monica, CA, USA, 2005.
41. Mortimore, P.; Sammons, P.; Stoll, L.; Lewis, D.; Ecob, R. *School Matters: The Junior Years*; Open Books: London, UK, 1988.
42. Jackson, D.; Temperley, J. From professional learning community to networked learning community. In *Professional Learning Communities: Divergence, Depth and Dilemmas*; Stoll, L., Louis, K.S., Eds.; McGraw-Hill: New York, NY, USA, 2007; pp. 45–62.
43. Hoy, W.K.; Miskel, C.G. *Educational Administration: Theory, Research, and Practice*, 9th ed.; McGraw-Hill: New York, NY, USA, 2012.
44. Resnick, L.B. Nested learning systems for the thinking curriculum. *Educ. Res.* **2010**, *39*, 183–197.
45. Kippers, W.; Wolterinck, C.H.; Schildkamp, K.; Poortman, C.L.; Visscher, A.J. Teachers' views on the use of assessment for learning and data-based decision making in classroom practice. *Teach. Teach. Educ.* **2018**, *75*, 199–213.
46. Stecher, B.; Hamilton, L.; Gonzalez, G. *Working Smarter to Leave No Child behind*; WP-138-EDU; Rand: Arlington, VA, USA, 2003.
47. Walsham, G. Interpretive case studies in IS research: Nature and method. *Eur. J. Inf. Syst.* **1995**, *4*, 74–81.
48. Walsham, G. Doing interpretive research. *Eur. J. Inf. Syst.* **2006**, *15*, 320–330.
49. Yin, R.K. *Case Study Research: Design and Methods*, 3rd ed.; Sage: Thousand Oaks, CA, USA, 2003.
50. Lijphart, A. Comparative Politics and the Comparative Method. *Am. Political Sci. Rev.* **1971**, *65*, 682–693. [CrossRef]
51. Webster, J.; Watson, R.T. Analyzing the past to prepare for the future: Writing a literature review. *MIS Q.* **2002**, *26*, 13–23.
52. Coburn, C.E.; Stein, M.K. Communities of practice theory and the role of teacher professional community in policy implementation. In *Complexity and Policy Implementation*; Honig, M.I., Ed.; SUNY Press: Albany, NY, USA, 2006; pp. 25–46.
53. Fullan, M. *The New Meaning of Educational Change*, 4th ed.; Teachers College Press: New York, NY, USA, 2007.
54. Park, S.J.; Hong, H.I. Analysis of the use of publicly disclosed school information in media. *Korean J. Educ. Adm.* **2015**, *33*, 369–391. (In Korean)
55. Oh, S.H.; Choi, S.D. Searching for rational ways of finding an education information disclosure system in elementary and secondary schools. *Korean J. Local Gov. Stud.* **2008**, *12*, 229–248. (In Korean)
56. Vanlommel, K.; Vanhoof, J.; Van Petegem, P. Data use by teachers: The impact of motivation, decision-making style, supportive relationships and reflective capacity. *Educ. Stud.* **2016**, *42*, 1–18. [CrossRef]
57. Lee, J.K. The design and evaluation of U.S. school accountability policy. In Proceedings of the Symposium Conducted at the Meeting of KEDI-KAERA, Seoul, Korea, 23 June 2010; pp. 75–101.
58. Sutherland, D.; Joumard, I.; Nicq, C.; Price, R.W.R. *Performance Indicators for Public Spending Efficiency in Primary and Secondary Education*; Organisation for Economic Co-Operation and Development (OECD): Paris, France, 2007.
59. Park, J.J. A theoretical study on the measurement scale of education information disclosure system service. *CNU J. Educ. Stud.* **2013**, *34*, 43–63. (In Korean)
60. Data Quality Campaign. Creating a Longitudinal Data System: Using Data to Improve Student Achievement. 2006. Available online: http://www.dataqualitycampaign.org/ (accessed on 18 March 2010).
61. Amrein-Beardsley, A.; Berliner, D.C. Re-analysis of NAEP Math and Reading Scores in States with and without High-stakes Tests: Response to Rosenshine. *Educ. Policy Anal. Arch.* **2003**, *11*. [CrossRef]

62. Nichols, S.L.; Glass, G.V.; Berliner, D.C. High-stakes testing and student achievement: Does accountability pressure increase student learning? *Educ. Policy Anal. Arch.* **2006**, *14*. [CrossRef]
63. Vasquez Heilig, J.; Darling-Hammond, L. Accountability Texas-Style: The Progress and Learning of Urban Minority Students in a High-Stakes Testing Context. *Educ. Eval. Policy Anal.* **2008**, *30*, 75–110.
64. Choi, M.Y. "Can't Trust the National-Level Standardized Test Result": The Controversy Concerning the Reliability Was Amplified. The Kyounghyang Sinmun. Available online: http://news.khan.co.kr/ (accessed on 17 February 2009). (In Korean).
65. Lee, K.H. A review on the school information disclosure system. *J. Politics Educ.* **2010**, *17*, 89–110.
66. Wayman, J.C. Involving teachers in data-driven decision making: Using computer data systems to support teacher inquiry and reflection. *J. Educ. Stud. Placed Risk (JESPAR)* **2005**, *10*, 295–308. [CrossRef]
67. OECD. *Creating Effective Teaching and Learning Environments*; Organisation for Economic Co-Operation and Development (OECD): Paris, France, 2009.
68. Lee, S.Y. Study of the Relationship between teachers' team learning and learning organization of school. *J. Educ. Adm.* **2007**, *25*, 95–115. (In Korean)
69. Bolman, L.G.; Deal, T.E. *Reframing Organizations: Artistry, Choice, and Leadership*, 4th ed.; Jossey-Bass: San Francisco, CA, USA, 2008.
70. Spillane, J.P. *Distributed Leadership*; Jossey-Bass: San Francisco, CA, USA, 2006.
71. Hord, S.M. Professional learning communities: Educators work together toward a shared purpose—Improved student learning. *J. Staff Develop.* **2009**, *30*, 40–43.
72. Muijs, D.; Harris, A. Teacher leadership-Improvement through empowerment? An overview of the literature. *Educ. Manag. Adm.* **2003**, *31*, 437–448.
73. OECD. TALIS 2013 Results: An International Perspective on Teaching and Learning. Available online: https://www.oecd-ilibrary.org/. (accessed on 24 February 2019).
74. Ikemoto, G.S.; Marsh, J.A. Chapter 5 Cutting through the "Data-driven" mantra: Different conceptions of data-driven decision making. *Yearb. Natl. Soc. Study Educ.* **2007**, *106*, 105–131.
75. Hargreaves, A.; Fink, D. Distributed Leadership: Democracy or Delivery? In *Distributed Leadership*; Harris, A., Ed.; Springer Science and Business Media B.V.: Dordrecht, The Netherlands, 2009; Volume 7, pp. 181–193.
76. Opfer, V.D.; Henry, G.T.; Mashburn, A.J. The district effect: Systemic responses to high stakes accountability policies in six southern states. *Am. J. Educ.* **2008**, *114*, 299–332.
77. Chung, M.K.; Joo, Y.H.; Chung, P. A study of policy strategies and directions for reducing the burden of teachers in administrative affairs. *J. Korean Teach. Educ.* **2013**, *30*, 377–404. (In Korean)
78. The Korean Federation of Teachers' Associations. *Many Teachers Neglect of Their Duties to Deal with an Official Document*; The Korean Federation of Teachers' Associations: Seoul, Korea, 2009. (In Korean)
79. The Korean Teachers & Educational Workers' Union. *Analysis of Job Status and Opinion Survey for Teacher Tasks*; KTU: Seoul, Korea, 2013. (In Korean)
80. Jensen, B. *Findings from TALIS and its Implication for South Korea. 2009 Korea-OECD International Seminar: New Millennium Learners and Teachers*; KEDI: Seoul, Korea, 2009; pp. 231–248.
81. Hevner, A.R.; March, S.T.; Ram, J.P. Design science in information systems research. *MIS Q.* **2004**, *28*, 75.
82. Moody, L.; Dede, C. Models of data-based decision making: A case study of the Milwaukee public schools. In *Data-Driven School Improvement: Linking Data and Learning*; Mandinach, E.B., Honey, M., Eds.; Teachers College, Columbia University: New York, NY, USA, 2008; pp. 233–254.
83. Loeb, H.; Knapp, M.S.; Elfers, A.M. Teachers' response to standards-based reform: Probing reform assumptions in Washington State. *Educ. Policy Anal. Arch.* **2008**, *16*, 1–32.
84. Scott, W.R. *Institutions and Organizations*; Sage Publications: Thousand Oaks, CA, USA, 1995.