

ORIGINAL RESEARCH ARTICLE

Examining school leaders' perceptions of school readiness for data-driven leadership in the UAE: A mixed-methods approach

Mahmoud Hamash^{1,*}, Hanan Ghreir², Hasnah Mohamed¹

¹ Faculty of Education, Universiti Teknologi, Johor Bahru 81310, Malaysia

² Faculty School of Educational Studies, University Sains Malaysia, Pulau Pinang, Malaysia

* Corresponding author: Mahmoud Hamash, dr.m.hamash@gmail.com

ABSTRACT

A growing demand for data-driven leadership (DDL) has emerged in the United Arab Emirates (UAE). Despite the use of implementation frameworks to guide DDL implementation, there is a lack of application of this concept in the context of UAE schools. This study aims to evaluate the readiness of public schools in the Western region, specifically cycle two and three, for DDL implementation. Using an exploratory sequential mixed-methods design based on the active implementation framework (AIF) drivers, the researcher conducted a qualitative scoping review of sixty-three literature sources and a quantitative survey of sixteen school principals from nineteen schools, selected through simple random sampling. Descriptive analysis and thematic analysis were performed to analyze the collected data. Findings suggest that organizational drivers receive greater emphasis in DDL readiness compared to competency drivers among school principals. However, the overall readiness for DDL remains uncertain, with ratings for this driver falling between the highest and middle-scoring categories. The school principals have identified competency, organizational, and technical leadership as essential drivers for successful DDL implementation in their schools. Further research is recommended to examine the role of adaptive leadership in DDL implementation. Overall, this study offers valuable insights into DDL implementation in Western region public schools and underscores the significance of AIF drivers in achieving successful DDL implementation.

Keywords: data-driven leadership; educational leadership; educational technology; active implementation framework (AIF); implementation science

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1. Introduction

Data-driven leadership in education has become increasingly crucial in recent years. Mandinach^[1] emphasizes the significance of Data-Driven Leadership (DDL) in education, highlighting the need for educators and leaders to utilize data to inform their decision-making processes. This underscores the importance of leveraging data to enhance educational practices and policies. Furthermore, the work underscores the relevance of recent data-driven approaches in education, aligning with the need for up-to-date statistics to support data-driven leadership in the educational context. to effectively address these challenges reforms regarding DDL recognize the significance of utilizing data to advance schools and student achievement, establish accountability, and evaluate school safety and student progress. The ability of a school system to acquire, analyze, disseminate, and apply data is critical for the success of each student^[2]. As a result, educational leaders have begun implementing data to direct and support efforts for school improvement, resulting in

a global demand for insights and data. School leaders in the United Arab Emirates have long been collecting and using data to inform their practices. Through evaluating student performance, tracking assignments, and scores and standardized testing. Thus, gaining a deeper understanding of the main implementation drivers that can improve DDL in public schools and the current school readiness level for DDL in UAE public schools will positively affect the education system.

According to Uding^[3], DLL integrates leadership, change-management, and data analytics in a successive advancement atmosphere. Essentially, it is a data-based organizational-competency that enhances communication between procedures, assessments, results, and learning. School leaders can comprehensively view student progress, pitfalls, and performance. As a result of this visibility, teachers and leaders can make knowledgeable judgments about interventions that will enhance learning. An article by Koltay^[4] highlights the importance of DDL in bringing data literacy to organizations. As per Koltay, it is nearly impossible to improve any establishment's data literacy without a leader capable of understanding data and using it in decision-making. In this research, DDL is defined as the leadership model focusing on creating a data-driven school culture that utilizes metrics such as learning, behavior, and engagement to reveal patterns in student learning, facilitates professional growth, and instructional improvement, and empowers student success.

The schools' leadership data-driven implementation drivers in the literature are crucial to guide all necessary efforts to implement DDL^[5]. Although school leaders, education authorities, and researchers recognise the need to support school principals on how to analyze and benefit from data, there is little theoretically proper research on DDDM and DDL to support them^[6]. Undoubtedly, data-driven campaigns pushed for the inclusion of DDL practices. Even with all this, educational organizations aren't always integrating DDL^[7]. Building on the available literature this research will develop an understanding of how school leaders rate their schools' readiness for DDL in Western region cycle 2 and 3 public schools.

2. Literature review

Abu Dhabi has recently made significant changes in its education system. One of these changes is the introduction of DDL. The demand for external accountability has pushed educational leaders to develop data-driven practices that can benefit teaching and learning^[8]. This has led to the implementation of data-driven procedures across schools, resulting in a consistent approach to data usage. While many researchers have focused on the importance and effects of DDL, others have examined the requirements and capabilities necessary for its achievement. A study conducted by Litz et al.^[9] suggests that schools in Abu Dhabi must enhance their capacity and upgrade their operations to keep up with the evolving demands of dynamic learning and DDL. Furthermore, Alzuhair^[10] highlights the lack of research on DDL practices in schools in the UAE and proposes the need for additional research to gain a deeper understanding. It is important to acknowledge that there are different aspects involved in establishing DDL practices in schools. As such, it is crucial to evaluate a school's readiness to implement DDL, as the process cannot begin without first assessing the school's current readiness. An increasing amount of literature appeared in the last twenty years regarding implementation science^[5]. However, a scoping review of 8541 publications from different databases which were presented by Albers et al.^[11] showed that small proof is seen in student programs to advise the deployment of implementation frameworks. Alzuhair^[10] conducted a study utilizing the grounded theory methodological approach and qualitative interviews with school leaders to gain insight into the education system in the UAE. The researcher explains that this approach was chosen due to the lack of research on DDL implementation in schools in the UAE, requiring a more comprehensive examination.

Implementation science emerged as a distinct field in the early 2000s, building on the foundation of knowledge transfer (KT). Implementation science is a more rigorous and systematic approach to understanding and addressing the factors that influence the implementation of evidence-based practice^[12]. Malecki^[13] stated that the field of implementation science focuses primarily on the systematic translation and integration of

innovations, research, and evidence into standard procedures. During the last twenty years, a plentitude of frameworks has developed to direct the examination of implementation. Furthermore, as educational researchers often encounter limited access to research-backed implementations, they advocate the science of implementation as a tool for transmitting theory to practice^[14,15]. Due to the complexity of this quest, numerous theoretical frameworks have been developed over time to guide and enhance research^[16-18]. To study factors influencing the adoption of evidence-based approaches, the active-implementation-framework (AIF) was developed by the National Implementation Research Network (NIRN)^[19]. The significance of employing implementation frameworks to comprehend the prosperous execution of DDL has evolved increasingly in education. Albers et al.^[11] scoping review of the literature determined thirty-three sources that involved eight implementation-frameworks. The AIF-drivers were the most typically used of these frameworks. Within these studies, nine evaluated the application and evaluation of AIF-drivers in student programs. Nilsen^[17] suggested that, to achieve the best implementation results, it is important to narrow down the choice of implementation frameworks before making a decision. He suggested the AIF as a rational approach for studying implementation. Drivers can be classified into the following three categories. The first is competency drivers^[20]. The second driver is organisational drivers^[15-21]. Thirdly, leadership-drivers^[21].

Barton^[5] developed and initially validated a new tool based on the AIF-drivers to measure program readiness for DDL following Goodwin's^[22] suggestions. The findings of this study demonstrate that constructing a tool from the nine AIF-drivers is viable for measuring data-use and DDL. This literature review enabled the researcher to gain a holistic understanding of how to measure school readiness for implementing DDL in Western region public schools.

3. Methods

For this research project, an exploratory sequential mixed methodology design was utilized. This approach, consisting of two phases as illustrated in **Figure 1**, is advantageous for researchers looking to develop research instruments^[23]. The use of this design was specifically chosen due to the limited literature available on data-driven educational leadership in the UAE. In the exploratory sequential methodology, data was collected in two consecutive phases. The first phase involved collecting and analyzing qualitative data, while the second phase focused on collecting and relating quantitative data to the findings from the first phase.

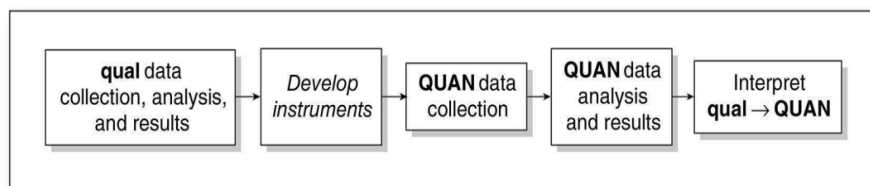


Figure 1. Exploratory sequential design^[23].

3.1. Research phase 01: The qualitative phase (scoping review procedure)

The first phase is a qualitative phase that follows the Scoping review method. The researcher used it to examine what is understood from the available literature about the implementation drivers that influence DDL. This scoping-review adhered to the steps outlined by the Joanna Briggs Institute^[24], the procedure of scoping review is explained in **Figure 2**.

The researcher developed a set of guidelines for selecting the literature to be included in the scoping-review, as illustrated in **Table 1**. Considering that qualitative research should aim to achieve saturation^[25].

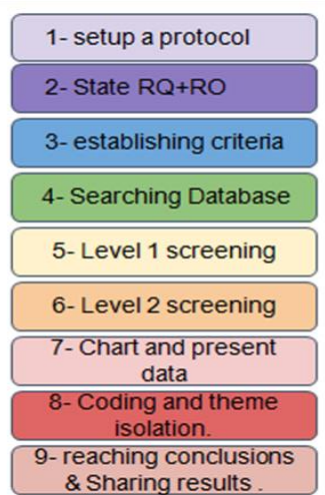


Figure 2. The procedures for conducting a Scoping-review^[24].

Table 1. Inclusion and exclusion criteria and the search string.

Number	Criteria	Range
1	Date of publication	2019–2022
2	Publication type	Books, published papers.
3	Subject	Data-driven leadership in education, data-driven decision-making, data-use, data-driven leadership in UAE schools.
4	Paper language	English, Arabic
5	Database	Google Scholar

The researcher used a spreadsheet to chart the information that contributed to answering the research questions. The collected data included detailed attributes concerning the principles, context, research procedures, and main findings applicable to the research objectives. These details were influenced by the (PRISMA-ScR) scoping review checklist^[24]. The researcher used the scoping review data extraction instrument which was used (JBI template source of evidence)^[24]. The qualitative-data from the scoping review was analyzed using Braun and Clark’s^[26] six-step thematic analysis method which is presented in **Figure 3**. The gathered data was categorized and coded into themes to facilitate analysis. The findings were then grouped into major categories, aligning with the implementation drivers for DDL and the evaluation of a school’s readiness to adopt DDL practices. Additionally, the factors that can enhance DDL implementation, both in general and specifically in the UAE, were identified. This was followed by a thematic analysis and the final stage of triangulation in this study.

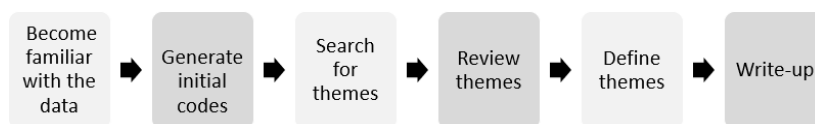


Figure 3. Braun and Clarke’s six-phase framework^[26].

The following **Table 2** presents the association between the data from the first phase and the research questions.

Table 2. Relationship between the research instrument in research phase 1 and results.

Research instrument	Research question	Results
Scoping review data	RQ	Determining the implement drivers for DDL. Determining the framework used to study how school principals rate their school readiness for DDL.

3.2. Research phase 02: The quantitative phase (questionnaire procedure)

The second phase is a quantitative phase that follows the questionnaire method. In the second phase of the study, the researcher utilized a quantitative approach with a simple random sampling technique. This involved randomly selecting a subgroup from a population with an equal probability for everyone^[27]. The study's population consisted of 17 school principals from cycle 2 and 3 public schools in the Western region of Abu Dhabi. A sample size of 16 school principals was chosen to achieve a margin of error of $\pm 5\%$ with a 95% confidence level, based on the Krejcie and Morgan^[28] formula and table. The results from the Western region can be generalized to the whole of Abu Dhabi schools as the Ministry of Education establishes the same quality and resources in all of the public schools regarding allocating resources and expertise and in the requirement process.

The research instrument that was used in the second quantitative phase is the SP-DDL questionnaire. Theories that were found in the first qualitative step were used as a reference because they provided relevant information on how to modify existing research questionnaires utilized by other researchers in the literature to implement the study. The researcher adapted a questionnaire (SP-DDL) based on the AIF framework from the DDDM-Q and EC-DDDM instruments used and verified in several research projects^[22,5,29-31]. Then the SP-DDL instrument was presented to a panel of five reviews. Panel members were chosen for this research due to their diverse knowledge backgrounds, which are relevant and complementary to the research subject. The panel provided their feedback on how to adjust it to be suitable for Western region public schools. In the next step, the researcher conducted a pilot study with five participants from school leadership teams in Western region. As a result, questions were reviewed, and amendments were made according to the participant's responses and recommendations. The SP-DDL questionnaire is made of three primary parts as presented in **Table 3**, the first part collects participants' demographic information, and the second part contains nine Likert scales, corresponding with the nine AIF-Drivers which are sub-component of three main construct levels (competency drivers, organization drivers, leadership-drivers). The items related to each factor were grouped in each scale. The statement was rated using a Likert-style scale with 5-points, with 1 indicating strongly-disagree, 2 indicating disagree, 3 indicating neither agree nor disagree, 4 indicating agree, and 5 indicating strongly-agree. The questionnaire constructs are explained in **Table 4**.

Table 3. SP-DDL questionnaire construct.

Construct-level model (3 factors)	Subcomponent driver level model (9 factors)	Number of items
Competency. drivers	Selection	5
	Training	7
	Coaching	6
	Performance-assessment	4
Organization drivers	Systems-intervention	6
	Facilitative-administration	8
	Decision-support data-systems	7
Leadership drivers	Technical	6
	Adaptive	5

Table 4. School principal questionnaire variables, survey items, and descriptive statistics ($N = 16$).

Survey item	N	M	SD	Strongly-agree n(%)	Agree n(%)	Neither agree nor disagree n(%)	Disagree n(%)	Strongly- disagree n(%)	
Staff selection & hiring	1	16	4.19	0.655	5(31.25)	9(56.25)	2(12.5)	0(0)	0(0)
	2	16	4.13	0.619	4(25)	10(62.5)	2(12.5)	0(0)	0(0)
	3	16	3.69	1.014	3(18.8)	8(50)	2(12.5)	3(18.8)	0(0)
	4	16	4.00	0.730	4(25)	8(50)	4(25)	0(0)	0(0)
	5	16	4.06	0.680	4(25)	9(56.3)	3(18.8)	0(0)	0(0)
Training	1	16	4.38	0.500	6(37.5)	10(62.5)	0(0)	0(0)	0(0)
	2	16	4.13	0.806	5(31.3)	9(56.3)	1(6.3)	1(6.3)	0(0)
	3	16	4.19	0.544	4(25)	11(68.8)	1(6.3)	0(0)	0(0)
	4	16	4.19	0.655	5(31.3)	9(56.3)	2(12.5)	0(0)	0(0)
	5	16	4.25	0.447	4(25)	12(75)	0(0)	0(0)	0(0)
	6	16	4.25	0.447	4(25)	12(75)	0(0)	0(0)	0(0)
	7	16	4.31	0.479	5(31.3)	11(68.8)	0(0)	0(0)	0(0)
Coaching & supervision	1	16	4.13	0.619	4(25)	10(62.5)	2(12.5)	0(0)	0(0)
	2	16	4.25	0.577	5(31.3)	10(62.5)	1(6.3)	0(0)	0(0)
	3	16	4.19	0.750	6(37.5)	7(43.8)	3(18.8)	0(0)	0(0)
	4	16	4.00	0.730	3(18.8)	11(68.8)	1(6.3)	1(6.3)	0(0)
	5	16	4.19	0.544	4(25)	11(68.8)	1(6.3)	0(0)	0(0)
	6	16	4.19	0.544	4(25)	11(68.8)	1(6.3)	0(0)	0(0)
Performance assessment & performance evaluation	1	16	4.13	0.806	5(31.3)	9(56.3)	1(6.3)	1(6.3)	0(0)
	2	16	4.19	0.544	4(25)	11(68.8)	1(6.3)	0(0)	0(0)
	3	16	4.31	0.602	6(37.5)	9(56.3)	1(6.3)	0(0)	0(0)
	4	16	2.88	1.088	2(12.5)	2(12.5)	4(25)	8(50)	0(0)
System intervention	1	16	4.31	0.602	6(37.5)	9(56.3)	1(6.3)	0(0)	0(0)
	2	16	4.50	0.516	8(50)	8(50)	0(0)	0(0)	0(0)
	3	16	4.38	0.500	6(37.5)	10(62.5)	0(0)	0(0)	0(0)
	4	16	4.56	0.512	9(56.3)	7(43.8)	0(0)	0(0)	0(0)
	5	16	4.25	0.447	4(25)	12(75)	0(0)	0(0)	0(0)
	6	16	4.13	0.500	3(18.8)	12(75)	1(6.3)	0(0)	0(0)
Facilitative administration	1	16	4.06	0.854	5(31.3)	8(50)	2(12.5)	1(6.3)	0(0)
	2	16	4.50	0.632	9(56.3)	6(37.5)	1(6.3)	0(0)	0(0)
	3	16	4.19	1.047	8(50)	5(31.3)	1(6.3)	2(12.5)	0(0)
	4	16	4.31	0.873	8(50)	6(37.5)	1(6.3)	1(6.3)	0(0)
	5	16	4.63	0.500	10(62.5)	6(37.5)	0(0)	0(0)	0(0)
	6	16	4.50	0.632	9(56.3)	6(37.5)	1(6.3)	0(0)	0(0)
	7	16	4.75	0.447	12(75)	4(25)	0(0)	0(0)	0(0)
	8	16	4.25	0.856	7(43.8)	7(43.8)	1(6.3)	1(6.3)	0(0)

Table 4. (Continued).

Survey item	N	M	SD	Strongly-agree n(%)	Agree n(%)	Neither agree nor disagree n(%)	Disagree n(%)	Strongly- disagree n(%)
Decision support data system	1	16	4.38	0.500	6(37.5)	10(62.5)	0(0)	0(0)
	2	16	4.50	0.516	8(50)	8(50)	0(0)	0(0)
	3	16	2.94	0.929	0(0)	5(31.3)	6(37.5)	4(25)
	4	16	3.75	1.000	4(25)	6(37.5)	4(25)	2(12.5)
	5	16	3.94	0.772	3(18.8)	10(62.5)	2(12.5)	1(6.3)
	6	16	3.94	0.854	4(25)	8(50)	3(18.8)	1(6.3)
	7	16	4.25	0.577	5(31.3)	10(62.5)	1(6.3)	0(0)
Technical leadership	1	16	4.25	0.577	5(31.3)	10(62.5)	1(6.3)	0(0)
	2	16	4.00	0.816	4(25)	9(56.3)	2(12.5)	1(6.3)
	3	16	4.00	0.816	4(25)	9(56.3)	2(12.5)	1(6.3)
	4	16	4.25	0.577	5(31.3)	10(62.5)	1(6.3)	0(0)
	5	16	4.25	0.577	5(31.3)	10(62.5)	1(6.3)	0(0)
	6	16	4.25	0.577	5(31.3)	10(62.5)	1(6.3)	0(0)
Adaptive leadership	1	16	4.31	0.479	5(31.3)	11(68.8)	0(0)	0(0)
	2	16	4.19	0.655	5(31.3)	9(56.3)	2(12.5)	0(0)
	3	16	4.31	0.602	6(37.5)	9(56.3)	1(6.3)	0(0)
	4	16	4.25	0.577	5(31.3)	10(62.5)	1(6.3)	0(0)
	5	16	4.13	0.619	4(25)	10(62.5)	2(12.5)	0(0)

*Note: Items selection 3, perf-assess 4, and decision-support 3 were reversed scored.

The researcher collected quantitative data from the school leader questionnaire using a Google-form with Likert scales. Preparing the data for analysis on SPSS software, the researcher converted respondents' answers from words like (strongly agree) into numbers like (5). After preparing the data for import into IBM SPSS, the researcher extracted the data from the original file based on the research questions and the scale used. This step was necessary to ensure the accuracy and validity of the data for the data analysis step. The researcher employed descriptive analytics to answer the RQ concerning how school leaders in Western region cycle 2 and 3 public schools rate their school's readiness for DDL. The frequency means and standard deviations for each item were calculated using SPSS version 27.

3.3. Pilot study

The researcher conducted a pilot study with a sample of five SLTs. These SLTs present a representative sample as they are all school leaders who are working in UAE public schools. The pilot study was conducted using Google Forms, as the means to share and fill the questionnaire with the SLT, the researcher observed directly five of the SLTs as they filled out the questionnaire using Google Meet video call and he noted down all their notes and the obstacles they faced as they answered the questionnaire, and also, his observations. Moreover, participants were asked to write their notes on the questionnaire using a form that was shared with them. The internal consistency of the questionnaire was analyzed by the researcher through the calculation of Cronbach's alpha for both nine and three models. For the nine-factor. model, seven of the nine factors surpassed Nunnally^[32] suggested tolerated level of α 0.7 and higher. The other two factors, (staff-selection.) and (performance-assessment.), dropped barely under this level ($\alpha = 0.68$, and $\alpha = 0.69$). For the three-factor model, the three factors confirmed high internal-consistency with Cronbach-Alpha values varying between 0.831 to 0.92. The Cronbach-Alpha (α) for the totality of the questionnaire is 0.976, which shows an excellent internal-consistency established by Konting et al.^[33].

4. Data analysis

The scoped sources showed that the implementation of change needs to follow implementation frameworks^[13], moreover, the sources indicated that the active implementation framework (AIF) is one of the most suitable and frequently used implementation frameworks for DDL in education^[5,11,13,29,34–37]. The researcher argues that the scoped sources also show that the main implementation drivers presented in the sources are aligned with the nine AIF framework^[34–35,38–41]. Thus, the researcher reduced the initial themes that were produced by scoping the 63 sources into three main categories that are aligned with the three main competencies from the AIF-framework. Thus, the researcher utilized the AIF framework and its nine implementation drivers and research instruments related to it^[5,11,29] during the second-phase of the research, which is the quantitative-phase.

The analysis of school principal responses to 54-items on the school principal questionnaire (SP-DDL) was measured on a 5-point Likert. Scale from 1 to 5 (strongly-disagree to strongly-agree). In order to ensure higher scores indicate a higher use of data, three items were reverse-scored. The three items were selection 3, performance-assessment 4, and decision-support 5. The researcher executed descriptive-analyses in SPSS. For each item in **Table 4**, descriptive statistics are provided, including the number of participants, means, SD, and frequencies.

Participants responded to the 54 individual SP-DDL questionnaire items, the range of responses traversing 1.0 to 5.0. Overall, descriptive-statistics showed principal agreement as 52 of the 54 items had mean scores of 3.5 or higher. As the lowest-scoring item, “The school principal exercises their judgment when assessing the performance of each staff member.” ($M = 2.88$, $SD = 1.088$), while the highest mean score is “Our school will improve if we continuously review school data” ($M = 4.75$, $SD = 0.447$). This implies that the majority of participants showed small, medium, or high-agreement with the items, indicating a belief that DDL can improve the quality of education in a school.

5. Results

The SP-DDL questionnaire was used to assess respondents’ perceptions of the nine drivers in their schools. For each of the nine AIF subscales of the questionnaire, two index scores were calculated; The overall index score was determined by adding the scores of the items within each subscale. To allow for standardized comparisons and analyses across subscales, the index score was divided by the number of items in each subscale. On a five-point scale, the lowest possible mean-per-item index score is 1.0, while the highest possible is 5.0. A mean of 3.5 was achieved in all subscales, which indicates overall agreement among respondents. Adaptive leadership scored the highest ($M = 4.24$, $SD = 0.586$), while staff selection scored the lowest ($M = 4.01$, $SD = 0.74$). According to the subscale scores presented in **Table 5.**, respondents generally agreed that the schools were generally successful in terms of the nine drivers, with all subscales above 3.5.

Table 5. Summative and mean per item index score.

Subscale	N	Mean summative index score	Std dev.	Mean per item index score	Std dev	Rank*
Staff & selection & hiring	16	20.06	3.699	4.01	0.740	7th
Training	16	29.69	3.878	4.14	0.640	5th
Coaching & supervision	16	24.94	3.765	4.14	0.636	5th
Performance assessment & performance evaluation	16	15.50	3.040	4.10	0.656	6th
Systems intervention	16	26.13	3.078	4.15	0.629	4th
Facilitative administration	16	35.19	5.842	4.20	0.649	2nd
Decision support data system	16	27.69	5.148	4.16	0.661	3rd

Table 5. (Continued).

Subscale	N	Mean summative index score	Std dev.	Mean per item index score	Std dev	Rank*
Technical leadership	16	25.00	3.942	4.16	0.661	3rd
Adaptive leadership	16	21.19	2.932	4.24	0.586	1st

*Note: Rankings are based on the highest to lowest.

The researcher examined the internal-consistency of the research tool by computing Cronbach-Alpha (α) for the nine and three-factor models as demonstrated in **Table 6**. Seven of the nine factors in Nunnally's^[32] model exceeded his threshold for a satisfactory level (notice **Figure 4**). The remaining factor, (staff-selection), and (performance-assessment) dropped barely under the threshold ($\alpha = 0.678$, and $\alpha = 0.660$).

Table 6. Cronbach-Alpha (α) for the nine and three-factor.

9 Factor Model	Number of Items	Cronbach's Alpha (α)
Competency Drivers		
Selection and Hiring	5	0.678
Training	7	0.903
Coaching & Supervision	6	0.909
Performance Assessment and performance evaluation	4	0.660
Organization Drivers		
System Intervention	6	0.901
Facilitative Administration	8	0.927
Decision Support Data System	7	0.801
Leadership Drivers		
Technical Leadership	6	0.939
Adaptive Leadership	5	0.938
3 factor Model		
Competency Drivers	22	0.931
Organization Drivers	21	0.938
Leadership Drivers	11	0.962

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

Figure 4. Cronbach's Alpha Values(α)^[33].

6. Discussions

Generally, school principals agree that DDL is important to their schools, according to SP-DDL survey results. On average, respondents agreed with 52 out of 54 items. This indicates that school principals see the value in leveraging data to support DDL in their schools. As for the other two items, answers show moderately neutral replies as they were 2.88 and 2.99 and based on the weighted means, they are in the range of wight between (2.61–3.40) which indicates (neither agree nor disagree). The SP-DDL questionnaire indicates that

school leaders largely agree with data use and the underlying competencies, organizational structures, and leadership concepts. Certainly, these topics are not foreign to school principals. This suggests that they may be transitioning from the pre-contemplative phase of change^[42] and are open to DDL. Understanding school readiness for DDL and further exploring its implications may require connecting these findings to change theories. This is further related to the theme (leadership style and change model) which was derived from the research phase 01.

The researcher presented two notable findings regarding the highest-ranking subscales. In the organizational construct of the AIF-Drivers framework, the adaptive-leadership scale and facilitative-administration scale scored the highest. This finding may reflect the stress principals experience when documenting school success, suggesting that leaders understand the need to demonstrate accountability, ongoing quality-improvement, and effect^[43]. Additionally, the subscales with the lowest scores were related to performance assessment, staff selection, coaching, and training, all of which are competency-based. This suggests that school leaders may not view these processes as strongly connected to data-driven practices, providing opportunities for further integration of data into these processes. On the other hand, the middle-ranking subscales consistently related to the leadership construct. The decision-support data-system and technical-leadership subscales occupied the third place, indicating that school principals may prioritize the management functions of DDL over its transformational leadership aspects. This finding is in line with the conclusions of Guerrero et al.^[44].

This research did not explain why school principals focused on DDL in their facilitative-administration and adaptive-leadership roles more than in their technical-leadership roles. It is possible that the principals perceived the facilitative and adaptive roles as being more conducive to the effective implementation of DDL. Alternatively, the technical roles may have been perceived as requiring more traditional leadership approaches, thus making DDL less of a priority. The higher ratings of systems-intervention, administrative-facilitation, and decision support systems subscales may be due to participants being familiar with the responsibilities of school principals and recognizing their correlation with DDL. On the other hand, the lower responses on the technical-items could be a consequence of participants not having sufficient experience with DDL or associating it with the duties of top executives. As implementation frameworks stress the significance of substantial leadership to ensure successful change^[45], more research is needed to identify the rules of leadership in the context of education and DDL measures. Furthermore, in the organization-construct subscales, the decision-support data-systems subscale ranked third, putting it in the middle rank, while the other subscales ranked highest. The research also raises questions about why school principals prioritize certain leadership roles over others in the context of DDL, indicating a need for further investigation into the rules of leadership in education and DDL measures. This aligns with the recommendation for future research to explore the implications of leadership in the context of education and DDL measures. In conclusion, the findings suggest that while school principals recognize the value of DDL, there are opportunities for further integration of data into various processes, and a need for deeper exploration of the implications of leadership in the context of DDL. This calls for future research to address these gaps and provide evidence-based recommendations for policy and practice in DDL in schools.

7. Conclusion

Adopting data to indicate learning efficacy, designate cues of responsibility, and execute evidence based interventions are increasingly demanded in educational systems^[46]. While there is a wealth of literature to suggest that the utilization of DDL in schools can support change^[47], the use of data in schools for advising practice is still in its infancy^[46]. In particular, schools are required to utilize data to facilitate DDL, yet there is limited research as to the most effective ways to utilize data and the ability to gather and analyse data in practices that reinforce DDL, both globally^[48], and in the UAE context^[49]. The definition of DDL is more than

the type of data collected, the way it is stored, or the method of analysis, the process involves a detailed understanding of the interactions between staff competence, organizational structure, and leadership dynamics inside a school^[43].

This research aspired to expand comprehension regarding DDL and revealed evidence through scoping resources based on a set of criteria to make sense of this complexity. These efforts resulted in identifying the AIF and its drivers as a suitable framework for understanding DDL in schools and using associated research instruments to study how school principals in Western region public cycle 2 and 3 public schools rate their school readiness for implementing DDL. According to the study's findings, an instrument based on nine different AIF Drivers may provide an initial framework to understand how DDL is implemented in schools. The findings are particularly noteworthy in light of existing theory and practical literature and recent calls for more rigorous measurement. Using the three model drivers of the AIF, school principals rated their school readiness. In the group that scored the highest, organizational-drivers related to systems-intervention, decision-support data-systems, and facilitative-administration were prevailing, suggesting that principals essentially comprehend the significance of data. The group with the lowest score was mainly competency-driver items. This finding indicates that in both hiring, training processes, coaching, and performance-assessment, there is a lower preparedness for DDL. Additionally, some leadership drivers were rated between middle and upper levels contributing to ambiguous readiness for DDL at the leadership level. Overall, this classification also confirms that school's function within multifaceted and multilevel^[50]. The researcher concludes that the findings of this research will support school principals, and other educational leaders to implement DDL in their schools and allow them to understand how their needs relate to DDL readiness, as they encounter increasing necessity to use data to reinforce DDL and thriving implementations. In addition, the tool will provide researchers with a research-based tool for studying DDL in schools.

8. Limitations and future studies

Considering these promising findings and discussions, the study encountered general limitations. These limitations can be categorized into different contexts. First and foremost, it is a prevalent study with no proof of SP-DDL's effectiveness over time. This study can't determine how DDL readiness varies over time or how implementation drivers change during the implementation duration, The implementation process can be lengthy in some cases^[20,51]. The use of SP-DDL questionnaires multiple times could support test-retest reliability and aid in recognizing patterns in these tendencies. Moreover, this study is restricted in two ways. Firstly, the data collected in this research was obtained through self-report surveys, which may be subject to bias due to respondents' perceptions, attitudes, and beliefs toward DDL. Secondly, the sample size was decided to be sufficient, though it was limited to school principals in Western region public schools. The researcher argues that this research would benefit from recruiting study participants on a national basis to gain a greater understanding of school data practices, as well as at different levels of the school leadership hierarchy such as school vice principals, academic principals and heads of departments, teachers, administrative-leadership, and students guardians. This could help to provide a more comprehensive and diverse view of data practices in the UAE public schools.

Secondly, this study used an exploratory sequential design, despite its necessity, this design resulted in limited commentary on the reasons for these results. School principals' responses to the SP-DDL questionnaire should be combined with qualitative data from interviews and other resources to understand why they rated certain factors or items more strongly than others. This will help researchers understand why respondents rated items differently and how scores on different factors are related. Thirdly, the researcher chose a small panel to review the final instrument due to some limitations of time and availability. Similar studies should be guided by these considerations in recruiting various panel members, involving them in subsequent instrument development iterations, and ensuring panelists are compensated. Fourthly, while the internal structure of the

SP-DDL questionnaire may provide important evidence regarding its validity, caution must be taken when relying solely on this type of evidence^[22]. This research offers preliminary evidence supporting the validity of the SP-DDL questionnaire and suggests that the AIF-Drivers can be used to measure school readiness. However, there are still many unanswered questions that need to be explored. More research is needed to understand the different roles of school leaders in DDL and to include more leadership roles from the SLT teams in school such as VP, AVP, etc. One recommendation for future research is to further explore the impact of DDL on student outcomes. This could be done through a comparative study that looks at student performance and learning outcomes in schools that have implemented DDL versus those that have not. Further research could also investigate the factors that influence the successful implementation of DDL in schools. In addition, further research should be conducted to investigate the strategies for successful DDL implementation. This could include exploring the strategies for engaging teachers and other staff in DDL, as well as the role of data coaches and data champions. Further research could also look at the impact of DDL on teacher motivation and job satisfaction. In addition, the research could investigate the role of data use and DDL in improving school culture and climate. Further research is needed to gain a deeper appreciation of DDL's role in education.

Author contributions

Conceptualization, MH and HG; methodology, MH; validation, MH, HM and HG; formal analysis, MH; investigation, M.H and HG; data curation, MH; writing—original draft preparation, MH; writing—review and editing, MH and HG; visualization, MH; supervision, H.M; project administration, MH. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declare no conflict of interest.

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