Teachers' Perceptions on Instructional Leadership: Drawing Implications for Professional Development Program for Instructional Leaders

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Abstract—Instructional leadership is an essential component of any educational institution. The skills and competencies of instructional leaders are very important to deliver quality education and school improvement. The main purpose of this study was to examine the teachers' perceptions on instructional leadership in a private school in basic education in the Philippines. The Instructional Leadership Questionnaire by Al-Omari was adapted to determine the perceptions of faculty on effective use of resources, communication skills, serving as instructional resource, and being visible and accessible. A total of 104 respondents voluntarily participated. Results show that respondents have positive perception on all four components of instructional leadership which can be surmised that instructional leaders should be able to demonstrate skills and competencies on effective use of resources, clear communication, serve as instructional resource, and being visible and accessible. Further research is recommended to determine the effect of these components to the actual teaching and learning implementation in the school.

Keywords—instructional leadership, communication skills, instructional leaders, resources, school

I. INTRODUCTION

Instructional leadership is an essential component of any educational institution. It is generally defined as the management of curriculum and instruction by a school principal. This important role extends beyond the scope of the school principal to involve other academic leaders [1]. Research shows that instructional leadership has a direct influence on students' achievement [2–4]. Instructional leaders with high-quality instructional leadership would influence the development of students' learning achievement [5, 6]. Hence, they are extensively involved in curricular and instructional issues that directly affect student achievement. Instructional leadership includes the development of the teaching profession in the whole school [7–9].

It is also defined as the efforts to create the necessary working environment which is satisfying and productive in order to provide the conditions for teachers to develop themselves as well as their ability to train students [10–12]. However, leadership practice is not simply a function of an individual leader's ability, skill, charisma, and cognition. While individual leaders and their attributes do matter in constituting leadership practice, they are not absolute. Other school leaders and members of the institution also matter in that they help define leading practice. Further, the situation surrounding leaders' practice-resources, tools, language among others-is also a constituting element of that practice and not simply an appendage. Leadership practice emerges in and through the interaction of leaders, followers, and situations. Attending to situation as something more than a container for leaders' practice. It is argued that sociocultural context is a constitutive element of leadership practice, fundamentally shaping its form. Leadership practice is constituted in the interaction of leaders and their social and material situations [1].

A. Effective Use of Resources

The administration of a school institution has the responsibility for bringing together various resources and allocating them effectively to accomplish the general goals of the institution [13]. All schools have an obligation to prepare its citizens for life in a world that is characterized by rapid social, economic, political, and technological changes. The idea that human and material resources are to be assembled by educational administration within the school system for effective teaching and learning cannot be over-emphasized [14]. It is supported on this ground that, in schools, the instructional leaders play the role of administrators, supervisors, and instructors. They should

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be made to realize their responsibilities of improving and developing instruction in the school system. This is possible through harnessing the available resources allocated to the schools to realize the goals of education. All materials and non-material factors that are necessary and contribute to the attainment of goals in any institution are regarded as resources [13]. The human aspect of resources interacts with facilities and equipment at certain times to bring about the production of output. The quality and quantity of this output are to a greater extent dependent on the quality and quantity of resource input and the manner of processing. By implication therefore input and output are significantly responsive to administration. Instructional leaders of any institutions have a role to play in ensuring effectiveness and efficiency within and outside the institution, not only in the procurement or acquisition of resources but also in their organization, coordination, control, and maintenance [13]. According to literature, strong instructional leader should be able to analyze and understand the resources that need to be managed such as planning, organizing, scheduling, and prioritizing work to be done, delegating work as appropriate and assigning faculty members according to their strengths. Materials appropriate for the curriculum are provided through skillful management of the instructional budget. Opportunities for new resources such as grants, workshops, and professional conferences are examined in terms of their value to the school's goals and priorities. Successful instructional leaders are good at acquiring needed Routine administrative tasks--discipline, materials. an orderly school climate, personnel providing management, facilities management, and budget are all a part of mobilizing resources. The effective instructional leaders should be able to blend and balance these elements through time management and clear communication [7, 13].

B. Communication Skills

Instructional leaders manage people, data, and processes. They are tasked with setting goals and motivating constituents to meet these goals. Therefore, skillful communication has been broadly accepted as an important leadership attribute across disciplines. Scholars have focused much attention on the study and practice of communication skills in fields, such as business, medicine, and social services [15–17]. Research identified the role of a communicator as the number one most important element of highly effective instructional leaders [18]. These leaders' impact is of significance due to the actions that they take to hire teachers, create school-wide conditions that support student learning, and directly influence teacher effectiveness [19]. As communicators, the instructional leaders articulate a vision of the school that heads everyone in the same direction. The leaders' day-to-day behavior communicates that she has a firm understanding of the purpose of schooling and can translate that meaning into programs and activities within the school. Effective communication must be displayed at three levels; one-to-one, small group, and large group to articulate the vision of the school to all stakeholders. The leaders use communication as the basis for developing sound relationships with staff through behavior that is consistent, objective, and fair. They communicate so that both the content and processes for communication are explicit. Communication processes are important. The leaders make a commitment to those processes in establishing school goals, together with the staff, parents, and students. Resources are committed to the goals, and evaluation systems are established. Frequent reference is made to goals, and classroom observations, in-service topics, and faculty meetings focus on those priorities.

C. Serving as Instructional Resource

Effective instructional leaders work relentlessly to improve achievement by focusing on the quality of instruction [20]. They help define and promote high expectations and they connect directly with teachers and the classroom. Effective instructional leaders also encourage continual professional learning. Thev emphasize research-based strategies to improve teaching and learning and initiate discussions about instructional approaches, both in teams and with individual teachers [21, 22] The instructional leaders are actively engaged in innovations for the improvement of classroom circumstances that enhance learning. They encouraged the use of a variety of instructional materials, technology integration and teaching strategies. Teachers are major players in the educational landscape. They are the facilitators of knowledge and skills development to ensure that their students become digitally literate and competent human capital. Thus, the integration of technology into education is a substantial issue for supporting and updating teachers' professional development in today's world [23]. With these, instructional leaders should be knowledgeable, and teachers can readily approach them for any instructional concerns or innovative ideas. The most important role of the leaders as instructional resource is to facilitate quality teaching. To do this, they must stay abreast of new developments in materials, technology integration, and strategies for improving instruction especially in this time of pandemic. They maintain a continuous development program that includes regular review of educational research, curriculum development, and new advances in understanding how children learn [24].

D. Being Visible and Accessible

Visibility is a key component for instructional leaders to monitor instruction relentlessly and develop a clear and well-defined curriculum. Leaders can ensure quality instruction, promote best practices, monitor the implementation of the curriculum, provide resources, and examine assessment data when they are visible in all areas of the school. Staying out of the office to see what's going on in the school is critical to being an instructional leader. By being out of the office, a leader will know on a firsthand basis what is happening inside and outside the classroom. The instructional leaders interact with faculty and students in classrooms and hallways, attend gradelevel and departmental meetings, and strike up spontaneous conversations with teachers. Their presence is felt in formal and informal observations of classroom teachers. The visible leaders constantly display behavior that reinforces school values. The visible presence of the leaders appears to be most keenly felt when they serve as rewarder, giving positive attention to faculty and student accomplishments. Setting up an award system that clearly "strokes" faculty and students for academic success is perhaps the most important aspect of creating an effective school. Acknowledging the achievements of others is a regular practice of instructional leaders [22]. Being positive, cheerful, and encouraging; making themselves accessible to the staff, making their presence felt often by moving around the building; doing things with teachers; and involving teachers and getting the staff to express and set their own goals are overlapping elements of positive school climates and effective, visible instructional leaders. In high-achieving schools, instructional leaders emphasize instruction as the most important goal. One indicator of consensus on commitment to the goals of academic achievement is reflected in the way they expect teachers to give their personal time. In the schools with higher achievement, teachers are willing to do this, but in those with lower achievement, teachers are not willing to give extra time unless they are paid for it. One way that instructional leaders can get greater teacher commitment is by being role models themselves. If they put in long hours, is fair-minded in dealing with student complaints, and attends student activities in the school and the community. a positive tone is set for both teachers and students. Teachers perceive their leaders to be a visible presence if they make frequent classroom observations, is accessible to discuss matters dealing with instruction, is regularly seen in and about the building, and actively participates in staff development activities [25-28].

In the context of institution where this study was conducted, the key players in instructional leadership include the Principals, Vice Principals, and Subject Area Coordinators. Driven by its thrust for continuous development, the school gathered the perceptions of teachers on instructional leadership. It aims to answer the question, "What is the perception of the faculty on instructional leadership?"

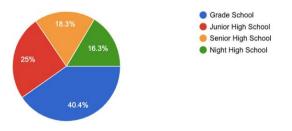
II. METHODOLOGY

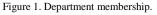
A. Research Design

This study used descriptive quantitative research approach.

B. Demographics

104 faculty members voluntarily participated.





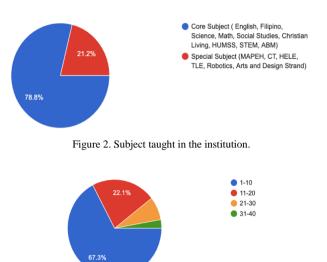


Figure 3. Number of years teaching in the institution.

Fig. 1 shows the frequency and percentages of respondents by department. Fig. 2 shows the subject taught by the participants. Fig. 3 shows the number of years the participants taught at the institution.

C. Research Instrument

The Instructional Leadership Questionnaire by Al-Omari was adapted with a few modifications to align with the school's current teaching setup which is online distance learning to determine the perceptions of faculty on effective use of resources, communication skills, serving as instructional resource, and visibility and accessibility [12].

D. Research Procedure

The study was done during the pandemic thus, all communications were made using different technology applications specifically the Google Suite App namely Google Forms, Gmail, and Google Meet. Prior to the roll out of the questionnaire, approval from the Brother President was sought. This was followed by a meeting using web video conferencing with the Department Heads of Grade School, Junior High School, Senior High School, and Night High School and Strategic Management Officer. The content of the survey questionnaire was presented for comments and the purpose of the study was discussed. All suggestions were considered, and the questionnaire was modified to cater to the current setup of the institution. The survey questionnaire using Google Forms was shared by the Executive Vice President to the faculty members of the institution.

III. RESULTS AND DISCUSSION

This current study is focused on instructional leadership. In this regard, the perceptions of teachers on effective use of resources, communication skills, serving as instructional resource, and being accessible and visible were investigated.

Statements	SA	Α	Ν	D	SD
Effective Use of Resources					
Aligns resources and allocation to priority teaching goals	51.9	39.4	6.7	1.9	0
Encourages colleagues to use the instructional ime for teaching and participating new skills and concepts	57.7	37.5	2.9	1.9	0
Creates professional growth opportunities for init members	60.6	35.6	3.8	0	0
Uses procedures and other performance tools to assess progress toward department goals	51.9	42.3	4.8	1	0
nforms faculty members of the unit's performance results	61.5	29.8	6.7	1.9	0
Communication Skills					
Communicates learning goals, standards, and expectations so that goals are clear and there is consensus in understanding	61.5	32.7	5.8	0	0
Meets individually with faculty members to discuss student progress	52.9	1.7	12.5	2.9	0
Discusses academic performance results with he faculty members to identify curricular strengths and weaknesses	56.7	35.6	7.7	0	0
Utilizes supervisory model to improve teaching and learning	51	34.6	13.5	0	1
Communicates belief about education, including he conviction that every student is capable of earning	49	45.2	5.8	0	0
Serving as an Instructional Resources					
Involves faculty members in the planning process to make goals clear and there is consensus in understanding	50	39	11	1.9	0
Supports and evaluates teaching through regular observations	51.9	38.5	8.7	1	0
Supports and evaluates teaching by providing faculty members formative and summative feedback	52.9	38.5	7.7	1	0
Promotes formal or informal professional earning for faculty members	55.8	36.5	6.7	1	0
Should be tuned in to pertinent issues and current events related to curriculum, effective assessment, and pedagogical strategies	55.8	36.5	6.7	1	0
Being Visible and Accessible					
Fakes time to talk informally with colleagues and students during work time	48.1	35.6	9.6	6.7	0
Visits colleagues virtually to discuss lepartment/unit concerns	56.7	34.6	7.7	1	0
Attends and participates in extra and co- curricular activities	51.9	34.6	13.5	0	0
Reinforces superior performance by faculty nembers in department meetings, newsletters,	51.9	38.5	9.6	0	0
nd/or other communication memos					

TABLE I. FREQUENCY DISTRIBUTION OF FACULTY PERCEPTIONS ON INSTRUCTIONAL LEADERSHIP (N = 104)

Legend: SA – Strongly Agree; A – Agree; N – Neutral; D – Disagree; SD – Strongly Disagree

As can be seen in Table I, the teacher's perceptions are mostly agree and strongly agree. This is indicative of their positive perceptions that instructional leaders should be able to demonstrate skills and competencies on effective use of resources, good and clear communication, knowledge on instruction, and visibility and accessibility. Perhaps, the teachers observe these behaviors exhibited by the academic leaders hence, the mean is high. It can be assumed that based on the experiences and observations of the teachers, these qualities are evident hence, they rated many items either as strongly agree or agree.

A. On Effective Use of Resources

Data shows that instructional leaders are perceived to align resources and allocate to priority teaching goals, encourage colleagues to use the instructional time for teaching and participating new skills and concepts, create professional growth opportunities for unit members, use procedures and other performance tools to assess progress toward department goals, and informs faculty members of the unit's performance results. The respondents seem to lean most on the instructional leader being able to inform the faculty members of the unit's performance results. It can be assumed that the respondents may see transparency as an important component of instructional leadership. Aligning resources and using procedure and other performance tools to assess progress are seen to have lower frequency level as compared to the other items. t is worth noting though that there are a few respondents who are neutral, or they disagree on certain item. It would help to determine the cause of the disagreement and take actions.

B. On Communication Skills

results show that the respondents view The communication skills as a key indicator of an effective instructional leader. Research identified the role of a communicator as the number one most important element of highly effective school leaders [18]. Skillful communication has been broadly accepted as an important leadership attribute across disciplines [15–17]. The highest frequency distribution is related to communicating the goals and standards. It can be deduced that in this school, there is high expectation that leaders are able to communicate the vision mission of the institution, standards and learning goals, and expectations to the teachers and other members of the institution so that there is clarity and consensus in understanding and implementation.

C. On Serving as an Instructional Resource

Results show that the respondents have high regard for instructional leaders serving as instructional resources. The first two highest items are the promotion of formal or informal professional learning for faculty members and leaders should be tuned in to pertinent issues and current events related to curriculum, effective assessment, and pedagogical strategies. Based on data, it can be argued that there is a high level of willingness to grow professionally among the members of the institution. As such, they expect that the instructional leaders can support them by providing professional learning opportunities. If the faculty members are highly motivated to learn, it is not surprising to see that they expect the same with the instructional leaders. According to literature, effective instructional leaders are actively engaged in the improvement of classroom circumstances that enhance learning, and encourage the use of a variety of instructional materials and teaching strategies and teachers can readily approach them for any instructional concerns or innovative ideas. The most important role of the leaders as an instructional resource is to facilitate good teaching. To do this, they must stay abreast of new developments in materials and strategies for improving instruction. They maintain a continuous development program that includes regular review of educational research, curriculum development, and new advances in understanding how children learn [21-24].

D. On Being Visible and Accessible

As can be seen in Table I, visibility and accessibility are highly regarded by the respondents as qualities of instructional leaders. In the current context of the institution, visibility is seen in the many virtual engagements of the instructional leaders. Their presence is felt in doing teleconferences with all the stakeholders and attending to all concerns using any online platforms such as Gmail, web video conferencing, and Google Chat among others. All face-to-face activities have been done through online platform. Hence, visibility and accessibility are always evident with the help of many technology tools. Based on studies, visibility is a key component for instructional leaders to monitor instruction relentlessly and develop a clear and well-defined curriculum. Leaders can ensure quality instruction, promote best practices, monitor the implementation of the curriculum, provide resources, and examine assessment data when they are visible in all areas of the school [25–28].

The overall findings indicated that teacher respondents tend to perceive the instructional leadership as positive as indicated by their agreement on the items. The results of other studies are mainly consistent with the findings of the present study in terms of the positive perception on instructional leadership [1, 7, 27]. These findings suggest that instructional leaders should exhibit instructional leadership behaviors as these skills help develop the unity of vision and mission, and improve education. These findings are consistent with findings from previous studies [19, 22, 26, 28].

IV. CONCLUSION

The success of the school depends among others on effective use of resources, communication skills, serving as an instructional resource and visibility and accessibility. Among the variables, informs faculty members of the unit's performance results, communicates learning goals, standards, and expectations so that goals are clear and there is consensus in understanding, promotes formal or informal professional learning for faculty members, should be tuned in to pertinent issues and current events related to curriculum, effective assessment, and pedagogical strategies, and compliments faculty members privately for their efforts or performance tend to have the highest frequency distribution. Therefore, it is obvious that teachers perceive that instructional leaders' who are focused on performance, communication of school purpose, and promotion of professional development contribute to the success of instructional leadership. Moreover, giving feedback and affirmation seems to be favored as another instructional leaders' quality. These findings are congruous with that of Al-Omari's (2020) study in which similar research tools were used. When these are evident among instructional leaders, the institution is geared towards the improvement of all other factors in teaching and learning process thus ensuring qualitative service delivery by the school to the society.

V. RECOMMENDATIONS

Instructional leaders should be provided with training opportunities that will enable them to improve their instructional leadership, taking into consideration its positive effects on the successful delivery of quality instruction. Further research is recommended to determine the effect of these components to the actual teaching and learning implementation in the school.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Torrato conducted and wrote the research; Aguja analyzed the data; Ramos assisted in the conduct of the study; Prudente reviewed and edited the paper; all authors had approved the final paper.

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REFERENCES

- J. P. Spillane, R. Halverson, and J. B. Diamond, "Investigating school leadership practice: A distributed perspective," *Educational Researcher*, 2021. doi: 10.3102/0013189X030003023
- [2] J. Sebastian and E. Allensworth, "The influence of principal leadership on classroom instruction and student learning: A study of mediated pathways to learning," *Educational Administration Quarterly*, vol. 48, no. 4, pp. 626–663, 2012.
- [3] M. Şişman, "Factors related to instructional leadership perception and effect of instructional leadership on organizational variables: A meta-analysis," *Educational Sciences: Theory & Practice*, vol. 16, pp. 1761–178, 2016.
- [4] Y. Yapandi, "Strategic planning model to increase quality basic school education by 2020," JP2D (Jurnal Penelitian Pendidikan Dasar) UNTAN, vol. 1, no. 1, pp. 35–47, 2018.
- [5] P. Hallinger and R. H. Heck, "Exploring the principal's contribution to school effectiveness: 1980–1995," *School Effectiveness and School Improvement: An International Journal of Research, Policy and Practice*, vol. 9, pp. 157–191, 1998. http://dx.doi.org/10.1080/0924345980090203
- [6] T. Waters, R. J. Marzano, and B. McNulty, "Balanced leadership: What 30 years of research tells us about the effect of leadership on student achievement," *Aurora, CO: Mid-continent Research for Education and Learning*, 2003.

- [7] Y. F. Hendawy and R. Amal, "Teachers' perceptions of principals' instructional leadership in Omani schools," *American Journal of Educational Research*, vol. 3, no. 12, pp. 1504–1510, 2015. DOI:10.12691/education-3-12-4
- [8] Hardianto, "Strategic instructional on character education," *Journal of Education and Human Development*, vol. 6, no. 3, pp. 118–129, 2017. doi: 10.15640/jehd.v6n3a13
- [9] A. Sotarat, P. Buasuwan, S. Sarnswang, and W. Lapanachokdee, "An influential model of instructional leadership affecting students' achievement in small-sized secondary schools under the Office of the Basic Education Commission in Thailand," *Asian Political Science Review*, vol. 2, no. 2, 2018.
- [10] C. J. Ward, "Why leadership matters: One school's journey to success," *Educational Leadership and Administration: Teaching* and Program Development, vol. 24, 2013.
- [11] J. Abu-Hussain, "Leadership styles and value systems of school principals," *American Journal of Educational Research*, vol. 2, no. 12, pp. 1267–1276, 2014. doi: 10.12691/education-2-12-22
- [12] A. A. Al-Omari, "Sultan Qaboos University faculty members' perceptions of strategic planning effectiveness helped improve their department chairperson practice as instructional leaders," *Educational Studies in the new Millennium*, vol. 3, no. 2, pp. 46–57, 2020.
- [13] Y. D. Usman, "An integral component for effective school administration in Nigeria," *Research on Humanities and Social Sciences*, vol. 6, no. 13, 2016.
- [14] J. N. Okendu, "The influence of instructional process and supervision on academic performance of secondary school students of River State, Nigeria," *Academic Research International*, vol. 3 no. 1, 2012.
- [15] K. Aspegren, "BEME Guide No. 2: Teaching and learning communication skills in medicine-a review with quality grading of articles," *Med. Teach.*, vol. 21, no. 6, pp. 563–570, 1999. doi: 10.1080/01421599978979
- [16] V. P. Goby and J. H. Lewis, "The key role of listening in business: A study of the Singapore insurance industry," *Business Communication Quarterly*, vol. 63, no. 2 pp. 41–51, 2000. doi: 10.1177/108056990006300203
- [17] G. Makoul, "Essential elements of communication in medical encounters: The Kalamazoo consensus statement," *Acad. Med.*, vol. 76, no. 4, pp. 390–393, 2001. doi: 10.1097/00001888-200104000-00021
- [18] E. K. McEwan, 7 Steps to Effective Instructional Leadership Edition 2, Corwin Press, 2003. doi: http://dx.doi.org/10.4135/9781483328775
 [19] D. E. Tyler, "Communication behaviors of principals at high
- [19] D. E. Tyler, "Communication behaviors of principals at high performing elementary schools in Virginia: School leaders, communication, and transformative efforts," *Creighton Journal of Interdisciplinary Leadership*, vol. 2, no. 2, pp. 2–16, 2016.
- [20] Five key responsibilities The school principal as leader: Guiding schools to better teaching and learning. [Online]. Available: https://www.wallacefoundation.org/knowledge-center/pages/keyresponsibilities-the-school-principal-as-leader.aspx
- [21] J. B. Torrato, S. E. Aguja, and M. S. Prudente, "Analysis of the teachers' perceptions and understanding on the conduct of action research," in *Proc. the 2021 12th International Conference on E-Education, E-Business, E-Management, and E-Learning*, Tokyo, Japan, 2021, pp. 264–270.
- [22] J. B. Torrato, S. E. Aguja, and M. S. Prudente, "Assessing teacher leadership readiness during the pandemic," in *Proc. the IEEE 2021: International Conference on Educational Technology*, Beijing, China, 2021.
- [23] J. B. Torrato, M. S. Prudente, and S. E. Aguja, "Examining school administrators' technology integration leadership," *Int. J. Learn. Teach.*, vol. 7, pp. 38–42, 2021.
- [24] J. B. Torrato, S. E. Aguja, and M. S. Prudente, "Using web video conferencing to conduct a program as a proposed model toward teacher leadership and academic vitality in the Philippines," *Education Sciences*, vol. 11, no. 11, 658, 2021. https://doi.org/10.3390/educsci11110658
- [25] M. Hunitie, "Impact of strategic leadership on strategic competitive advantage through strategic thinking and strategic planning: A bimeditational research," *Verslas: Theory and Practice*, vol. 19, pp. 322–330, 2018. https://doi.org/10.3846/btp.2018.32

- [26] G. Smith, M. Minor, H. Brashen, and K. Remaly, "Successful instructional leadership styles in education," *Journal of Instructional Research*, vol. 6, 2017.
- [27] J. Lambrecht, J. Lenkeit, A. Hartmann, et al., "The effect of school leadership on implementing inclusive education: how transformational and instructional leadership practices affect individualised education planning," *International Journal of Inclusive Education*, 2020. doi: 10.1080/13603116.2020.1752825
- [28] A. A. Al-Omari, "Strategic planning effectiveness and leadership for educational Institutions," *Innovations in Educational Leadership and Continuous Teachers' Professional Development*, 2019. doi: https://dx.doi.org/10.46679/isbn9788194848325

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