

# Attributes of Digital Leaders in Health Professions Education

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## ABSTRACT

**Objective:** This study investigates the essential attributes of effective digital education leaders (DELs) in health professions education (HPE), aiming to refine digital leadership development and advance digital learning environments in healthcare education.

**Study Design:** Qualitative research with exploratory study design.

**Place and Duration of the Study:** Department of Medical Education, Riphah International University, Rawalpindi, Pakistan, from February to July 2021.

**Methodology:** Semi-structured, in-depth, open-ended interviews were conducted with 18 health professions education leaders from the medical and dental institutes of Pakistan. The participants were selected through purposive sampling and had experience of leading online / blended education systems. The interviews were conducted online, audio recorded, and transcribed verbatim. A systematic process of iterative data collection and analysis was employed. Manual thematic analysis was done to analyse the data. Codes were organised into 13 sub-themes, which were consolidated into three overarching themes by discussion and consensus amongst all authors.

**Results:** Three themes emerged including social, strategic, and personal attributes. Social attributes included social intelligence, promotion of diversity, and networking intelligence. Strategic attributes comprised innovative vision, digital intelligence, adaptability, and flexible leadership style. Personal attributes encompassed motivation, role modelling, openness, self-awareness, agility, and learning through errors.

**Conclusion:** Healthcare educational institutions can use the identified attributes of DELs to inform the development of targeted training programmes and aid in the strategic selection of leaders to lead their digital transformation.

**Key Words:** Digital leadership, E-leadership, Leaders in the digital era, Higher education, Medical education, Health professional education.

**How to cite this article:** Iqbal S, Sabqat M, Akbar Z, Khan YH, Yasmin R. Attributes of Digital Leaders in Health Professions Education. *J Coll Physicians Surg Pak* 2025; **35(02)**:229-233.

## INTRODUCTION

The education sector, including health professions education (HPE), has integrated digital technologies, a trend significantly accelerated by the COVID-19 pandemic.<sup>1</sup> This rapid adoption necessitates a comprehensive digital transformation (DT) of HPE institutes and their processes.<sup>2</sup> The value that this DT can add to healthcare education even in the post-pandemic era has been emphasised in the literature.<sup>3,4</sup> The DT of HPE institutes encompasses more than just moving to online platforms; it involves enhancing the educational experience with technology, such as social media, digital resources, and artificial intelligence.<sup>5</sup>

It is an ongoing process requiring a strategic approach, dedicated resources, faculty development, and a culture shift towards innovation and adaptability.

Effective leadership is essential in the context of evolving educational processes. The rapid pace of change in the information age, with its diverse and accessible knowledge, necessitates a new leadership approach known as 'digital education leaders' (DELs). DELs integrate information and communication technology (ICT) into teaching and leadership, often leading virtual teams. They are adept at meeting the needs of digital-age learners.<sup>6</sup> Understanding the qualities that define a successful DEL is crucial for developing the leadership skills required to deal with the challenges of digital transformation in educational institutions.

Many studies explore digital leadership and the characteristics of digital leaders, with majority of them pertaining to the organisational context.<sup>7,8</sup> Despite the increasing digital integration in education, there exists a gap in understanding the specific attributes that characterise successful digital educational

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Received: June 20, 2024; Revised: September 17, 2024;

Accepted: November 12, 2024

DOI: <https://doi.org/10.29271/jcpsp.2025.02.229>

leaders, particularly within the context of HPE in Pakistan.<sup>9,10</sup> The authors hope that the findings of this study will provide valuable insights that would help to recognise competent individuals who are able to create and sustain a relevant, meaningful, and practical digital learning culture, and provide the students with adequate opportunities to succeed in the current era of digitalisation. The identification of characteristics of digital leaders in HPE will also inform the development of formal digital leadership training programmes in the field of healthcare education. Ultimately, this research will hopefully facilitate the development of competent DELs in medical education, thereby enhancing the quality of HPE. This research aimed to explore the specific attributes that define effective DELs in HPE.

## METHODOLOGY

Ethical approval (Ref. No. Riphah/IIMC/IRC/21/21) was obtained from the Ethics Review Committee of Islamic International Medical College, Islamabad, Pakistan, in February 2021. Participation was kept voluntary, and the names of the participants were coded as R1, R2, etc. (R = Respondent) for confidentiality.

A qualitative exploratory design was used under the constructivist paradigm,<sup>11</sup> to identify and explore the characteristics of effective DELs in HPE. This study was conducted among HPE leaders working in medical and dental educational institutes in different cities of Pakistan.

Participants were selected based on the information power of the sample, using a purposive sampling technique.<sup>12</sup> They included high-level (Principals of Institutes and Directors of the Department of Medical Education), and mid-level (heads of departments and educational committees) HPE leaders based on inclusion criteria of experience with leading online/blended education systems. The exclusion criteria included educational leaders with less than five years of teaching experience and no exposure to online/blended education systems. Data were collected from February to July 2021. Formal invitation letters, project summary, and informed consent forms were emailed to the participants. Out of the initial 22, semi-structured and in-depth interviews were conducted by the first author with 18 DELs. A systematic process of iterative data collection and analysis was employed. Theoretical data saturation was achieved after 15 interviews, with the remaining three reconfirming saturation. All interviews were conducted and recorded (audio and video) via Zoom software and transcribed by the first author.

An interview guide comprising engagement, exploratory, and exit questions was developed based on themes extracted from a thorough literature review. After expert validation by a panel of six health professions educationalists, the initial 13 open-ended questions were reduced to 10. Following pilot testing with three DELs, the questions were refined, resulting in a final interview guide containing nine questions.

Manual thematic analysis was used to analyse the interview texts.<sup>13</sup> The first three interviews were coded independently by the first and second authors, and a consensus on the coding

scheme was achieved through discussion. The remaining interviews were coded independently by the first author using two coding cycles. The codes were evaluated and merged, achieving a final set of 13 sub-themes and three main themes. All authors approved the final framework after a group discussion.

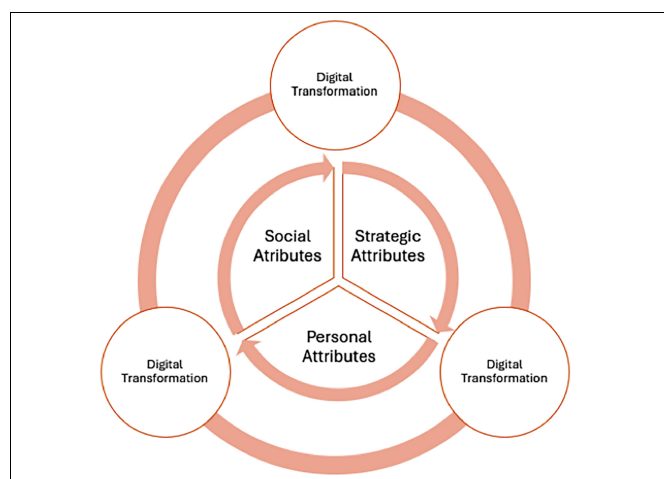
For quality assurance, the Lincoln and Guba framework was used.<sup>14</sup> The first author took reflective notes during interviews to record participants' nonverbal cues and acknowledged potential biases. Four peer-debriefing sessions were conducted at different stages to obtain feedback from all authors and ensure data analysis triangulation. Additionally, interview transcripts were emailed to the respective participants for validation.

## RESULTS

Eighteen educational leaders from nine medical and dental institutions across five cities in Pakistan participated in the study (Table I). The thematic analysis with themes, sub-themes, and codes is given in Table II.

**Table I: Participants' demographics.**

Dimensions		No. of participants (N)
Gender	Male	11
	Female	7
Designation	DME Director	4
	Principal	4
	Professor	4
	Associate Professor	6
Speciality	Clinical	5
	Basic	13
City	Rawalpindi	2
	Islamabad	2
	Peshawar	2
	Karachi	2
	Lahore	1



**Figure 1: Digital educational leadership attributes framework.**

The study proposes a framework of DEL attributes based on the results (Figure 1). This framework can help organisations train their leaders in the necessary characteristics for success in this digital era. Additionally, the framework can be used to identify competent digital leaders who can effectively manage change and work dynamics in the long run.

**Table II: Themes, sub-themes, and corresponding quotations generated by data analysis.**

Sub-themes	Codes	Participants' quotations
<b>Theme 1: Social attributes</b>		
Social intelligence	<ul style="list-style-type: none"> <li>Ability to listen</li> <li>Engage in meaningful dialogue</li> <li>Demonstrate empathy</li> <li>Negotiate effectively</li> </ul>	<p>"He should be a very good listener; he should be able to adapt his style and his methods of communicating and interacting with people based on the situation."</p> <p>"They should be empathetic towards students as well as their team members."</p> <p>"Often there arises a scenario where I have to convince the higher authorities to adopt a certain change, so my negotiation skills are very useful in such a scenario."</p> <p>"...(they should) be respectful and caring and understand that everybody has a certain point of view ... based on the particular individual's perspective and identity both personal and professional."</p>
Promotion of diversity	<ul style="list-style-type: none"> <li>Welcoming diverse opinions</li> <li>Understanding the needs of employees</li> <li>Welcoming students' perspectives</li> </ul>	<p>"When leading in a digital environment, I actively seek students' perspectives as they are quite well-versed with the latest technologies and can actively contribute to the digitalisation of their education."</p>
Networking intelligence	<ul style="list-style-type: none"> <li>Capacity building through collaboration and sharing</li> <li>Networking with other institutions</li> <li>Challenging to lead dispersed team members.</li> </ul>	<p>"... connecting with other leaders, you can share experiences and learn from each other's successes and mistakes. It is all about sharing and collaboration."</p> <p>"Through networking, stay updated with the latest trends and it creates new opportunities for learning."</p> <p>".... Leading team in education comes with its own set of challenges...."</p>
<b>Theme 2: Strategic attributes</b>		
Innovative vision	<ul style="list-style-type: none"> <li>Innovative about the use of technology</li> <li>Visionary</li> <li>Context-driven tailoring of the use of digital solutions</li> </ul>	<p>"...various tools can be utilised; a telephone call, a WhatsApp call, an email exchange or whatever the tool...this digital tool is not only for the communication but for other educational purposes."</p> <p>"...having a vision is important, and their (DELS') vision is related to fulfilling the needs of today's students I had to come up with unique ways to incorporate the new technological tools in education."</p> <p>"Every institution is different in terms of resources, context, faculty, and students. What works in one, might not work in the other, so you need to be creative when figuring out digital solutions and tailor them according to your context."</p> <p>"A good digital leader encourages his team to be creative and provides them a safe space to try out new ideas."</p>
Digital intelligence	<ul style="list-style-type: none"> <li>Encouraging team members to be creative</li> <li>Providing safe space for innovation</li> <li>Digital literacy</li> <li>Knowledge about the use of digital tools</li> <li>Updated on recent technologies</li> <li>Embracing digital tools</li> <li>Embracing change</li> <li>Ready for adaptation</li> </ul>	<p>"Only a leader who is literate (on digital skills) can advocate (it) because he knows whatever questions are going to come to him, he has sufficient knowledge to answer them (and is confident). Therefore, it is extremely important for them to have knowledge."</p> <p>"(they should be) well aware and up-to-date about recent technologies and definitely should be able to embrace the digital tools."</p>
Adaptability	<ul style="list-style-type: none"> <li>Consistency to learn new things</li> <li>Versatile personality</li> <li>Democratic</li> </ul>	<p>"...in order to move towards a change. The first step is I have to learn the thing and then once the things are developed, then I train my faculty members."</p> <p>The whole process is adaptation process and the digital leaders must be ready wholeheartedly to do that.</p> <p>"They (should have) consistency, adaptability to change, and ability to learn new things every day."</p> <p>"They should have a versatile personality, the personality which can accept the challenges."</p>
Optimal leadership style	<ul style="list-style-type: none"> <li>Autocratic</li> <li>Delegative</li> <li>Collaborative / Transformative</li> <li>Combination of different leadership styles</li> </ul>	<p>"...you need to be democratic to listen to them to listen to their views, their suggestions, and their problems."</p> <p>"I believe my leadership style has always been that of leading from the front and trusting those who are working under me."</p> <p>"I think you need a team and you have to give them autonomy....and ownership in order to get the results, as a single person cannot do a job."</p> <p>"I have a collaborative and transformational style, which I like, but for transformational leadership (to be successful) you have to collaborate a lot."</p> <p>"I think you have to use all the leadership styles depending upon the condition; circumstances that you have or the people you are dealing with..."</p>
<b>Theme 3: Personal attributes</b>		
Motivation	<ul style="list-style-type: none"> <li>Motivating</li> <li>Supportive</li> <li>Inspiring confidence and commitment</li> </ul>	<p>"Leading, especially if you are leading a digital transformation, is about motivating, and supporting others, guiding others, and managing the group as a team."</p> <p>"A motivated leader inspires confidence and commitment, which are very important for building a collaborative digital educational community."</p>
Role modelling	<ul style="list-style-type: none"> <li>Demonstrate competence</li> <li>Role model to inspire others</li> <li>Role model for change management</li> <li>Role model for ethical use of technology</li> </ul>	<p>"...if you want to inspire someone for something, you yourself need to demonstrate competence of that thing."</p> <p>"... you have to not only lead from the front, you have to be a role model where you are inspiring others to follow in your footsteps."</p> <p>"He should be willing to be a role model to show how change happens."</p> <p>"A dilemma arises in the form of ethical use of these new technologies so the leader must set a standard by his own behaviour so others can follow in his footsteps."</p>
Openness	<ul style="list-style-type: none"> <li>Respecting everyone's perspectives</li> <li>Open exchange of ideas</li> </ul>	<p>"I must create an environment where everyone feels heard so that people can express their ideas and thoughts."</p> <p>"My leadership is about the efforts I make for an open exchange of ideas and my openness to different perspectives... Openness is my strength."</p> <p>"The key is to stay organised, setting priorities and not losing focus of the goal."</p>
Self-awareness	<ul style="list-style-type: none"> <li>Organisational skills</li> <li>Self-evaluation</li> <li>Reflection</li> </ul>	<p>"I need to understand my strengths and weaknesses so I can lead my team better in the changing scenario."</p> <p>"Reflection is my compass as a digital leader."</p> <p>"If you are a leader who reflects on their actions and evaluates the impacts of their decisions for.... digital initiatives and uses this data for future decisions, then you are a good digital educational leader."</p>
Agility	<ul style="list-style-type: none"> <li>Agile</li> <li>Fast-paced digital educational environment</li> <li>Rapid decision-making</li> </ul>	<p>"...as per the scenario and the circumstances, we have to be agile, responsible, hardworking, have some skills of team building, coordination, problem solving..."</p> <p>"...in the digital era, there are many limitations and many opportunities. So, a good leader has to be agile and hardworking so he can leverage the opportunities which are there..."</p> <p>"Digital technologies have made the educational environment very fast so accordingly, the leaders have to be fast in their decision-making."</p> <p>"Every challenge, every mistake becomes an opportunity for growth."</p>
Learning from errors	<ul style="list-style-type: none"> <li>Learning-oriented approach</li> <li>Learning from errors</li> <li>Learning from experimentation</li> <li>Lifelong learner</li> </ul>	<p>"I regard errors as stepping stones to improvement. As a digital leader, I encourage my team to take risks and consider mistakes as lessons that guide us to be better at what we do."</p> <p>".....Technology is always changing, right? To stay updated and be a part of same bandwagon. You have to keep up the latest trends and be flexible to learn new venues"</p>

(R = Respondent).

## DISCUSSION

The present study aimed to understand the essential qualities of digital educational leaders in HPE. Three primary clusters of attributes were identified: Social, strategic, and personal. It was found that these attributes are essential in overcoming the challenges DELs encounter during digital transformation.

The present study identified social intelligence as an essential attribute for effective DELs, synonymous with existing literature. Social skills are necessary for building trust and rapport with stakeholders, which remains a persistent challenge for digital leaders. Tigre *et al.* suggested that this challenge is often exacerbated by factors such as social isolation, less satisfying communication, and ambiguity of goals in the digital medium.<sup>15</sup> These limitations can hinder a leader's ability to engage stakeholders effectively.

Another challenge faced by DELs is the need for extensive networking across diverse educational institutions and with multiple stakeholders. These findings highlight networking intelligence as an indispensable skill for overcoming these obstacles. This finding is supported by the literature that emphasises the importance of digital leaders' abilities to communicate, negotiate, and cultivate strong relationships, which are essential for encouraging collaboration and successfully adapting to technological transitions.<sup>16</sup>

Furthermore, this study revealed a diverse range of perspectives on the optimal leadership style for DELs. This diversity mirrors the argument by Jakubik and Berazhny, who contend that the evolving digital trends demand a shift towards more collaborative and participatory leadership models.<sup>17</sup> These contemporary approaches encourage co-creation, innovation, and empowerment in digitally dispersed teams.<sup>18</sup>

Recognising innovation and adaptability as essential attributes of DELs aligns with the literature, which emphasises the necessity for DELs to create an environment that encourages innovation and experimentation within educational institutions.<sup>15,19,20</sup> Adaptability is particularly significant in the context of DELs, due to the dynamic nature of DT and the need for leaders to respond to rapid changes effectively.

In addition to adaptability, DELs must possess an inspiring digital vision that enables them to design and implement digital solutions that meet the changing demands of educational institutions. This forward-thinking approach is the key to ensuring that institutions remain at the forefront of digital pedagogy.<sup>21,22</sup> The present findings align with the work of Guzman *et al.*,<sup>22</sup> who highlighted that DELs' commitment to technological proficiency enhances organisational innovation and competitiveness. Similarly, Sainger emphasised the role of leaders in the driving digital maturity within their organisations by maintaining expertise in the emerging technological tools.<sup>23</sup> These findings align with the present study's observations,

highlighting the importance of DELs being self-aware of the evolving work environments and adjusting their practices accordingly.

This research identified several personal attributes as crucial for DELs, with agility emerging as particularly significant. This finding aligns with the existing literature, which emphasises the necessity for DELs to effectively manage the rapid changes inherent in digital education and make well-informed, adaptive decisions.<sup>24</sup> Agility allows leaders to respond swiftly to new challenges, a key capability in the fast-paced digital environment.

Additionally, these findings emphasise the value of a learning-oriented leadership approach, where errors and failures are not viewed as setbacks but as opportunities for growth. This approach resonates with literature, which suggests that leaders must embrace experimentation and seek out new opportunities to stay competent and competitive in the ever-evolving digital environment.<sup>25</sup>

The study's limitation is that the data were collected from leaders solely from medical and dental institutions. Including leaders from other health professions such as nursing and pharmacy would enhance the generalisability of the findings. Future studies should use mixed-method approaches to develop a deeper understanding of how various DEL attributes impact DT processes.

## CONCLUSION

As educational institutions undergo digital transformation, DELs play a crucial role in ensuring success. Effective DELs must exhibit key social, strategic, and personal attributes: Social qualities enhance collaboration, strategic ones offer adaptability, and personal traits drive motivation and self-awareness. These enable leaders to manage current digital challenges and anticipate future needs. The findings have important implications for healthcare education, guiding the creation of training programmes, and leader selection. By equipping DELs with these essential skills, institutions can adapt to new technologies, strengthen digital strategies, and improve educational outcomes in the evolving digital landscape.

### ETHICAL APPROVAL:

Ethical approval (Ref. No. Riphah/IIMC/IRC/21/21) was obtained from the Ethics Review Committee of Islamic International Medical College, Islamabad, Pakistan, in February 2021.

### COMPETING INTEREST:

The authors declared no conflict of interest.

### AUTHORS' CONTRIBUTION:

SI: Data collection, data analysis, and interpretation.

MS: Data collection, data analysis, interpretation, and editing of the manuscript.

ZA: Data collection, data analysis, interpretation, and finalisation of the manuscript.



YHK: Data analysis and interpretation.

RY: Data analysis, article writing, reviewing and finalisation of the manuscript.

All authors approved the final version of the manuscript to be published.

## REFERENCES

- Mumtaz N, Saqulain G, Mumtaz N. Online academics in Pakistan: COVID-19 and beyond. *Pak J Med Sci* 2021; **37(1)**: 283-7. doi: 10.12669/pjms.37.1.2894.
- Laufer M, Leiser A, Deacon B, Fecher B, Kobsda C, Hesse F, et al. Digital higher education: A divider or bridge builder? Leadership perspectives on edtech in a COVID-19 reality. *Int J Educ Technol High Educ* 2021; **18(1)**:51. doi: 10.1186/s41239-021-00287-6.
- Aziz A, Aamer S, Khan AM, Sabqat M, Sohail M, Majeed F. A bumpy road to online teaching: Impact of COVID-19 on medical education. *Ann King Edward Med Univ Lahore Pak* 2020; **26(Special Issue)**:181-6. doi: 10.21649/akemu.v26.
- Sabqat M, Aziz A, Mirza TI, Adeel B. Impact of COVID-19: Faculty suggestions regarding online medical teaching. *J Ayub Med Coll Abbottabad* 2022; **34(2)**:304-8. doi: 10.55519/JAMC-02-8997.
- Antonopoulou H, Halkiopoulos C, Barlou O, Beligiannis GN. Transformational leadership and digital skills in higher education institutes: During the COVID-19 pandemic. *Emerg Sci J* 2021; **5(1)**:1-13. doi: 10.28991/esj-2021-01252.
- Isaacs S. COVID-19 education responses and OER-OEP policy in the Commonwealth. In: Mishra S, Panda S, Ed. Technology-enabled learning: Policy, pedagogy and practice. Vancouver: Commonwealth of learning; 2020. p. 3. doi: 10.2139/ssrn.2032444.
- Klein M. Leadership characteristics in the era of digital transformation. Business and management studies. *Bus Manag Stud An Int J* 2020; **8(1)**:883-902. doi: 10.15295/bmij.v8i1.1441.
- Porfírio JA, Carrilho T, Felício JA, Jardim J. Leadership characteristics and digital transformation. *J Bus Res* 2021; **124**:610-9. doi: 10.1016/j.jbusres.2020.10.058.
- Abbasi N. Identifying leadership competencies in medical and dental healthcare professionals in Pakistan. *Open Acc J Dent Sci* 2021; **6(1)**:000290. doi: 10.23880/oajds-16000290.
- Butt AI, Quraishi U, Aziz F. Addressing the challenges for universities in digital era: A framework for e-leadership. *J Arts Soc Sci* 2023; **10(1)**:228-37. doi: 10.1111/puar.12980.
- Kumatongo B, Muzata KK. Research paradigms and designs with their application in education. *J Lexico Terminol* 2021; **5(1)**:16-32. Available from: <https://journals.unza.zm/index.php/jlt>.
- Malterud K, Siersma VD, Guassora AD. Sample size in qualitative interview studies: Guided by information power. *Qual Health Res* 2016; **26(13)**:1753-60. doi: 10.1177/1049732315617444.
- Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* 2006; **3(2)**:77-101. doi: 10.1191/1478088706qp0630a.
- Lincoln YS, Guba EG. Naturalistic inquiry. Thousand Oaks: SAGE; 1985. p. 289-331. doi: 10.1016/0147-1767(85)90062-8.
- Tigre FB, Curado C, Henriques PL. Digital leadership: A bibliometric analysis. *J Leadersh Organ Stud* 2023; **30(1)**: 40-70. doi: 10.1177/15480518221123132.
- Oh SP, Chua YP. An explorative review of e-leadership studies. *Int Online J Educ Leadersh* 2018; **2(1)**:4-20. doi: 10.22452/ijel.vol2no1.2.
- Jakubik M, Berazhny I. Rethinking leadership and its practices in the digital era. In: Laporsek S, Suzana S, Omerzel DG, Eds. Managing the global economy. Proceedings of the management international conference. Monastier di Treviso; Italy; 2017. p. 471-83. Available from: <https://urn.fi/URN:NBN:fi:amk-2018111517200>.
- Klus MF, Muller J. Identifying leadership skills required in the digital age. *SSRN Elect J* 2020. CESifo working paper no. 8180. Available from: <https://ssrn.com/abstract=3564861>.
- Antonopoulou H, Halkiopoulos C, Barlou O, Beligiannis GN. Leadership types and digital leadership in higher education: Behavioural data analysis from university of patras in Greece. *Int J Learn Teach Educ Res* 2020; **19(4)**:110-29. doi: 10.26803/ijlter.19.4.8.
- Cecilia F. E-leadership: The implication of digital transformation for leadership in organisation in Africa. *OSF Preprints*; 2020. doi: 10.31219/osf.io/sj6zf.
- Arnold D, Sangra A. Dawn or dusk of the 5<sup>th</sup> age of research in educational technology? A literature review on (e-)leadership for technology-enhanced learning in higher education (2013-2017). *Int J Educ Technol High Educ* 2018; **15(1)**. doi: 10.1186/s41239-018-0104-3.
- Guzman VE, Muschard B, Gerolamo M, Kohl H, Rozenfeld H. Characteristics and skills of leadership in the context of industry 4.0. *Procedia Manuf* 2020; **43**:543-50. doi: 10.1016/j.promfg.2020.02.167.
- Sainger G. Leadership in digital age: A study on the role of leader in this era of digital transformation. *Int J leadership* 2018; **6(1)**. Available from: <https://www.publishingindia.com/ijl/60/leadership-in-digital-age-a-study-on-the-role-of-leader-in-this-era-of-digital-transformation/684/4784/>.
- Pabst von Ohain B. Leader attributes for successful digital transformation (2019). ICIS 2019 Proceedings. 5. Available from: [https://aisel.aisnet.org/icis2019/practice\\_is\\_research/practice\\_is\\_research/5](https://aisel.aisnet.org/icis2019/practice_is_research/practice_is_research/5).
- Imran, F, Shahzad K, Butt A, Kantola J. Leadership competencies for digital transformation: Evidence from multiple cases. In: Kantola J, Nazir S, Salminen V, Eds. Advances in human factors, business management and leadership. 2020. Advances in intelligent systems and computing. Vol. 1209. United States; Springer, Cham; doi: 10.1007/978-3-030-50791-6\_11.

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