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RESEARCH ARTICLE

Design, Development and Validation of a Digital Performance Based Appraisal System: A Planned Approach in Change Management

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Abstract

Objectives: In India, the professional performance of the academic faculty is assessed annually using Academic Performance Indicator (API) as per the University Grants Commission (UGC), Government of India. This is a manual model is cumbersome in filling, and time-consuming. As a planned change and a measure to introduce technology-based platforms in JSS Academy of Higher Education & Research (JSSAHER), Mysuru, India, we have designed, developed, and validated digital platform technology to evaluate the annual performance of faculty working in medical, dental, pharmacy, life sciences fraternities. **Methods:** Academic Performance Indicator (API) guideline as per the University Grants Commission (UGC), Government of India, was used to design and develop the digital performance-based appraisal system (d-PBAS), and its performance was validated (20% random sampling) by comparing the manual and digital data entered by the faculty from different disciplines of JSSAHER. **Findings**: The present manuscript demonstrates the designing and validation methodology of d-PBAS. Software Development Life Cycle (SDLC) process and Waterfall model was adopted to develop d-PBAS. The digital platform was assessed for the performance and ranking of the faculty. More than 96% of the users expressed satisfaction and 4% expressed dissatisfaction in d-PBAS. **Novelty:** For the first of its kind in a university set up in India, JSSAHER designed and validated the digital performance-based appraisal system to evaluate academic performance. Since d-PBAS was developed using the SDLC process and Waterfall model it is easy and consumes less time to enter the data. The most important highlight is d-PBAS helps to rank the faculty performance automatically. The design and validation of d-PBAS described in the present manuscript are simple, robust, cost-effective, and have a go-green value.

Keywords: Change Management; Higher Education Institutions; Performancebased; Appraisal System; academic Performance Indicator; digital technology

1 Introduction

Higher education is defined as "all types of education (academic, professional, technical, artistic, pedagogical, long-distance learning, etc) provided by universities, technological institutes, teacher training colleges, etc., which are normally intended for students having completed a secondary education, and whose educational objective is the acquisition of a title, a grade, certificate, or diploma of higher education"[1]. Radical development of digital technologies boosted the online and blended learning models, which in turn incites the need for digital services such as management information models in higher education institutions (HEIs)[2]. The teaching faculty, students, and administrators are the key stakeholders of HEIs, nevertheless, the performance of teaching faculty largely echoes the quality of training and skill development being imparted in HEIs[3,4]. Thus, HEIs pursue a systematic periodic evaluation of faculty's performance that helps to assess efficiency and also improve productivity using procedures of internal quality assurance.

In India, the University Grants Commission (Regulations 2018) has provided a questionnaire-based tool as an academic performance indicator (API) with a scoring system for various activities involved in HEIs. The API, as per the performance-based appraisal system (PBAS), is a multifaceted scoring system with three major categories viz **Category-I**: teaching, learning, and evaluation-related activities; **Category-II**: Co-curricular, extension, and professional development related activities, and **Category–III**: Research, Publications, and academic contributions. PBAS tool is a hierarchical process wherein individual faculty provide comprehensive and self-score data prepared on the teaching, administrative, and research works carried out during a particular academic calendar as per the UGC guidelines. The head of the department verifies the data and forwards it to the dean/principal of the institution. The principal in turn forwards the academic indicator data to university authority for scrutinization. The final score gained by an individual faculty will be considered for credentials and promotions.

Although the UGC had prescribed the PBAS application with clear instructions and scoring guidance, in many instances there were intended and unintended humane errors confronted by universities, including application filling, scoring, and self-reviewing and evaluation. Another important factor is time. Manual filling of applications in a hard copy format is a cumbersome process including legibility, spelling, mathematical errors, and chances of failing to provide important data which imposes unsatisfied and low confidence amongst the faculty. This mandates the design and development of a digital technology model to record, and analyze the data from the faculty, and college(s), which in turn helps the HEIs for better planning, and financing and improve the performance standards to reach the global level.

"Change management is the ability to implement new initiatives or adapt to a changing external environment that takes into account the shared governance model of higher education"[5–7]. The development and implementation of digital technologies in academia is a constructive step toward change management in HEIs[8]. Understanding the importance of the API and its critical evaluation in HEIs, it is worthy to monitor the performance of the faculty using digital technologies. This spurts an interest to develop a comprehensive evaluation model using the digital technology platform in JSS Academy of Higher Education & Research (JSSAHER), Mysuru, India, a deemed to be a university under Section 3 of UGC Act 1956. The present study describes the sequential methodologies adopted during the design, development, and validation of a digital platform established to record and assess the faculty's annual performance in

JSSAHER. JSSAHER is a health and allied sciences university constituting 4 colleges, 7 university departments, and 2 schools with 550 plus teaching faculties which stand by its unique multidisciplinary teaching model. Based on the diversity of faculties across the university, an optimized PBAS assessment tool was developed without varying UGC norms using the Azure program (system software framework structure), and its effectiveness is discussed in detail.

2 Methodology

2.1 Ethical Statement

This study does not involve direct interaction or biological sampling with any individual, hence ethical requirement is not applicable.

2.2 Development of Digital PBAS Technology platform

The technology framework used to develop digital PBAS is hosted on Azure, a flagship Microsoft public cloud computing platform, which provides seamless integration of information and digital technology services for a massive network of computing devices, each of which was set to carry out a particular task.

The technologies used for both User Interface (faculty, head of departments, administrators, etc.) and Backend Data mining of digital PBAS are critical in providing a seamless experience to end users, and stakeholders to manage secured storage of data. Microsoft SQL server is used as it is tightly integrated with Azure. Since PBAS has a massive requirement for data interchange across systems, the JSON development tool was used because it is fast and designed specifically for data interchange (Figure 1).

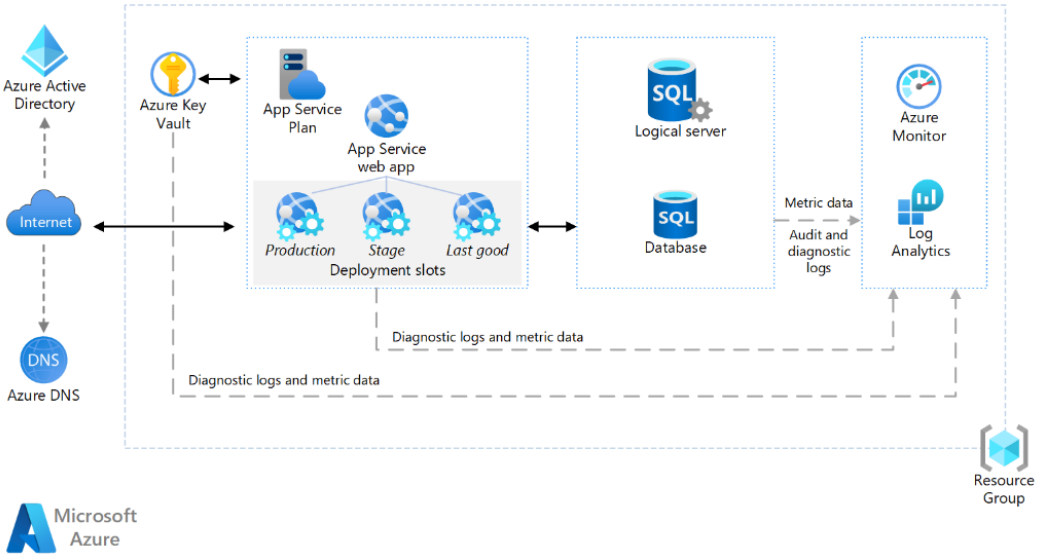

Fig 1. Technology framework used to develop digital PBAS is hosted on Azure (Source: https://learn.microsoft.com/en-us/azure/architecture/reference-architectures/app-service-web-app/basic-web-app?tabs=cli)

2.3 D-PBAS analysis

The performance of the d-PBAS model was analyzed from the individual faculty data entry and the sensitive data like publications, conferences attended, patents, etc are imported from the transactional system of the JSSAHER ERP database of 469 faculties across the constituent colleges and departments of JSSAHER for the academic year June 2021- May 2022. The data capture mechanism is illustrated in (Figure 2).

As per the UGC guidelines, the faculty performance was assessed based on three categories (academic performance indicators). **Category-I**: teaching, learning, and evaluation-related activities, capped with a maximum of 125 marks; **Category-II**: Co-curricular, extension, and professional development-related activities, with a maximum of 50 marks and **Category–III:** Research, Publications, and academic contributions. In the case of Category–III, the scoring is based on the number

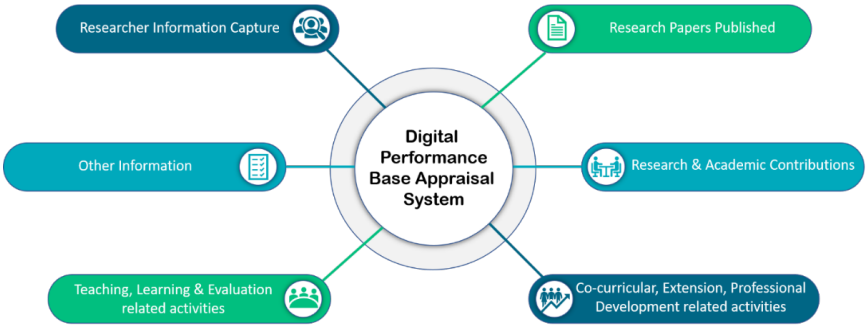

Fig 2. Data elements captured by d-PBAS

of research/review papers, books, book chapters, conference proceedings published, invited lectures and conference/seminar presentations, grants and consultancy projects obtained, research students guided, etc. Thus, the score depends on the individual faculty's performance. JSSAHER has created a customized scoring pattern for Category–III based on the weightage of each activity**.**

The digital PBAS model is validated in terms of the automated cut-off time for data entry, and 20% random sampling was performed for comparison of manual filling and digital data. Finally, the API score obtained from all three categories is summed up and the faculty's annual performance was automatically ranked and highlighted in fixed colour in the platform.

2.4 End-user feedback

The Internal Quality Assurance Cell (IQAC) of JSSAHER has designed a questionnaire to evaluate the feedback from the faculty on the broad understanding of the process of the online performance appraisal system. 157 responses recorded from different constituent colleges and departments of JSSAHER. The content of the questionnaire includes satisfaction with the digital PBAS model, time consumption, efficiency, and instruction provided, etc.

3 Results and Discussion

3.1 Design and validation of the digital PBAS

For the current digital PBAS platform, we have used the Software Development Life Cycle (SDLC) process and Waterfall model to develop the system. SDLC is a process that defines various systematic stages involved in the development of software to deliver a resilient software application. It is a disciplined approach to software development and delivering planned results.

SDLC has many phases viz starting from requirement gathering, designing, developing, testing, implementation, post-implementation maintenance, and improvements to the system (Figure 3). We have used the Waterfall model which is a linear sequential model as part of developing the application under SDLC. Under the Waterfall model, the development is undertaken in stages and each stage starts when the outcome of the previous stage is completed and as per the specifications.

3.2 The Process Flow

Following the data entry by the faculty, it will be reviewed by the concerned head of the department. If any clarification is needed it will be sent back to the faculty to rectify. The data further moves to the review by the head of the particular institution from the head of the department. Then, the data reviewed by the PBAS university coordinator i.e., IQAC dept, and then the results will be shared with the university leadership for further actions and credential considerations (Figure 4).

3.3 Implementation of the d-PBAS model

The d-PBAS platform was implemented for the academic year 2021-2022. In the current approach, we designed and implemented the d-PBAS model in JSSAHER, Mysuru, India, using Azure, the Microsoft cloud technology platform, and validated its efficiency by random sampling (25%) comparison between manual and digital entries. Based on the inputs entered by the individual faculty, the d-PBAS platform performs automated scoring and evaluation of API under the three broad criteria as per the UGC, Govt of India, New Delhi, guideline. Before the implementation of the digital PBAS model, the members

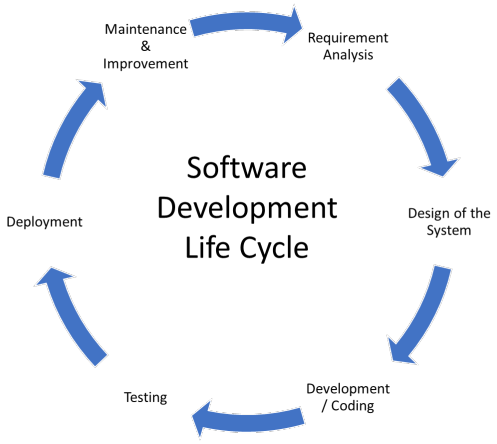

Fig 3. Software Development Life Cycle (SDLC) flow chart

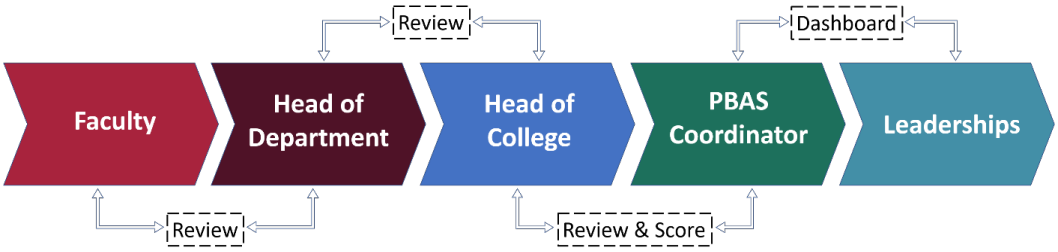

Fig 4. Data submission and review flow chart in the d-PBAS platform

(discipline-specific) of the IQAC team conducted three rounds of orientations to train the faculties to use and enter the data. Additionally, in separate sessions, the heads of the departments and university stakeholders were also provided orientations to review and evaluate the data.

The orientation programs helped the faculty to fill the entries quickly without any hassle and errors. Importantly, sensitive data like publications, conferences, workshops attended, patents, etc are automatically imported from the JSSAHER ERP database. This adds value to ensure the collation and assessment of sensitive data without errors.

3.4 Performance analysis of d-PBAS

In the trial performance analysis, 261 faculties from medical, 70 from dental, 82 from pharmacy colleges (Ooty and Mysuru), 45 from the life sciences and health department, and 11 from other disciplines of JSSAHER entered their data in the d-PBAS platform **(Supplementary Table. 1)**. A comparison between manual filling and d-PBAS was analyzed in 25% random sampling from each discipline. We observed zero error efficiency in the samples analyzed, which ensures that d-PBAS helps to obtain reliable data.

3.5 The d-PBAS-based ranking of faculty performance

Based on the total marks obtained in all three categories, an in-house ranking system was developed and the faculty's performance was ranked – I to IV. **Rank - I** (top performer) consisted of 118 faculties in the university and is indicated in green colour in the system. **Rank -II** (good performer), **III** (acceptable performer), and **IV** (faculty requiring improvement) consisted of 117 in each grade indicated in blue, orange, and red color, respectively (Figure 5).

The digital PBAS helped analyze the strengths and weaknesses by comparing API scores and also the performance categories (I-III). In all the cases, the top performers were found to obtain exceptional scores in all three categories. Particularly, they have scored high in category -III, i.e., in Research, Publications, and academic contributions. The good performer's scores indicate that they strived hard to improve in research and publications. Acceptable performers obtained average scores in category III. Category-IV performers obtained low scores in categories I and II and underperformed in III.

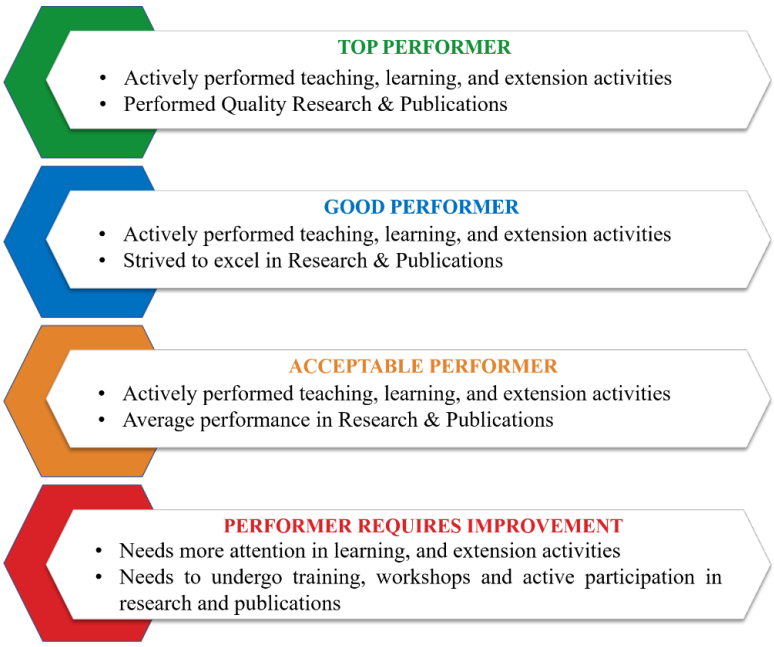

Fig 5. Performance-based ranking of faculty

The automated categorization obtained through the d-PBAS platform is utilized by management for decision-making on probation confirmation, annual increment, promotion, training, the scope for improvement, etc. This categorization also provides detail on the strengths, weaknesses, opportunities, and threats (SWOT) analysis for the organization as well as for the individual faculty. Thus, the d-PBAS was found to be an effective platform for entering, reviewing, analysing, and final assessment of data.

3.6 End User Feedback

A total of 165 feedback responses were recorded from the constituent colleges and university departments of JSSAHER. The result of the responses is presented in **Supplementary Table 2**. A majority (96%) of the faculty expressed satisfaction and 4% expressed dissatisfaction with the online PBAS. The dissatisfaction expressed by few faculties was more of an individual's technical limitations. Fifty percent of faculty expressed that the data entry is easier and filling instructions provided as pop-ups are very useful. Fifty-five percent of faculty express use of the digital platform for API filling is quick.

3.7 Discussion

In the present manuscript, we have described the design, development, and validation of a digital performance-based appraisal system that is introduced to the faculty, administrative staff, leadership, and other stakeholders in JSS Academy of Higher Education & Research, Mysuru, India.

Higher education institutions (HEIs) play a critical role in the transformation of individuals, and regions in realizing the Sustainable Development Goals (SDGs) and the agenda set for 2030 by United Nations General Assembly in 2015[9–11]. HEIs need to evolve as resilient organizations to face unprecedented challenges like government policy changes, global and local trends, economic and political pressures, technological advancements, etc. The activities carried out by HEIs after the Covid-19 pandemic are very different from the pre-pandemic period[12]. The faculty members in colleges and the universities of HEIs play critical roles in teaching students, imparting technical skills, conducting research, addressing societal challenges, designing curriculum, developing andragogy, etc that align with the promises of the university and to the students[13]. It is mandatory to keep the faculty at a high moral and reward them through periodic, and unbiased appraisal systems for their annual performance. Therefore, the performance evaluation system is critical to improving productivity and job satisfaction[14], and thus the PBAS becomes an opportunity to grow[15]. Like automated industrial sectors, the inclusion of technology-based platforms in teaching and research is inevitable[16,17]. Quick adaptation to technology-based teaching and training by students, teachers, and other stakeholders helps the HEIs to keep abreast of planned and unplanned changes[18,19].

Faculty members create a knowledge base and disseminate it to students and peers. Faculties are expected to follow the current developments in their field of expertise and remain knowledgeable and updated. This ensures the teaching of updated information to the students and develops skilled manpower to the need of technological advancements [20]. Thus, it becomes mandatory for the higher education institution management to evaluate the performance of the faculty periodically. In India, the University Grants Commission, Govt of India, introduced the annual self–assessment for the Performance Based Appraisal System (PBAS) for the maintenance of standards in HEIs in July 2010. The annual performance of the faculty is assessed using Academic Performance Indicators (API) under the three major categories viz category -I: teaching, learning, and evaluation-related activities; category - II: Co-curricular, extension, and professional development-related activities, and category – III: Research, Publications, and academic contributions. This system is introduced in the form of manual filling with a defined set of questions in each category with a prefixed score which the faculty needs to fill and submit with self-declaration. In many instances there were deliberate and unintended data errors were performed by faculty which poses a tough review process to the subsequent reviewers (head of the department/institution). Thus, the process is highly laborious and time-consuming. Finally, the API score of the faculty is summarised to evaluate the annual performance of the faculty. Unfortunately, there is no information on any ranking or grading of faculty performance indicated in this guideline.

Adaptations to changes in HEIs are best achieved by the synchronized efforts of Top-Down (key administrators, leaders in power) and Bottom-Up ("grass-roots" initiatives; likely faculty, students, parents, etc). Change management in HEIs is a process of quick adaption to unplanned and planned changes. COVID-19 is an unplanned change that forced primary schools to HEIs to quickly involve technology-based teaching, conduction, and evaluation of exams, etc [21–23]. In the present study, we have clearly described the use of Azure technology for the design of the digital PBAS system and also its validation. We have also explained the automated import of sensitive data into PBAS. Following multiple rounds of orientation to all the stakeholders, the d-PBAS system was implemented for the academic year 2021-2022 in JSSAHER. It is a planned approach to the change management process [24,25]. The technology-based assessment of faculty performance was found to be effective, fast, and unbiased. This ensures the satisfaction of the faculty and trust in the evaluation process. Importantly, the leadership and management review processes are made effective, reliable, and easier through the additional inclusion of faculty performance categorization. The d-PBAS assessment helps the HEIs management for the decision-making on the promotion, confirmation of probation, annual salary increment, and scope for training the faculty [26].

3.8 Limitation and future scope

The waterfall model used is a rigid platform and moves only in sequential phases. However, there are wide scopes in the future to take the advantage of agile model, after streaming the qualitative data in the PBAS.

4 Conclusion

JSS Academy of Higher Education & Research, Mysuru, India, a multidisciplinary higher education institution has designed and implemented a digital performance-based appraisal system (d-PBAS) to assess the annual performance of an academy faculty. It is developed using Azure software technology and a Waterfall model process which makes the easy and fast entry of data into the digital platform. The most important highlight is d-PBAS it helps to rank the faculty performance automatically and thus avoid biased decisions. The design and validation of d-PBAS described in the present manuscript are simple, robust, cost-effective, and have a go-green value.

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6 Data availability statement

The data that support the findings of this study are available in standard research databases such as Scopus, PubMed, Science Direct, or Google Scholar, and/or on public domains that can be searched with either keywords or DOI numbers.

7 Authors' contribution

CGB: conceptualization, literature collection original manuscript drafting, and finalization of the manuscript; HKM, SBC, and VP: assisted in manuscript drafting and formatting.

References

1) New report on higher education published by UNESCO and Right to Education Initiative. 2022. Available from: https://www.right-to-education.org/news/new-report-higher-education-published-unesco-and-right-education-initiative.
2) Blanka C, Krumay B, Rueckel D. The interplay of digital transformation and employee competency: A design science approach. *Technological Forecasting and Social Change*. 2022;178:1–15. Available from: https://doi.org/10.1016/j.techfore.2022.121575.
3) Crisol-Moya E, Romero-López MA, Caurcel-Cara MJ. Active Methodologies in Higher Education: Perception and Opinion as Evaluated by Professors and Their Students in the Teaching-Learning Process. *Frontiers in Psychology*. 2020;11:1–10. Available from: https://doi.org/10.3389/fpsyg.2020.01703.
4) Patfield S, Gore J, Prieto E, Fray L, Sincock K. Towards quality teaching in higher education: pedagogy-focused academic development for enhancing practice. *International Journal for Academic Development*. 2022;p. 1–16. Available from: https://doi.org/10.1080/1360144X.2022.2103561.
5) Higher Education Change Management. 2022. Available from: https://changinghighered.com/higher-ed-consulting/change-management/.
6) Maroun F, Hage UE. Change management in Higher Education: a New Perspective. *Lebanese Science Journal*. 2020;21(2):178–203. Available from: https://lsj.cnrs.edu.lb/wp-content/uploads/2022/02/Ursula-el-Hage.pdf.
7) Vlachopoulos D. Organizational Change Management in Higher Education through the Lens of Executive Coaches. *Education Sciences*. 2021;11(6):1–15. Available from: https://doi.org/10.3390/educsci11060269.
8) Bellantuono N, Nuzzi A, Pontrandolfo P, Scozzi B. Digital Transformation Models for the I4.0 Transition: Lessons from the Change Management Literature. *Sustainability*. 2021;13(23):1–40. Available from: https://doi.org/10.3390/su132312941.
9) Chankseliani M, McCowan T. Higher education and the Sustainable Development Goals. *Higher Education*. 2021;81(1):1–8. Available from: https://doi.org/10.1007/s10734-020-00652-w.
10) Schiller D, Radinger-Peer V. Introduction: The Role of Universities in Regional Transitions towards Sustainability. *Sustainability*. 2021;13(14):1–4. Available from: https://doi.org/10.3390/su13147940.
11) Serafini PG, De Moura JM, De Almeida MR, De Rezende JFD. Sustainable Development Goals in Higher Education Institutions: A systematic literature review. *Journal of Cleaner Production*. 2022;370:133473. Available from: https://doi.org/10.1016/j.jclepro.2022.133473.
12) Sharma A, Alvi I. Evaluating pre and post COVID 19 learning: An empirical study of learners' perception in higher education. *Education and Information Technologies*. 2021;26(6):7015–7032. Available from: https://doi.org/10.1007/s10639-021-10521-3.
13) Kämpf-Dern A, Will-Zocholl M. Transforming workplaces into performing workspaces—Holistic evaluation concept for managing workspace change projects. *Zeitschrift für Immobilienökonomie*. 2022;8(2):189–211. Available from: https://doi.org/10.1365/s41056-022-00058-y.
14) Dasanayaka CH, Abeykoon C, Ranaweera RAAS, Koswatte IS. The Impact of the Performance Appraisal Process on Job Satisfaction of the Academic Staff in Higher Educational Institutions. *Education Sciences*. 2021;11(10):1–20. Available from: https://doi.org/10.3390/educsci11100623.
15) Corso LD, De Carlo A, Carluccio F, Girardi D, Falco A. An Opportunity to Grow or a Label? Performance Appraisal Justice and Performance Appraisal Satisfaction to Increase Teachers' Well-Being. *Frontiers in Psychology*. 2019;10:1–9. Available from: https://doi.org/10.3389/fpsyg.2019.02361.
16) Akbar M. Digital Technology Shaping Teaching Practices in Higher Education. *Frontiers in ICT*. 2016;3:1–5. Available from: https://doi.org/10.3389/fict.2016.00001.
17) Røe Y, Wojniusz S, Bjerke AH. The Digital Transformation of Higher Education Teaching: Four Pedagogical Prescriptions to Move Active Learning Pedagogy Forward. *Frontiers in Education*. 2021;6:1–6. Available from: https://doi.org/10.3389/feduc.2021.784701.
18) Hartnett M, Brown C, Forbes D, Gedera D, Datt A. Enhanced or diminished attitudes: University students' agency. *Computers & Education*. 2023;198:104773. Available from: https://doi.org/10.1016/j.compedu.2023.104773.
19) Kaputa V, Loučanová E, Tejerina-Gaite FA. Digital Transformation in Higher Education Institutions as a Driver of Social Oriented Innovations. In: Păunescu C, Lepik KL, Spencer N, editors. Social Innovation in Higher Education . Innovation, Technology, and Knowledge Management;Springer, Cham. 2022;p. 61–85. Available from: https://doi.org/10.1007/978-3-030-84044-0_4.
20) Butt J. A Conceptual Framework to Support Digital Transformation in Manufacturing Using an Integrated Business Process Management Approach. *Designs*. 2020;4(3):1–39. Available from: https://doi.org/10.3390/designs4030017.
21) Akram H, Yingxiu Y, Al-Adwan AS, Alkhalifah A. Technology Integration in Higher Education During COVID-19: An Assessment of Online Teaching Competencies Through Technological Pedagogical Content Knowledge Model. *Frontiers in Psychology*. 2021;12:1–11. Available from: https://doi.org/10.3389/fpsyg.2021.736522.
22) Hu X, Chiu MM, Leung WMV, Yelland N. Technology integration for young children during COVID-19: Towards future online teaching. *British Journal of Educational Technology*. 2021;52(4):1513–1537. Available from: https://doi.org/10.1111/bjet.13106.
23) Pozo JI, Echeverría MPP, Cabellos B, Sánchez DL. Teaching and Learning in Times of COVID-19: Uses of Digital Technologies During School Lockdowns. *Frontiers in Psychology*. 2021;12:1–13. Available from: https://doi.org/10.3389/fpsyg.2021.656776.
24) Bagga SK, Gera S, Haque SN. The Mediating Role of Organizational Culture: Transformational Leadership and Change Management in Virtual Teams. *Asia Pacific Management Review*. 2023;28(2):120–131. Available from: https://doi.org/10.1016/j.apmrv.2022.07.003.
25) Vlados C, Chatzinikolaou D. Exploring Change Management and Innovation in Strategy-Technology-Management (Stra.Tech.Man) Terms. *Journal of Social and Administrative Sciences*. 2019;6(2):66–81. Available from: http://www.kspjournals.org/index.php/JSAS/article/view/1871.
26) Bilal, Guraya SY, Chen S. The Impact and Effectiveness of Faculty Development Program in Fostering the Faculty's Knowledge, Skills, and Professional Competence: A Systematic Review and Meta-Analysis. *Saudi Journal of Biological Sciences*. 2019;26(4):688–697. Available from: https://doi.org/10.1016/j.sjbs.2017.10.024.