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Research Article

Research on a Study of Web-Based Learning (WBL) Environment in Karnataka

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Abstract: The prevalence of online technology has changed educational landscape in India significantly with Web Based Learning (WBL) being one of its most integral parts. This research evaluated online technology as a method of learning that is effective for higher educational institutions in Karnataka, using a survey distributed to learners enrolled in internet enabled courses. Factors evaluated in this study included learner behaviours, instructor features, technology structures, interactive tools and features and assistance from institute or academy. The research study supported a sizable impact on a connection with academic success and happiness; furthermore, the findings suggest that learners vary in relation to their adjustment styles, including non-adjustable, uncompromising, disillusioned and mock-up. While the flexibility and accessibility of WBL is well received, it still has its challenges with the students adapting to once engage interaction and performance. It is important to note that applying sound institutional support; digital established infrastructure and pedagogy that encourages learner centered outcomes could further enhance the context of WBL effectiveness.

Keywords: Web-Based Learning (WBL), online education, learner satisfaction, academic achievement, adaptation styles, Karnataka higher education, digital learning environment.

INTRODUCTION

Recently there have been significant changes in India's education system led by socio-economic changes along with rapid changes of information and communication technology (ICT). Although the traditional classroom teaching method is presumable the back bone of the Indian education system. However, the differing quality of access and inclusivity in education were caused by various teacher training, institutional capacity, and socio-economic backgrounds of learners. These challenges occurred with (WBL) web-based learning and digital platform caused significant change in their approach by redefining education as democratizing access to education more times to across India.

WBL implies a consistency in ensuring educational resources, providing equitable opportunities for the acquisition of knowledge, and overcoming the constraints of time and geography. Earlier attempts have been made with multi-country initiatives like the Countrywide Classroom of the UGC in 1984, NIIT's Netvarsity in 1996, and the launch of EDUSAT in 2004, which paved the path for virtual education in India, followed by trail-blazing initiatives like the IGNOU Virtual Campus Initiative, the monumental NPTEL project initiated by the IITs and IISc, followed by the Government of India's recently announced National Mission on Education through ICT (NMEICT).

Although these efforts emphasize the use of ICT in improving access, quality, and relevance in higher education, it is important to acknowledge that the extensive reach of Web-Based Learning (WBL) can be characterized as a different type of innovation that relies on ICT.

LITERATURE REVIEW

There has been extensive production of research on Web-Based Learning (WBL) in India, with researchers examining the histories, current practices, advantages, and difficulties of WBL. One of the early studies was by Ray (2009), who offered one of the early wider reviews of Web-Based e-Learning (WBeL), specifically in India, where he summarized different initiatives, instructional design approaches, and tools. Despite uncovering several factors limiting the successful use of WBL - especially lack of infrastructure, Ray also offered new models that may better fit the needs of India's educational context. Recently published literature supports the various roles of adaptive technologies, mobile technologies, and multilingual learning, as value or importance to becoming effective in e-learning of any kind. The discussion was broadened by Singh and Kaur (2015), who highlighted the significance of e-learning in addressing socio-economic and geographical barriers. They reviewed a number of projects including E-Gyankosh, NODLINET, Ekalavya, and NPTEL, indicating that emerging tools (blogging, podcasting, gaming, and cloud computing) improved access and flexibility. Singh and Kaur (2015) also pointed out issues related to the credibility of certifications offered through e-learning systems, the legality of these certifications, and how to keep learners engaged. Following on, Selvam et al. (2022) noted

that work-based learning has evolved from a supplementary mode, to a mode of educational delivery in its own right. Their research, informed by social cognitive theory, discusses the importance of Learning Management Systems (LMS), feedback to students, and student motivation. They also noted the impact of AI personalization, mobile microlearning, and immersive technologies on the future of e-learning. Gond and Gupta (2017) and others examined which institutions and initiatives have shaped the e-learning movement in India with historical context in mind, including exploits of institutions such as IGNOU, NPTEL, and NIIT's Netvarsity. In general, they found that early challenges around the internet, coupled with government support, partnerships with private companies, and the emergence of open universities, offered an opportunity to build the historical roots of e-learning. The authors concluded that strategy involved with policy, content development, and building faculty communities was critical in allowing growth for quality and access to more inclusive practices within the digital space. Likewise, Velmurugan and Ramasamy (2017) also discussed the role of digital tools and libraries on supporting higher education through WBL by referring to the project of developing 'faculties' libraries' and access as being considered vital for addressing issues of access while institutions were developing AI and hybrid-enabled methodologies. Several studies have emphasized the significance of Web 2.0 technologies in enhancing e-learning. In their collaborative article Singh and Kaur (2015), they highlight the use of Web 2.0 technologies in distance education and learner-centered learning. Also, Wasim et al. (2014) evaluated participation and collaboration using multimedia and virtual learning environments (VLEs). They reported both positive aspects (accessibility and customizability) and negative factors (infrastructure gaps and learner isolation). Moreover, recent literature supports this claim by arguing that adaptive, mobile, and gamified learning environments represent effective means for creating engagement and improving learning In a design capacity, Maheswari and Gnanam (2020) posited an iterative and multi-disciplinary design in the building of Web-Based Learning Environments (WBLEs), endorsing a collaborative design by designers, developers, and content experts to guarantee usability, scalability, accessibility, and design which engaged behaviorist, cognitive, and constructivist theories. Similarly, Desai and Singh (2024) placed web-based education as an initiative for transformational change, with elements of integrated teaching models, data informed analytics, and collaboration through technology to transform learning. A more recent publication by Diddee (2023) emphasized the necessity of a nationwide standardized web-based educational system in India. Using the Technology Acceptance Model (TAM), this study illustrated how student interaction and engagement with peers and social media impact academic performance. The piece raised the potential of instructional models which mix blended models, use of collaborative tools, and learning analytics, yet acknowledged realities that remain an issue including infrastructure gaps, digital divides, and faculty preparation. Garg et al. (2020) echoed similar concerns; they described disparities, in teacher quality and access to resources, particularly based on urban vs. rural. Their study referred to flexibility of learning and interdisciplinary approaches that were beneficial in an educational technology environment, but cautioned, on the overreliance of internet connectivity and the risk of student isolation. Lastly, **Javed et al. (2014**) investigated the wider implications of WBL in improving access to higher education in India. The authors focused on government initiatives such as NMEICT, SWAYAM, and NPTEL as providing an infrastructure and multimedia content that could be leveraged at scale. The authors concluded that while WBL is a promising approach to democratize education, long-term success depended on a successful integration of pedagogy, technology, and policy.

Research Objectives

1. **To identify the influencing factors on web based learning.**
2. **To investigate the challenges and barriers** including infrastructural, socio-economic, and pedagogical constraints hindering the effective adoption of WBL.

Significance of the study

The importance of this research originates from its twin contributions - theoretical and practical - to the existing higher education system in India. The educationally valuable outcome will contribute to the body of literature on Web-Based Learning (WBL) by documenting the construct's development, pedagogical foundations and challenges in order to address the necessary studies that focused systematically on the Indian context. This study has practical significance, as well, in that it can provide insights for not only policy benefits to leverage organizations like UGC, AICTE and the Ministry of Education to develop better policy initiatives and design more effective strategies through engagement with institutions regarding design, faculty orientation and learner engagement progress. Socially, the study advocates for social justice for essential aspects of accessibility when addressing infrastructural gaps, social and economic inequalities, and accessibility for differently-abled learners. It argues for WBL as a means of democratizing education, particularly as a new means of creating balanced, equitable and standardized educational opportunities across geographical regions. The study also suggests potential uses of digital platforms to maximize technology in the educational sphere, creating a global classroom that permits engagement between learners beyond an educational space. The synthesis of policy, pedagogy and practice address significant gaps in higher education discourse in a rapidly evolving digital education space. In the end, the outcome provides recommendations that support the development of an inclusive, effective and sustainable web-based education system.

METHODOLOGY

Sample

The study surveyed 260 students selected from five major institutes of higher education in Karnataka that offered online degree programs affirmed by the University Grants Commission (UGC): the University of Mysore, Bangalore

University, Karnataka State Open University, Kuvempu University, and Mangalore University. The study was designed to explore the student experience and involvement within the online learning activities. Among them, the University of Mysore, which was established in 1916, is among the oldest and most prestigious in higher education in the state.

The data were collected using a Google Form questionnaire. The first section of the form collects demographic information and the second section collects students' attitudes and behaviors. The participants indicated whether they agreed or disagreed with various statements using a four-point Likert scale (1: Strongly Disagree – 4: Strongly Agree)

Findings

Total 260 respondents surveyed, 92.3 percent said that they had Internet access at home and/or the office for web-based learning. 8.7 percent did not have Internet access at home or work, and most respondents (87.3 percent) were using other access methods—not a LAN or modem; 6.9 percent used a modem, and 5.8 percent used a LAN access method. In terms of computer skill level, most respondents (88.46 percent) stated they were intermediate users—8.07 percent were beginners, and only 3.46 percent identified as advanced users. In terms of frequency of interaction with the instructor, 34.61 percent of respondents reported interacting with their instructor three to four times a week, 26.92 percent about once or twice a week, and 15.38 percent reported instructor contact five to six times a week, with the same proportion indicating that they contacted their instructor more than seven times a week; 7.69 percent indicated they had no contact. Correspondingly, peer-to-peer engagement was reported more frequently than instructor interaction: 42.30 percent reported interaction one to two times a week, 30.76 percent reported three to four times, 15.38 percent reported five to six times, and 5.76 percent reported more than seven times a week; the same proportion (5.76 percent) indicated they had no contact with peers. Finally, in terms of log-in behavior to a course portal to accomplish group work, most participants (73.01 percent) logged into the online learning community in the afternoon, 15.38 percent logged in at times in the morning, and 11.53 percent logged in during the evening, and This information is found in Table 1

Table 1 Internet accellibility profile of respondents (n = 260)

Variables	**Frequency**	**Percent**
Internet accessibility at home/office for WBL purposes		
Yes	245	92.3
No	15	8.7
Tools for access are available		
Lan	15	5.76
Modem	18	6.92
Other	227	87.3
What is your level of computer proficiency		
Beginner	21	8.07
Advanced	09	3.46
Intermediate	230	88.46
How many times do you interact with your instructor each week		
0 times:	20	7.69
1–2 times	70	26.92
3–4 times:	90	34.61
5–6 times:	40	15.38
Over 7 times:	40	15.38
How often do you interact with your classmates each week, either in person or online?		
0 times:	15	5.76
1–2 times	110	42.30
3–4 times:	80	30.76
5–6 times:	40	15.38
Over 7 times:	15	5.76
At what time of day do you usually log in to the college/university's online portal for completing working group tasks		
Morning (6 AM – 12 PM)	40	15.38
Afternoon (12 PM – 6 PM)	190	73.07
Evening (6 PM – 12 AM)	30	11.53
Late night (12 AM – 6 AM)	0	0

An assessment of the effectiveness of WBL programs

A one-way Analysis of Variance (ANOVA) was performed to investigate the association between demographic variables and students' perceptions of accessibility, interaction, and effectiveness of Internet-based learning. The analysis found several demographic variables to be statistically significant at the .05 level. Specifically, the demographic variables such as

(1) Internet accessibility;
(2) computer literacy;
(3) prior experience used or skill of surfing the Internet; and
(4) time of logon to the campus homepage;

The five factors were found to have a meaningful influence on the effectiveness of Web-Based Learning (WBL). Table II outlines the statistical significance of each factor. A one-way ANOVA analysis was conducted to better understand the contributing factors to WBL effectiveness or determine the main contributors of WBL effectiveness (the results are displayed in Table III). The results revealed that all five factors contributed significantly to the outcome of WBL ($p < 0.05$). Table IV displays a comparison of rank ordering of the five factors impact on WBL effectiveness based on data collected in Karnataka. The factor Interactive Applications had the highest ranking (mean = 3.187984496; standard deviation = 0.537200965) followed by Instructor Characteristics (mean = 3.158099688; standard deviation = 0.554796111). The institutional

Table 2 Relationship between Internet accessibility variable and learning effectiveness

Items	**F-value**	**Significance**
Internet accessibility at home/office	10.314	0.021*
Availability of access tool	7.042	0.095
Level of computer proficiency	16.843	0.037*
Frequency of interaction with instructor	11.925	0.029*
Frequency of interaction with classmates	9.457	0.041*
Time of day logging in to complete group tasks	8.134	0.046*

Table 3 ANOVA on factors affecting the effectiveness of Web Based Learning in Karnataka.

Factors	**F-value**	**Significance**
Students' behavior and attitude	8.072187832	0.00002562*
Technology system	8.405569	0.00000107865*
Interactive applications	4.236116	0.005492954*
Institutional factors	0.788393	0.532692981*
Instructors' characteristics	2.713268	0.0287*

Note: denotes significance at $p < 0.05$

The interactive applications factor was rated with an average of 3.142857143 and a standard deviation of 0.596597403 followed by the interactive applications factor with a mean of 3.187984496 and standard deviation of 0.537200965. The Technology system factor had the lowest rating with a mean of 3.137239784 and standard deviation of 0.613361588. Each of the factors demonstrated a Cronbach's a coefficient that was at least equal to 0.617333.

Factor 1: students' behaviour and attitude

One of the major factors impacting the effectiveness of e-learning was student behavior, which has a Cronbach's alpha of 0.6231, indicating acceptable internal consistency. Like the first major factor, student behavior was subdivided into several dimensions to further the understanding of learners' perceptions, especially with respect to how their behaviors related to the online learning environment. The dimensions capturing students' perceptions in the behavior factor included:

(1) students' satisfaction with flexibility of time and place;
(2) students' engagement and participation;
(3) students' level of self-assuredness;
(4) students' self-efficacy with technology;
(5) students' initiative and motivation; and
(6) students' level of anxiety.

The items were created on a four-point Likert scale, where the respondents noted the level of agreement or disagreement with each statement.

Table 4 Mean Rankings, Standard Deviations, and Cronbach's Alpha Coefficients of the Factors Affecting the Effectiveness of Web-Based Learning (WBL) in Karnataka

Factors	Means	Standard deviation	Cronbach's coefficient
Students' behaviour and attitude	3.167953668	0.646638324	0.623118684
Technology system	3.137239784	0.613361588	0.617333

Interactive applications	3.187984496	0.537200965	1.119177
Institutional factors	3.142857143	0.596597403	0.716864
Instructors' characteristics	3.158099688	0.554796111	0.925706148

Table 5 Percent, Mean, and Standard Deviation of Student Agreement on Behavioral and Attitudinal Factors Affecting Effectiveness of Web-Based Learning (WBL).

The table indicates that nearly all respondents (97.69 %) acknowledged that flexibility of time and place are important for web-based learning with the mean agreement score of 3.18 and standard deviation of 0.447064145

Factor 1: students' behavior and attitude that affects the effectiveness of WBL	Percentages of agreement (percent)					
	4	3	2	1	Means	Standard deviation
Satisfaction with time and place flexibility of the system	55	199	6	0	3.18	0.447064145
Student involvement and participation	55	199	6	0	3.18	0.443008746
Higher level of self-confidence	57	197	6	0	3.18	0.448489894
Technology self-efficacy	57	198	5	0	3.2	0.446349414
Students' initiative and motivation	57	198	5	0	3.2	0.446349414
Students' anxiety level	68	144	4	4	3.06	0.446349414
Total Means	58.16	189.16	5.33	0.66	3.16	0.4462685015
Note: The mean score have been calculated based on a four point likert scale, ranging from strongly agree (4) to strongly disagree (1)						

Flexibility became one of the main benefits of web-based learning (WBL). Students consistently reported levels of satisfaction with the individuality of the system, particularly for managing their own learning and workplace responsibilities in the corporate setting. A significant majority of participants (97.69%) reported that their engagement in the learning process increased due to their active participation in class activities, supported with a mean of 3.18, and a standard deviation of 0.44.

Additionally, 98.07% of the participants strongly agreed that students with high levels of technological self-efficacy had more confidence when using digital technologies which also positively influenced their WBL performance. Higher levels of self-efficacy was closely aligned with levels of interaction and engagement in the online learning experience.

Additionally, 81.57% of respondents indicated that the motivation for earning a degree, and with mean scores of at least 3.06, was a strong internal motivation. This academic ambition led to greater engagement in academic commitments, along with a stronger desire to perform better academically.

Table 6 Percentage, mean and standard deviation of student agreement on technology and system that affects the effectiveness of WBL

Factor 2: technology and system that affects the effectiveness of WBL	Percentages of agreement (percent)					
	4	3	2	1	Means	Standard deviation
The layout, design, colors, background, graphics, animations, and configuration of the WBL platform are clear, visually appealing, user-friendly, and supportive of effective learning.	86	166	4	4	3.28	0.5726
The guidance screens and navigation of the WBL platform are easy to use, making it simple to find information.	64	184	12	0	3.20	0.5032
The information provided on the WBL platform is reliable and trustworthy.	53	183	20	4	3.09	0.5782
The IT infrastructure supporting WBL is dependable, secure, and reasonably cost-effective.	55	166	23	16	3.00	0.7404
The browsing speed and connectivity of the WBL platform are satisfactory, with minimal disconnections during tutorials.	58	178	18	6	3.10	0.6119
Total Means	63.2	175.4	15.4	6	3.13	0.6013
Note: The mean score have been calculated based on a four point likert scale, ranging from strongly agree (4) to strongly disagree (1)						

Factor 2: technology and system

This factor refers to the efficacy of the WBL context concerning the technology and systems being employed for e-learning. It also demonstrated acceptable internal consistency, as indicated by a Cronbach's alpha coefficient of 0.617333. The items developed focused on selected aspects using a scale of one to four on a Likert scale. In total, there were a set of ten items pertaining to the following:

(1) screen layout and design;
(2) colour scheme and background;
(3) clear and easy to follow guidance screen;
(4) accessibility to information;
(5) credibility of the information;
(6) reliability and security of the technical infrastructure;
(7) cost of implementation/ investment;
(8) problems when navigating;
(9) disconnection from connection during online tutorials; and
(10) satisfactory browsing speed.

Analysis results illustrate the influence of technology and system-related attributes present in the Web-Based Learning platform in framing students' overall learning experiences. A strong majority of participants mentioned the Web-Based Learning platform's visual and structural components. Specifically, the layout, design, colors, background, graphics and animation were all favourably reviewed, as students found the platform to be aesthetically pleasing, easy to use, and conducive to learning (Mean = 3.28, SD = 0.5726). This indicates that a well-arranged system that is ergonomically designed contributes to more than ease of use, but can help provide upkeep in the learning experience in terms of attention and motivation. In addition to the system's visual clarity, the systems functionality was also noted. The guidance screens and the site navigation of the WBL platform were rated to be involve little effort for students to engage and locate and retrieve information (Mean = 3.20, SD = 0.5032). This is important to note because clear directions and easy navigation can have a positive influence on usability and cognitive load, which can support students' ability to concentrate on learning tasks and not on the difficulty of the usage of the site. The reliability and credibility of the information provided on the platform also received a positive response. Over two-thirds of the participants agreed that the information received was accurate and relevant, as demonstrated by a mean of 3.9 (SD = 0.5782). This finding speaks to the importance of having some academic rigor to the online learning experience and providing students with authentic and validated and reliable information. Altogether, while there was some variation in responses, suggesting room for improvement to further strengthen students' confidence in the credibility of the material provided. The next item of interest was the technical infrastructure that underpins WBL. While students agreed that the infrastructure was stable and secure, there were some concerns about cost-effectiveness (Mean = 3.00, SD = 0.7404). Overall, while stability and security of the IT infrastructure appears sufficient, the cost of maintaining and upgrading is also likely a barrier to the scalability and sustainability of WBL programs. Institutions must ensure to find an appropriate balance between the costs of investing in technology and the value presented to the learners, which is the primary concern for successful long-term operation. Finally, the operational efficiency of the platform in terms of browsing speed and connectivity was satisfactory for the majority of respondents (M = 3.10, SD = 0.6119). Although this figure shows that there were no substantial problems with disconnection rates during tutorials, and an acceptable speed of browsing, many of these issues can be improved. Limited disconnection issues and faster broadband are very much essential to providing students a seamless learning experience (also referred to as one of 'non-disruption') during WBL, especially in online synchronous tutorials where interruptions or speed delays can reduce the effectiveness of the learning experience. In summary the overall, total mean of 3.13 (SD = 0.6013) indicates that students are in general agreement that the technological and system aspects of WBL were positive. Results clearly suggest that while the aspects of design, navigation, information credibility, and system performance received positive evaluations, issues pertaining to the infrastructure costs and long-term reliability were barriers. To improve WBL's success, institutions need to focus on enhancing system performance, being smart in using limited resources to upgrade information technology (IT) infrastructure, and being eternally committed to improving the usability of the WBL platform and the credibility of the information provided on it. Continually monitoring and innovating technological support will be critical in maximizing student satisfaction and learning in WBL contexts.

Table 7 Percentage, mean and standard deviation of student agreement on interactive applications that affect the effectiveness of WBL

Factor 3: interactive applications	Percentages of agreement (percent)					
	4	**3**	**2**	**1**	**Means**	**Standard deviation**
Discussing course topics with classmate's online and sharing knowledge is useful, even if it can be time-consuming.	70	190	0	0	3.26	0.4444
Online discussions allow me to exchange ideas, ask questions, receive feedback, and reflect on my learning	74	176	4	6	3.22	0.5864

I can focus on quality learning during online sessions, and reviewing classmates' work and feedback helps me identify shortcomings and improve my own work.	63	178	15	4	3.15	0.5823
Effectiveness of formal training programs for Web-Based Learning (WBL) and do you find uploading coursework online to be appropriate and easy?	48	194	16	2	3.10	0.5160
Total Means	63.75	184.5	8.75	3	3.18	0.5323
Note: The mean score have been calculated based on a four point likert scale, ranging from strongly agree (4) to strongly disagree (1)						

An analysis of interactive elements in applications indicated students recognize utility in aspects of Web-Based Learning (WBL) centered around online engagement and collaboration. Most students agreed that chatting online with peers about course topics and sharing knowledge, which students described as a time-consuming process is valuable (Mean = 3.26, SD = 0.4444). This demonstrates that peer-to-peer communication represents a meaningful effort to develop understanding and expose students to collaborative learning. Similarly, it was noted that online discussions served as opportunities for thinking through ideas, asking questions, receiving feedback for their own learning and reflecting on their own learning (Mean = 3.22, SD = 0.5864). Overall, an analysis of student engagement and social element (interactivity), clearly indicates that interactive dialogue providing feedback to students enhances deeper levels of critical thinking and engagement in learning to be more effective. Students (many) also had a somewhat favourable perception of quality learning in online sessions as they began to realize that reviewing classmates' writing and feedback was also beneficial, as it helped them to discover their own shortcomings in their writing again considering engagement with feedback (Mean = 3.15, SD = 0.5824). This draws attention to the developmental benefit of peer review as it stimulates self-reflection and fosters academic development within a shared space. Additionally, the appropriateness of the submission of work online and formal workplace learning (WBL) training programs received a positive mean (Mean = 3.10, SD = 0.5160) for simplicity of dressing and ease of uploading coursework online. Overall, these findings indicate when well-planned and purposeful interactive tools and submission systems are leveraged effectively, this all leads to an intimate and efficient learning environment. The overall total mean score was 3.18 (SD = 0.5323) and we can say there is a general view shared by participants in the use of interactive applications in a WBL site. Although students valued the opportunities for collaboration and communal knowledge building, data suggested that some challenges persist where use of time and attendance in discussions were different. Ultimately to keep interactive applications effective, institutions need to facilitate structured guidance on online collaboration, use innovative tools to prompt online discussion and feedback, and acknowledge and support participation of all learners. When interactive applications are properly supported they can enhance learner engagement and peer learning, and help the overall effectiveness of WBL environments.

Factor 4: Institutional factors

Institutional factors that impacted students' regard toward WBL include the following:

(a) Accreditation;
(b) Availability of virtual library;
(c) Method of delivery of course content;
(d) Copyright issues;
(e) Easy accessibility;
(f) Relevance of materials; and students' performance about preference of delivery mode.

The computed Cronbach's alpha coefficient for this factor was 0.717 indicating an overall acceptable level of internal consistency. As seen in Table 8, respondents' perceptions of institutional factors were as follows. At least 60% of participants with a mean score of 2.66 or higher agreed with institutional factors enhancing institutional support utilized in WBLs (accreditation, a virtual library, delivery method, etc.).

On the other hand, more than 60% of respondents with a mean score below 2.50 expressed concerns with institutional responsiveness and the adequacy of academic advising, indicating that these institutional support items are likely seen as areas of institutional support weakness.

Table 8 Percentage, Mean, and Standard Deviation of Student Agreement on Institutional Factors Influencing the Effectiveness of WBL

Factor 4: Institutional factors	Percentages of agreement (percent)					
	4	3	2	1	Means	Standard deviation
Accreditation, course delivery methods, and institutional copyright ownership are important factors in determining the effectiveness and choice of a WBL course.	62	190	8	0	3.20	0.4764

The availability of a virtual library, along with easy access through links, is important for WBL courses.	53	189	16	2	3.12	0.5302
The materials in the virtual library are relevant and meet my learning needs.	67	163	26	4	3.12	0.6361
I prefer e-learning, classroom learning, or a blended combination depending on the context.	67	169	12	12	3.11	0.6899
I am equally effective in both online and classroom modes, though my performance may be better in a traditional classroom setting.	65	172	17	6	3.13	0.6245
Total Means	62.8	176.6	15.8	4.8	3.13	0.5914
Note: The mean score have been calculated based on a four point likert scale, ranging from strongly agree (4) to strongly disagree (1)						

According to institutional factors, students indicated that institutional credibility, availability of resources, and delivery modes are important aspects that contribute to how well Web-Based Learning (WBL) works. Accreditation, course delivery methods, and ownership of copyright were emphasized to considerable or high levels. Most students agreed that these factors were important when choosing WBL courses (Mean = 3.20, SD = 0.4764). In a similar way, a virtual library and links giving access to that library were regarded as significant (Mean, 3.12, SD = 0.5302), confirming that digital resources are increasingly becoming important in supporting flexible learning. The usefulness of the materials associated with these online libraries was also rated positively (Mean = 3.12, SD = 0.6361), indicating the importance of updated, curated materials to support students' academic needs The preferences for modes of learning reiterate the need for flexibility of the institution. An overwhelming majority indicated that they prefer those modes of learning when e-learning, classroom learning, or a mixed mode if applicable, was introduced (Mean = 3.11, SD = 0.6899), suggesting that hybrid mode is the best educational mode of delivery. Moreover, the respondents noted that while they are typically as effective in an online learning environment as a classroom setting, they perform better on average in traditional classroom environments (Mean = 3.13, SD = 0.6245). Therefore, in total, the overall mean total (3.13, SD = 0.5914) was indicative of a mostly positive perception of institutional support of WBL and would convey a relative satisfaction with institutional accreditations, digital resources, and flexible delivery modes.

Factor 5: instructors' characteristics that affects the effectiveness of WBL	Percentages of agreement (percent)					
	4	3	2	1	Means	Standard deviation
My instructors provide sufficient online learning resources; explain how to use the course website, and demonstrate the technical knowledge needed to ensure effective WBL.	56	196	4	4	3.16	0.5144
My instructors are friendly, approachable, enthusiastic in teaching online, and encourage student interaction while respecting students' viewpoints.	68	178	12	2	3.2	0.5473
My instructors can be easily contacted whenever I need help and respond promptly with feedback in discussion forums and email queries	53	177	24	6	3.06	0.6210
My instructors guide online discussions effectively and solve problems efficiently to support smooth learning experiences.	66	178	10	8	3.16	0.5977
My instructors' technical knowledge in using internet technology significantly affects the efficiency of WBL.	62	190	8	0	3.20	0.4764
Total Means	61	183.8	11.6	4	3.15	0.5513
Note: The mean score have been calculated based on a four point likert scale, ranging from strongly agree (4) to strongly disagree (1)						

Factor 5: instructors' characteristics

Table 9 Percentage, Mean, and Standard Deviation of Student Agreement on Instructor Characteristics Affecting the Effectiveness of WBL

The findings pertaining to instructor characteristics indicate the importance of instructors in the success of Web-Based Learning (WBL). Students generally agreed that instructor skills, feedback, and teacher presence are all important in the online learning environment. This was reflected with a mean score of 3.15 and a standard deviation of 0.5513. Suggesting an overall agreement was present among respondents.A majority of the participants strongly agreed that instructors supplied enough online learning

resources, explained how to use course websites, and demonstrated sufficient technical knowledge for the effective operation of WBL. This demonstrates that the students relied heavily on instructors not only for knowledge of content material but also for some technical and navigation support in the virtual environment. With an average response of 3.20, students placed high value on instructors being approachable, friendly, and enthusiastic about their teaching of the online courses. This suggests that learners view positive instructor attitudes and encouragement as motivating, encouraging their engagement in the online course. Further, guidance in online discussions and the ability to efficiently resolve questions and issues were viewed as important contributions to an effective and seamless learning experience. Nonetheless, a few obstacles were noted. The question regarding the inherent accessibility of the instructors and the ability to respond to questions at a reasonable speed received a slightly lower mean of 3.06. While it still represents a positive view for students, this average implies they expect quicker or more consistent response or feedback in the discussions or emails. If there are too long of a period to wait for the instructor, it may reduce the interactive and collaborative principles of WBL. Overall, the findings underscore that the instructor's technical competency, communication skills, responsiveness, and other interpersonal characteristics are critical to the overall effectiveness of WBL. Students not just are interested in learning from the faculty; they see the instructor as someone who enables an interactive, engaging, and supportive online learning experience. As a result, it appears essential for institutions that want to better the outcomes of WBL to invest in their faculty for professional development, particularly with training in technology, online-practice pedagogy, and to respond within a timely manner.

Evaluation

A Chi-square test of independence was conducted to examine the relationship between learners' perceptions of academic performance and their overall satisfaction with (WBL). This to find out the significance of the relationship between the perceived academic performance and satisfaction in the context of WBL. The analysis revealed a significant association, variable ($\chi^2 = 23.45$, df = 4, $p < 0.001$). indicating that students who perceived higher academic achievement were more likely to report greater satisfaction with their learning experience. In Table 10, it is seen that 27.69% of learners rated both Low achievement--Low Satisfaction (Non-adjustable). While only 0.83% in this sample rated both Low achievement--High Satisfaction (Uncompromising), and High achievement--Low Satisfaction (Disenchanted) only indicated 5.77%, high achievement and high satisfaction (Mock-up) appeared in 7.31% of respondents. This data continued to support, in relation to the original study, that learners from this cohort posed no common outcome in the WBL environment. Adaptation styles were apparent again for the respondents.

Table 10 Interrelationship Between Learners' Perception of Academic Performance and Satisfaction

Achievement	Low	Intermediate	High	Total	df	x^2
Low	43 (16.54%)Non-adjustable	22 (8.46%)	7 (2.69%) Uncompromising	72 (27.69%)	4 23.45	
Intermediate	70 (26.92%)	47 (18.08%)	15 (5.77%)	132 (50.77%)		
High	15 (5.77%)	22 (8.46%)	19 (7.31%)	56 (21.54%)		
Total	128 (49.23%) Disenchanted	91 (35.00%)	41 (15.77%) Mock-up	260 (100.00%)		

This table indicates that there is significant variation in student experiences with WBL, as students have adapted to WBL compositions in various methods. Most of the students (50.77%) represent the intermediate achievement group with varying levels of satisfaction which suggests that students are not failing with their academic work nor excelling. The developed non-adjustable group with a significant portion of students (16.54%) with more academic and emotional struggle with WBL. Only a small group of students (7.31%) are associated as the "ideal" mock-up learners who are doing well academically with a high level of satisfaction. The chi-square result validates that achievement and satisfaction have a connection in WBL; however, many students remained moderately engaged or unable to adjust to WBL.

Table 11 Pearson Correlation Coefficients for Grades, Perceived Preference, Self-Efficacy, Satisfaction, and Online Interaction

Variables	Grade scores (CGPA),	Standard deviation	Significance (two tailed)
Perception	3.188	0.590	0.000*
Self-efficacy	3.220	0.564	0.000*
Satisfaction	3.157	0.543	0.000*
Online interaction	3.143	0.554	0.000*

The analysis also explored the link between grade scores (CGPA) and the four constructs related to learner: perception, self-efficacy, satisfaction, and online interaction. The results showed all four constructs are significantly associated with academic performance at the 1% level ($p < 0.01$). Students responded with relatively large averages for perception (M = 3.188, SD = 0.590), self-efficacy (M = 3.220, SD = 0.564), satisfaction (M = 3.157, SD = 0.543), and online interaction(M = 3.143, SD = 0.554). It appears that learners who have positive perceptions of WBL, confidence in their own abilities (self-efficacy), more satisfaction, and more online interaction are more likely to perform better academically.

Results show that students' perceptions, self-efficacy, satisfaction, and online interaction are all related and significant factors influencing academic performance, indicating that students' perception, self-efficacy, satisfaction, and online interaction may be important variables that determine student success in online learning experiences. Learners who have more positive perceptions of WBL, higher self-efficacy, greater satisfaction, and more online interaction have greater academic outcomes.

CONCLUSION

This investigation has shown that a variety of aspects have an impact on the effectiveness of Web-Based Learning (WBL). Possible influences include students' behaviour and disposition, technology characteristics, interactive tools, and characteristics of the instructor. Except for the influence of institutional factors, all other aspects were statistically significant. Students' positive perceptions related to their 'ability to participate effectively' and 'engagement with learning', are significant aspects related to effective learning. Positive perceptions related to finding value in system flexibility, being a participant, self-efficacy, and motivation matter. Similarly, a reliable and user-friendly technology platform and interactive tools (discussion boards) increases levels of student engagement and sharing of knowledge. Instructors are the primary driver of engagement, particularly because of timely feedback, being approachable and supportive of learners' questions, and good technical skills that create a smooth and effective learning experience. Institutional factors, such as accreditation and virtual libraries, have an important role, but have a comparatively smaller influence than the other domains. Collectively, these findings support that maximising student engagement and involvement; developing effective technology environments and resources; and maintaining the availability of instructor support and engagement are useful strategies to build stronger learners' levels of satisfaction and educational achievement in web-based learning.

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