

The Impact of Internal and External Factors of Students on Their Learning Process

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Abstract

This study aims to identify the significant internal and external factors of students on the students' learning process (SLP) in a non-state university in Sri Lanka when lectures are conducted online. Learning style and technology skills were considered as students' internal factors and access to technology, connectivity, and a conducive home environment were considered as students' external factors. Various attributes were considered for each factor. Required data were collected from the selected sample of students through two questionnaires. A new latent variable was developed to measure SLP based on 15 attributes related to the academic motivation of students. The distribution of SLP is skewed to the right with a mean of 72.7 and a median 76.8. The attributes under learning style such as, 'asking questions verbally', 'use of chat box for answers', 'use of video/audio clips', 'checking with individual students if they understand', and 'sharing computer screen' have a positive and significant impact on SLP. Among those attributes, 'asking questions verbally' is the most effective attribute of SLP. Among the attributes under technology skills, 'access to the delivered lecture via Eduscope' (Eduscope is where the registered students can access their recorded lectures online at the Sri Lanka Institute of Information Technology (SLIIT)) has a positive and significant effect on SLP and 92% of students use Eduscope. Among the attributes under technology, most students prefer Zoom to Microsoft Teams or as the shared platform to have lectures. However, the type of access does not significantly impact SLP. 'Use of laptops' as a connectivity device significantly and positively impacts SLP. Among the attributes of conducive home environment: 'background noise' and 'background not presentable' have a significant negative impact on SLP. These findings can be effectively used to plan an efficient online teaching environment. The new index developed is, a good proxy measure for SLP as the attributes of academic motivation of the lecturers, directly have an impact on SLP. It is recommended to carry out similar studies for programme-wise or subject-wise taking a proper sampling frame.

Keywords: New index for students' learning process, students' internal factors, students' external factors, weighted latent factors

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Introduction

The closure of both state and non-state universities due to COVID-19 pandemic continues to have a significant impact on higher education system in Sri Lanka. In response to the significant demand for online teaching, the government provided the Zoom Pro video conferencing facility to all state university staff via the Lanka Education and Research Network (LEARN) for free of charge. The Telecommunication Regulatory Commission of Sri Lanka also introduced several subsidized data packages through various Internet Service Providers (ISPs) to support both academics as well as students in taking part in video conference-based teaching and learning. These facilities and online technologies pose new challenges of technical and non-technical nature to both lecturers and students in the universities. Thus, both state and non-state higher education sectors have taken additional steps to further support the online teaching learning process. Consequently, various studies were carried out by different authors on various aspects of online teaching and learning process in Sri Lanka (Pavithya, et al., 2021; Pinnawala & Hettige, 2021; Pathberiya et al., 2021; Wijesundara et al., 2021) as well as in other countries (Răducu & Stănculescu, 2021; Paul & Jerrerson, 2019; Barrot et al., 2021; Kalimullina, 2020). The study by Wijesundara et al., (2021) has reported that more than 80% of the students have claimed that the online delivery at SLIIT works well, enabling them to continue with studies smoothly.

Engaging learners during this pandemic is a significant challenge for lecturers as they have had no formal training in online teaching. Consequently, lecturers face challenges in adapting themselves to online teaching to support the SLP and enhance teaching with limited time available for communication with students as opposed to face-to-face (F2F) teaching. However, the extent to which lecturers have successfully mastered these techniques and which factors are most relevant to this process have not been adequately investigated. Nevertheless, it can be hypothesized that having a stable technological infrastructure and receiving adequate institutional support are the cornerstones of online learning. Furthermore, subjects which involve laboratory practicals such as engineering, sciences and which involve computer software for mathematics and statistics, etc. create further challenges for online teaching. To tackle those problems, no technology can replace the face-to-face teaching environment because there will be visual as well as verbal discussion which could help to improve students' thinking ability under a homogeneous environment. The learners (students) also have various problems in adjusting to the new environment. Furthermore, no studies have been carried out to compare students' logical thinking during F2F and online learning. Nevertheless, the factors related to intellectual, learning, physical, mental, emotional, social, and personality of teachers may impact the SLP, but no data driven studies were reported to find the impact of specific external and internal factors of both lecturers and students on students' learning process. The objective of this study is therefore to investigate the impact of specific external and internal factors of students on SLP based on a case study from a non-state university. This study can be considered as a continuation of the previous study carried out by Wijesundara et al. (2021).

Materials and methods

Population and sample

SLIIT was purposively selected to represent the non-state universities as it is the biggest non state university in Sri Lanka. It has more than 10,500 undergraduates and postgraduates students (Wijesundara et al., 2021). SLIIT has four faculties; namely Engineering, Computing, Business and Humanities & Sciences and two schools; namely Architecture and Hospitality as well as Culinary. All the undergraduates in SLIIT for the academic year 2001 comprise the population of the study while the students in the Faculty of Humanities and Sciences (FHS) were taken as the sample.

Primary data

The questionnaire that was designed to get the students' feedback under the quality assurance process which consists of 15 attributes (Table 1) for academic motivation of students (AMS) was used for data collection. Responses for each of their subjects were obtained from students who followed different modules for the degrees offered during June to October 2021 by various departments in the FHS. Thus, the sample size was 2064. The questionnaire had a 5-point Likert response scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4= agree, 5 = strongly agree).

According to past studies, no common factors have been used as external and internal factors for students. In this study, learning style and technology skills were considered as students' internal factors while access to technology, connectivity and conducive home environment were considered as students' external factors. To capture various attributes of the external and internal factors, an additional questionnaire that consists of seven questions was distributed to all 2064 students.

Statistical analysis

Basic exploratory analysis, chi-square analysis and exploratory factor analysis (EFA) were carried out using SPSS software. A novel indicator was developed as a Proxy Indicator for students' learning process based on the data collected on Academic Motivation of Students (AMS) (Table 1).

Results and discussion

Proxy variable for students learning process (SLP)

Academic motivation of students (AMS) means motivation of students towards academic activities by the lecturers. It is defined as the enthusiasm of students to participate in online classes, learning activities, and the extent of attention and effort the student puts

into different engagements (Cave, 2003). The fifteen attributes considered for AMS and the mean score for each attribute based on the students’ response (ignoring the neutral cases) are shown in Table 1.

Table 1

Mean Score for 15 Attributes Related to AMS

Code	Attributes used for AMS	mean score
S1	Learning objectives are clear	4.56
S2	Explanation is clear and understandable	4.54
S3	Presentation is interesting	4.48
S4	Friendly with students	4.60
S5	High degree of commitment	4.63
S6	Well prepared on each day	4.67
S7	Use practical examples	4.54
S8	Punctual & reliable	4.65
S9	Knowledgeable of subjects	4.71
S10	Helpful in subject matter	4.67
S11	Different learning styles	4.26
S12	Stimulates my interest	4.25
S13	Teaching materials are very helpful	4.57
S14	Lecturer has motivated me	4.32
S15	Uploaded all the teaching material on time	4.53

The results in Table 1 clearly indicate that the mean scores for almost all the 15 attributes are very high (> 4.5) with the exception of (i) “stimulate my interest”, (ii) “different learning style” and (iii) “lecturer has motivated” confirming high level of student satisfaction for the online lectures conducted by lecturers in FHS. There’s no doubt that these attributes directly influence SLP. Thus, a common factor can be developed based on those 15 attributes, as a proxy variable for SLP.

To identify such common factors (latent variables), exploratory factor analysis (EFA) was carried out via principal component factor extraction method with varimax orthogonal transformation after confirming that the observed data satisfied the precondition of factor analysis (Peiris, 2020). It was found that the initial system of 15 variables can be reduced to

a system of two independent factors and the corresponding eigen values are 9.37 and 1.08. Based on the size of the eigen scores, two factors were named as academic motivation of student factor 1 (AMS1) and factor 2 (AMS2) and defined as:

$$AMS1 = 0.103*S1 + 0.097*S2 + 0.023*S3 + 0.125*S4 + 0.206*S5 + 0.225*S6 + .257*S7 + 0.251*S8 + 0.273*S9 + 0.212*S10 \tag{1}$$

$$AMS2 = 0.406*S11 + 0.389*S12 + 0.179*S13 + 0.319*S14 + 0.112*S15 \tag{2}$$

By weighing the factors with respect to eigenvalues (Peiris, 2020) the proxy variable was defined as $SLP = 9.37*AMS1 + 1.08*AMS2$.

Distribution of SLP

The distribution of SLP is skewed to right (Fig. 1). The values of SLP varies from 19.3 (minimum) to 81.2 (maximum) with a mean of 72.7 and median 76.8. The first and third quartiles are 67.1 and 80.5, indicating that 25% of students got scores less than 67.1 for SLP while 25% of students got scores higher than 80.5 for SLP. Based on the scores of SLP, students were grouped in to two categories on the median value in order to find the association between different attributes and SLP.

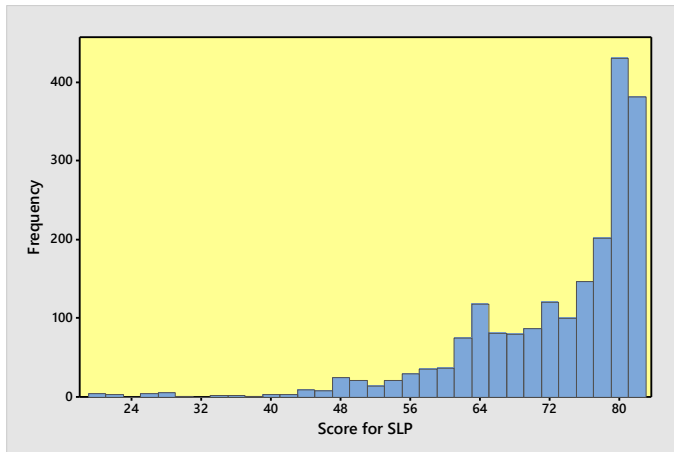


Figure 1. Distribution of SLP

Students' Internal Factors

Impact of learning style on SLP

The percentage scores for the various attributes are shown in Table 2.

Table 2

Students' Response (%) to Different Attributes Under Two Factors of Learning Style

Type of attributes	Percentage
1. Methods through which lecturer interacts with the students	
• Asking questions verbally	83.7
• Chat box for answers	63.5
• Video clips / Audio clips	48.5
• Checking with individual students if they understand	37.4
2. Extra methods through which the lecturer used to give more explanation to the student	
• Shared computer screen	92.2
• Writing pad /Tablet	23.9
• White board on camera	14.9

According to the results in Table 2, the most frequently used method by the lecturers to interact with students is, “asking questions verbally” (84%) followed by “chat box” (64%). The percentage of asking questions verbally is significantly higher than ($p < 0.5$) that of other three attributes. Further, it shows that, “shared computer screen” is the most popular tool used by the lecturers for additional explanation and it is also significantly higher than ($p < 0.05$) that of the other three attributes. The null hypothesis: there is no significant association between the status of use of these attributes and level of SLP was carried out using chi-square analysis. The summary results are shown in Table 3.

Table 3

Status of Significance Association Between Attributes of Learning Styles and the Levels of SLP

Attributes related to type of approach for interaction	P value	Attributes related to extra method used	P value
• Asking questions verbally	0.000	• Shared computer screen	0.000
• Chat box for answers	0.000	• Writing pad /Tablet	0.102
• Video /Audio clips	0.000	• White board on camera	0.175
• Checking with individual students if they understand	0.000		

As all the p-values are less than 5% under type of approaches for interaction, it can be concluded with 95% confidence that the four attributes of which lecturers interact with students are positive and significantly affect the SLP. Similarly, among the extra methods used by the lecturers, the shared computer screen has a positive and significant impact on SLP. Results in Table 4 clearly indicate that percentages of students above the median value of SLP among the students who use such attributes is significantly higher than that of students who do not use such attributes. Furthermore, the difference between percentages in column 2 and column 3 in Table 4 is the highest for the attribute, “asking questions verbally”; which confirms that asking questions verbally is the most effective attribute among the attributes under internal factors.

Table 4

The Percentage of Students Who Obtained SLP Higher Than Median

Attribute	Yes	No
Asking questions verbally	58.8%	27.6%
Use of chat box for answers	59.7%	43.2%
Use of Video /Audio clips	66.2%	46.2%
Checking with individual students if they understand	61.4%	46.4%
Shared computer screen	55.7%	38.8%

Impact of technology skills on SLP

The technology skills were judged by the percentage score (%) obtained for different methods which students used to access delivered lectures (Table 5).

Table 5

Percentage Score (%) for the Attributes (methods) of Access to Delivered Lectures

Method of access	Percentage use (%)
Eduscope (E) alone	64.6
Google Drive or one drive (G) alone	0.6
YouTube (Y) alone	2.5
Microsoft Stream Video (M) alone	2.3
E+G	12.2
E+Y	15.6
E+M	2.2

Table 5 indicates that the Eduscope alone is used by 64.6%. The use of other three methods alone is extremely low compared to the use of Eduscope. Furthermore, Eduscope with Google Drive / one drive, Eduscope with YouTube and Eduscope with Microsoft Stream Video were used by 12.2%, 15.6% and 2.2% respectively. These results confirm that Eduscope is used by at least 94.6%. It was also found that all these methods have positive impact on SLP and the highest impact was found among the students who use both Eduscope and the percentage of students having SLP above median is more than 50% for all seven cases in Table 5.

Students' External Factors (SEF)

Online teaching platforms are education portals that enable teachers to deliver lectures online in ensuring continuity in education. Thus, digital devices like laptops, tablets, etc. are essential items for students to access information for online learning. . If students can not access their classes, lectures, or assignments online; it puts them at a steep disadvantage. Thus, one of the biggest challenges that online education faces is the connectivity of digital devices. Unfamiliar environments will also cause the students to feel stressed, which can affect the students' learning. Moreover, the smooth conducive home environment is also essential for better online delivery. Therefore, three attributes namely (i) access to technology, (ii) connectivity and (iii) conducive home environment were considered for students' external factors.

Impact of access to technology (ACCTECH) on SLP

Internet access opens doorways to a wealth of information, knowledge, and educational resources. Access to technology is influenced by many controllable and uncontrollable factors. In this study, the access to technology was judged by the rate of use of the platforms of which students prefer most to have the lectures. The students' preference for the three main platforms for online teaching can be ranked as zoom (80.8%) > teams (6.0%) > share power point - SPP (1.1%). This is an interesting study to investigate why students do not prefer Teams. However, no significant association was found between SLP category and different online platforms ($\chi^2_1 = 1.146$ $p = 0.284$) .

Impact of connectivity on SLP

One of the biggest challenges that online teaching faces is the connectivity via digital devices, which leaves many students without access to broadband connectivity. The three ways in which online links for the lecture is received are CourseWeb (CW), Emails (EM) and WhatsApp (WA). The CW is the Learning Management System at SLIIT. It is customized to suit SLIIT. The most popular device used to join online lectures by the students is the laptop. Laptops alone is used by 62.2%. The percentages using desktop alone and smart phones alone are 5.3% and 1.5% respectively. The balance 31% of students uses more than one device. Results in Table 6 indicate that the type of device used is significantly associated

with the level of SLP ($\chi^2_3 = 21.757, p = 0.000$). Among the laptop users, the percentage of students getting higher than the median of SLP (53.6%) is significantly higher than the percentage of students getting higher than the median of SLP when desktops or smartphones are used.

Table 6

The Percentage of Students Who Obtained SLP Higher Than Median

Method of joining online lectures	Yes
Laptops	53.6%
Desktops	36.4%
Smartphones	48.4%

Impact of conducive home environment (CHE)

In order to get information on CHE, the students were asked to specify whether they came across the following difficulties: namely connection issues, power failure, lack of data, background noise, background not presentable and device not suitable. The percentage scores for the above six attributes under CHE are shown in Table 7.

Table 7

Difficulties Faced by Students in Online Learning (in %)

Attributes under COHE	Percentage *
Connection issues (CI)	82.6
Power failure (PF)	75.4
Lack of data (LD)	44.7
Background noise	17.4
Background not presentable	6.9
Device not suitable	3.9
None	5.4

* Sum is not 100 due to multiple response

Results in Table 7 indicate that among the six attributes considered under CHE, main difficulties faced by the students are connection issues (82.6%) followed by power failures (75.4%). However, the Chi-square analyses found that only 'background noise', 'background not presentable' and 'power failure' are significant factors ($p < 0.05$) on the level of SLP.

The percentage of students that obtained SLP higher than median when background noise is not present (55.7%) is significantly higher than that of when background noise is present (44.3%). Similar results were obtained for background not presentable. Background noise can exist due to various reasons depending on the environment of the place where you use internet. Unlike face-to-face delivery, the environment under online learning is significantly varied among students which can be considered as an uncontrollable variability.

Conclusions and recommendations

Conclusions

When there are no direct measurements to measure students' learning process (SLP), the weighted latent factor developed in this study based on 15 attributes related to the students' academic motivation can be used as a good proxy indicator to measure SLP. The indicator: $SLP = 9.37*AMS1 + 1.08*AMS2$ was defined as a linear function of two latent factors: (i) academic motivation of students factor 1 (AMS1) and (ii) academic motivation of students factor 2 (AMS2); identified using exploratory factor analysis.

Different attributes of students related to internal and external factors have significantly positive and negative effects on SLP. Among the attributes of which lecturers used to interact with students, 'asking questions verbally', 'use of chat box for answer's, 'use of video/audio clips', 'checking with individual students if they understand', and 'use of shared computer screen' have a significant and positive impact on SLP. Among the attributes, the lecturer giving more explanations, and 'shared computer screen' have a significant and positive effect on SLP. The percentage of students having high SLP among those who practise the above internal attributes is significantly higher than that of students who do not practise above attributes. Access to technology, connectivity and conducive home environment were considered for students' external factors. There is no significant association between SLP and different online platforms used by the students. Among the conducive home environment, 'background noise' and 'background not presentable' have a significant and negative impact on SLP. Though this study was based on a sample based on a non-state university, results derived can be effectively used to improve the students' learning process under any environment.

Recommendations

The above results were applied irrespective of the subjects and programs. Thus, it is recommended to carry out similar studies subject-wise or programme-wise in order to find with-in-variability of internal and external factors. As no marks of the students were obtained, a proxy indicator was developed using marks given by the students for the 15 attributes related to academic motivation. Thus, it is suggested to test the relationship between actual SLP and the new index.

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