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Time-Of-The-Day Effect On Online Learning: An Empirical Study Of Stem And Non-Stemcourses

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Abstract:

Online learning has become an indispensable part of course delivery methodologies since the onset of COVID-19 and it is essential that we understand the learning process in terms of time-of-the-day effects to improve its efficiency. This is a must as productivity may vary during different times of the day depending on the cognitive nature of academic tasks based on the courses learnt online. This paper studies the student engagement patterns of STEM and non-STEM courses among undergraduate students while learning online using a learning management system (LMS). Results show that between STEM and non-STEM courses there is not much of a difference in terms of student engagement in terms of time-of-the-day, while there was variation observed in terms of average duration attended between STEM and non-STEM courses.

Keywords: Online learning, STEM, Cognitive, time-of-the-dayeffect, learning management system

INTRODUCTION

Over the past few years the significance of online education delivery model is now understood by all the stakeholders and now its growth is evident in India. Several leading higher education institutes such as IGNOU, Symbiosis, NMIMS, IIMs, IITs, BITS Pilani, Jadavpur University, Manipal University, VTU etc., have launched programs built around this model.Many educational institutes in India have started embracing E-learning due to obvious reasons.The delivery of course, via electronic media, such as internet, extranets, intranets, satellite broadcast, audio/video tape, interactive TV and CD-ROM is E-learning (Urdan and Weggen, 2000). In the recent times the domain of learning had undergone a sea change and digital learning had become a force to reckon with. It has become a part and parcel of the learning repertoire of the modern day student. The recent pandemic has already necessitated students embracing e-learning to complete their course work from their homes and hostels. Though the government has

announced through is "Pragyata" guidelines in terms of times for online classes for different levels of schools students like not more than 30 minutes for pre-primary students and two sessions upto 45 minutes for classes I to VIII and four sessions of 30-45 minutes for XI to XII, rarely this is being followed. Any one will agree that at certain times learners find it easy to understand and engage with the classes than at other times. Trying to understand how learners may be differently affected by class times may be useful for researchers, educators and students alike. In this paper efforts are made to understand the time-of the day effect and the level of task difficulty. Specifically optimal time-of the day effects will have very little or low influence on tasks that are relatively low in cognitive demands that they require. On the other hand, tasks that are cognitively demanding may be more affected by time-of-the-day. It is believed that when engaged in STEM (Science, Technology, Engineering and Mathematics) subjects, students can develop and reinforce their cognitive skills when compared to non-STEM subjects like humanities, arts, literature, and management. STEM course is often believed to be relatively tougher because of its learning nature and syllabi; while non-STEM students are expected to have an 'easier' flow of learning.

To improve the efficacy of an e-learning environment it is imperative to understand the determinants of cognitive achievement in terms of the time-of-day effects on the learning process. Depending on the complexity of the academic task, it is obvious that learning peaks at certain times and it at the nadir other times. So there may be different optimal times to schedule a mathematics class, environmental studies class or a language class and this is certain to affect productivity.

REVIEW OF LITERATURE

For this study a set of articles related to time-of-the day effect on learner engagement and effect of e-learning of non-STEM and STEM subjects were referred to. McElroy T., and Mosteller L. (2006) in their work on student grades based on time of the day of classes and difficulty levels reported how students' performance was affected by circadian rhythm and time-of-the class and class difficulty. The morning-ness and evening-ness classification was done for the students class recall was used to study the effectiveness and it was found for "difficult classes", the optimal time of the day influenced class grades. It was also found that standard class schedules affected evening ness type individuals.Juhary (2014) in his study on the use of LMS for supplemental learning deals with perceived usefulness of the LMS and attitude towards LMS and behavioural intentions that influence students use of the LMS. The hypotheses were modestly supported. Dimitrova's (2016) work on afternoon effect on students' performance shows that sessions in the afternoon lowered mathematics scores and increased test score and this is a testimonial of optimal time-of-the day

argument and calls for optimal course scheduling. Nolan (2016) in his study on time of the day effect on productivity states that rearranging class schedules improved performance.

Paul J. and Jefferson F (2019) in their work on comparison of student performance for Environmental Science course in face-to-face as well as online learning reported that there was no significant difference in performance overall with respect to the instructional modality or gender or with respect to class rank. It was concluded that non-STEM majors can be taught through online learning to teach the core concepts. For this purpose performance outcomes of 548 students with 147 students being taught online and 401 students being taught in conventional classrooms were considered.

METHODOLOGY

Participants were students of the second year BCA (Batch of 2019) course who studied Visual Programming subject and General English Subjects. The course was offered through an LMS platform and attendance details and session timings recorded through the LMS was used for the purpose of this study. Data pertaining to 72 students (65 boys and 7 girls) was used for this study.The objective is to find whether there is any difference between the student engagement in terms of attendance in subjects which require more cognitive involvement and those which does not require cognitive involvement. This was formulated as a hypothesis and tested.Another hypothesis that was tested was the difference in student engagement patterns between the forenoon and afternoon sessions specifying time-of-the-day effects. Another objective was to find out the average time a student attended an online class for a STEM course and non-STEM course and the average attendance for STEM and non-STEM subjects. Independent sample t-test and dependent sample t-tests were used for the purpose of analysis.

RESULTS AND DISCUSSION

A total of 72 students from Bachelor of Computer Applications programme who took visual programming course (STEM) and General English course (Non-STEM) were considered for the purpose of analysis. A paired sample T-test was performed to understand the difference in student engagement (attendance) for STEM course (M=48.84, SD=26.89) and non-STEM course   (M=49.89, SD = 27.22). The value of t was 1.19. The value of p was 0.238. The result was not significant at p<.05.

In terms of time-of-the-day analysis an Independent sample T-test was carried out for the STEM course separately to understand the significant difference between forenoon session and afternoon session engagements. The same was computed for non-STEM course also. For the STEM course a total of 95

sessions was considered out of which 59 were forenoon sessions and 36 were afternoon sessions. There was no significant difference in attendance between sessions, t (93) = 1.12, despite forenoon sessions (M = 34.92, SD = 12.34) reporting relatively better attendance than afternoon sessions (M=32.25, SD = 9.19). The t-value was 1.121. The p-value is 0.265. The result was not significant at p< .05.
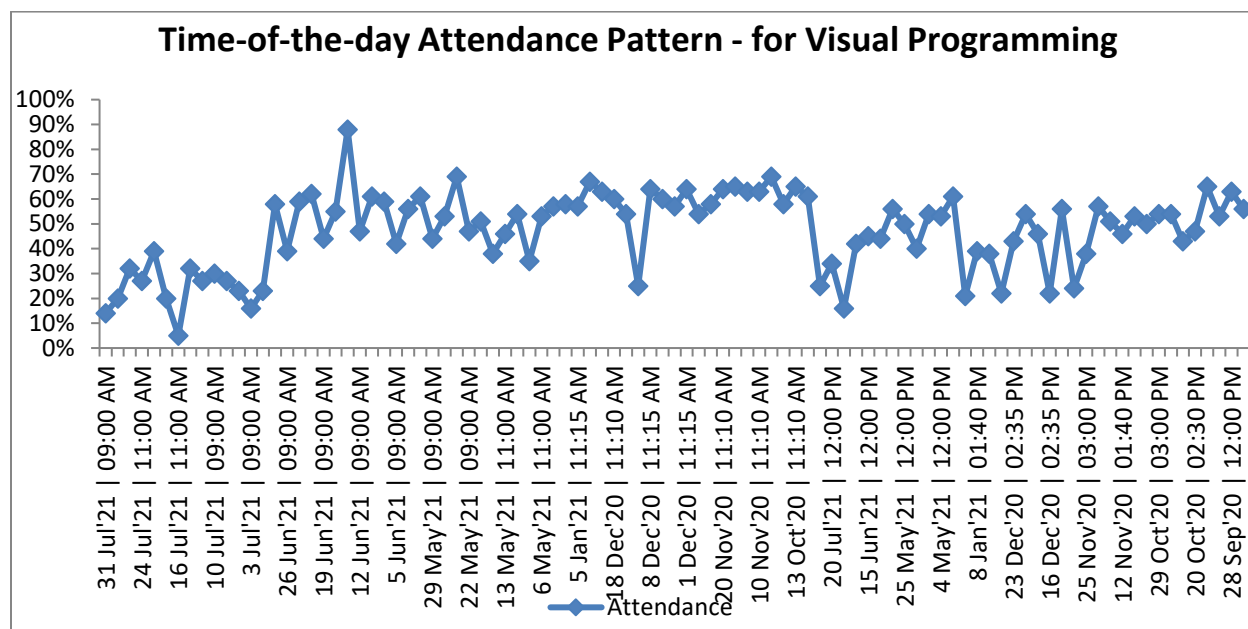

Fig.1 Attendance Pattern for STEM Course (Visual Programming)

Fig.1 presents the attendance pattern for the STEM course for the forenoon and afternoon sessions in that order. Though it may appear forenoon sessions have slightly better attendance, statistically it is not significantly different than that of afternoon sessions.

For the non-STEM course, a total of 68 sessions were considered out of which 34 were forenoon sessions and 34 were afternoon sessions. There was no significant difference in attendance between sessions, t (66) = 1.36, despite forenoon sessions (M = 36, SD = 9.61) reporting relatively better attendance than afternoon sessions (M = 32, SD = 14.1). The t-value was 1.358. The p-value was 0.178. The result was not significant at p<.05.
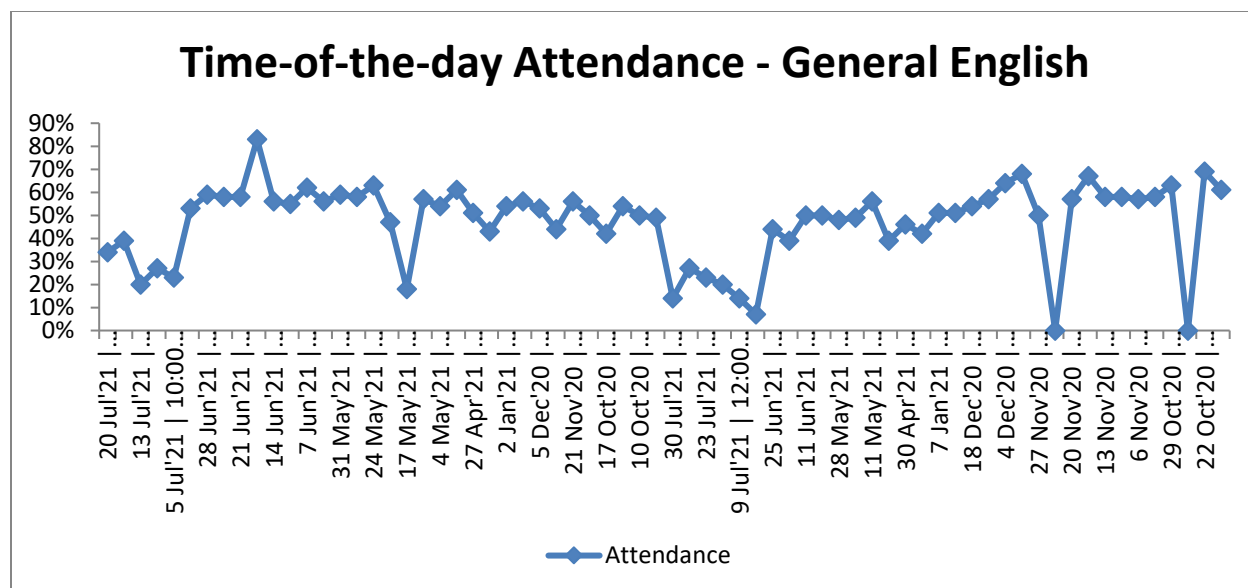
Fig.2 Attendance Pattern for Non- STEM Course (General English)

Fig.2 presents the attendance pattern for theNon-STEM course for the forenoon and afternoon sessions in that order. Though it may appear forenoon sessions have slightly better attendance, statistically it is not significantly different than that of afternoon sessions.

The average duration attended by a student for the STEM course was found to be 68.91 hours and the average duration attended for the non-STEM course was found to be 49.39 hours. The coefficient of variation of attended duration for the STEM course was 15.56 and for the non-STEM course it was 14.73 indicating non-STEM course attendance durations were more stable.

SUGGESTIONS AND CONCLUSION

The study revealed that student attendance patterns do not vary significantly between STEM and non-STEM courses. It was also observed time-of-the-day effect in terms of attendance was not different for forenoon and afternoon sessions for the courses. The average duration of attendance was different for STEM and non-STEM courses. The study did not cover performance outcomes in terms of class test or semester exam performance as well as faculty feedback. These may be studied further to understand the influence of time-of–the-day effect. Further studies can be carried out in this area for more STEM subjects and could be compared with other non-STEM subjects. It is also suggested that we need to understand to what extent classes were passive or interactive to understand the effect of level of interaction on class login time as long periods of passive participation may lead to logouts often.

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