Editor’s Note: Asynchronous learning adds flexibility to the hours, days, and geographic locations where learning takes place. This raises questions regarding technology, when peak loads occur, time-of-week to post online classes, and hours when students need academic and technical support. This study clarifies a host of issues by analyzing student behavior based on the total enrollment of a large distance learning—blended learning program for a period of four years. It sometimes confirms and sometimes changes our frame of reference. For example, scheduling should accommodate student’s lives and family activities, which in turn are shaped by the work week and seasonal holidays. As a result:

“We may need to undergo a mental attitude shift: rather than talking about 'students who work,' it may well be more appropriate to talk about 'workers who study'—where it is irrelevant whether this is paid or unpaid work. In essence most of these students are comparatively resource rich but time poor.”

This study is especially valuable for instructors and administrators for designing and scheduling online programs and support.

Patterns of User Behavior in University Online Forums

Leslie Burr and Dirk HR Spennemann

Abstract

Online forums have become the backbone of most computer-supported distance education programs. While analyses have been carried out assessing the content of a limited number of such forums, there is little work done on how and when students make use of such facilities. There is much talk about 24/7, anytime, anywhere availability—but do students make use of this extended envelope, or is this just education rhetoric? This paper presents the outcomes of a large-scale study examining the usage of over 2000 forums for a period of four years.

Keywords

computer-mediated communication, asynchronous discussions, bulletin board discussions, higher education, student study habits, time use analysis, forums.

Introduction

Studies have shown a phenomenal growth of the internet usage in Australia, with the number of households connected to the internet increasing from 6% in 1996 to 53% in 2003 (ABS 2004; Lloyd & Bill 2004). A recent study based on the 2001 census found that 75% of all users connect to the internet from home; 34% from work and 18% from elsewhere. Of the population surveyed, 25% used more than one access location (Lloyd & Bill 2004). As both an innovator and an early adopter, the Australian education sector has been a major driver in this regard. Internet technology now pervades all aspects of academia, from research and administration to computer-enabled learning. Online discussion forums (threaded discussion boards, bulletin boards) are a major element in developing asynchronous and threaded environments in which students can participate in tutorial discussions regardless of physical locations and time zones.

Some research has been carried out on forums, mainly on the discussion of content, commonly based on a select number of forums (cf. Theodore & Nelson 2004) but also their suitability for specific learning needs, such as field situations (Knowlton 2004), an assessment of usage difference by gender and age (Burr & Smith 2003); matters of rurality as limiters of access (Burr & Smith 2003)
Elsewhere, Burr & Dawson (2003) have addressed the learner-teacher interaction in forums, redefining the passive to active process as an evolutionary process which matures over time and with experience of the environment. The evolution moves from system interaction, through content interaction to the higher levels of learner interaction. Burr developed a methodology for assessing whether a forum is a mere question-and-answer tool or whether advanced learning does take place (Burr 2004).

Some studies looked at student satisfaction and level of engagement with online forums (Virk 2004), but are usually based on selected forums and small samples.

An understanding of student utilization and usage behavior is critical to any such discussion but has rarely been analyzed. There is much rhetoric that digital, online environments allow students to study irrespective of the tyrannies of distance and time (Creed 1998), that learning can, and in fact, does occur 24/7, and that tertiary education providers have to make allowances for this. Does this reflect wishful thinking by pedagogues and university administrators, or is it reality? Online study environments have been around for some time so that arguments of a time-lag for adjustment and familiarization are less and less persuasive.

Users of an online environment do so largely on a non-compulsory basis, so it is important to analyze those who come to the environment despite the predictable hurdles of connection and access. This study, drawing on the very large scale environment of online forums at Charles Sturt University and the large user population of the environment will examine the student behavior in three dimensions: over the duration of a study term; as a factor of the day of the week, and as a factor of the time of day. It will do so by analyzing all forum posts and views for all subjects offered by Charles Sturt University between 2000 and 2003. The large user population allows this study to take Buxton's direction into the "human centric" domain which reflects the importance of usage and activity rather than technology (Buxton 2001).

**Rationale**

The patterns of user behavior are important to analyze both for technical and for pedagogical reasons. On the technical level, they are an indicator of load determinants for network and server traffic predictions. On the pedagogical level, it is important to understand user behavior in order to ensure that the pedagogy is suitable for users. Thirdly, an understanding of the patterns of use allows for the planning and timely delivery of resources and services.

**Load Determinants**

Any newly introduced system will see an increased take up of usage by the student population as both the technology improves and as participants appreciate the usefulness of the features offered. Therefore, online learning systems within enterprise environments must be able to scale to very large levels of use. Predicting levels of use is important in order to ensure that the physical information technology infrastructure has the capacity to deliver reasonable access times, which in turn influences user satisfaction and, ultimately, acceptance of the system. In the ideal world the system is available 24/7 with both a high functional availability and unobtrusive, seamless functionality—it is just ‘there.’

Understanding usage patterns allows maintenance times to be more easily slated with system outages/unavailability affecting as few users as possible. In some circumstances, however, it is impossible to cope with very large peak loads. The release of exam results is a classic example.

If techniques can be found for flattening the peaks of user load, it is possible to amortize infrastructure in order to reduce costs. This modeling can only be achieved by reaching an
understanding of patterns of user behavior. As can be seen by Figure 1, large peaks occur at the start of each session, particularly the (southern) autumn session (February to June).

In physical infrastructure terms a machine has to be sized to be able to cope with the peak, in order that users do not suffer a negative experience. This is particularly important for new users experiencing the environment for the first time. It is critical to ensure that the initial experience is a positive one. At the rate of growth of the forums, it is unlikely that a machine can be sized for that peak growth and then be extensively under-utilized for the greater proportion of the semester. Thus practical ways have to found for phasing the introduction of forums and thus spreading the peak demand.

![Figure 1. Annual Pattern of Daily Forum Posts (daily absolute numbers) at Charles Sturt University.](image)

**Pedagogical Issues**

Understanding patterns of user behavior can influence planning and scheduling of assessment dates, as well as pre-reading and pre-tests to be slated during session breaks. In order to respond to posts in a timely manner, it is important to understand the pattern of online attendance by students. This will then allow for not only a more orderly approach to work planning, so that the lecturer can timetable work sessions throughout the week (anecdotal evidence suggests that lecturers can be overwhelmed by the feeling that they must monitor all their forums throughout the day - and night in some extreme cases!), but that a pedagogical, student-centered approach could be determined. This would allow a lecturer to plan posts on a regular basis, but at a time which is best for the learning outcome.

It may tempting to suggest that the time of posting by a lecturer may influence the pattern of behavior of the user, however later discussion will refute that argument of cause and effect.

**Resource Paradigms**

Patterns of use allows for the planning and timely delivery of resources and services to students. Although current delivery of services is very much tied to “normal” office hours (\textit{i.e.} 9 am – 5
pm, Monday – Friday), a new paradigm of flexible hours which is determined more by the requirements of online learners than the availability of staff must surely develop.

The extent to which a forum moderator is required to be online on a Saturday evening for example, can only be predicted by monitoring and understanding user behavior. Although it is unlikely that staff work patterns will need to totally reflect user behavior, other models of resource provision can be considered.

For example, user behavior may determine that a discipline “generalist” be available online to cover every subject area until (say) midnight. This could be arranged on either a daily, weekly, monthly or session basis. The availability of staff is not limited to academic staff. For example, staff should be available from student services. Some staff may well wish to have this flexibility of work hours and is entirely consistent with the “work from home” established practice of academic staff.

By a detailed understanding of user behavior, a new and efficient model of generalist support can be planned well in advance. In gross terms it can be seen that previously expected high levels of support for weekend and term break periods are in fact not required. Large numbers of users do not appear to take advantage of time away from work (i.e. Easter, Christmas holidays) in order to engage in study. Overwhelmingly, users appear to align study patterns with what is considered “normal” work patterns.

The institution
Established in 1989, Charles Sturt University is a multi-campus institution in New South Wales, Australia. It maintains campuses in Albury-Thurgoona, Bathurst, Dubbo, Goulburn and Wagga Wagga, with study centers in additional localities. In 2003, the majority of a total enrolment of 38,365 students studied via distance education (80.2%) with another 10.7% studying as ‘blended learners’ (i.e. some subjects studied by distance education). The gender balance is slightly skewed towards women, with more among on-campus students (56.8%) than distance education students (53.5%). On average, on campus students are approximately seven years younger than distance education students (25.5 vs. 32.1 years), with little difference between the genders.

Charles Sturt University provides online support for approximately 2,000 different subjects, both internal and distance education, throughout each year. At the time that an online subject becomes available to students, an online forum is automatically generated and linked to the subject. Each forum is populated automatically via the C.S.U. student administration system with each of the students enrolled in that subject. The manager of the forum is electronically assigned via a database list of subject coordinators. Subject coordinators are able to manually create sub forums based on manually selected sub populations of the class list. The subject coordinator is provided with this capability as part of the suite of functions available through the management tool.

The data
Each member of a forum at C.S.U. must authenticate themselves into the forum. Each time a new message is posted or an existing message viewed, these actions are recorded within a database. Thus it is possible to analyze a very large scale online environment using semi-automated techniques. The initial analysis of interaction undertaken within this study concentrated on participation rates as measured by the number of posts and their relationship to views.

The data have been collected for the period 2000 to 2003, covering eight sessions, with data relating to the usage of the forum by time of day limited to 2000–2002. The key academic dates for the period are set out in table 1.
Table 1.  
Key academic dates for the period covered in this study (2000–2003)

<table>
<thead>
<tr>
<th>Year</th>
<th>Session</th>
<th>Begin</th>
<th>End</th>
<th>Begin</th>
<th>End</th>
<th>Begin</th>
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<tbody>
<tr>
<td>2000</td>
<td>Autumn</td>
<td>21 Feb</td>
<td>31 Mar</td>
<td>1 Apr</td>
<td>20 Apr</td>
<td>26 Apr</td>
<td>2 Jun</td>
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<td></td>
<td>17 Nov</td>
<td>16 Dec</td>
</tr>
<tr>
<td>2001</td>
<td>Autumn</td>
<td>19 Feb</td>
<td>31 Mar</td>
<td>17 Apr</td>
<td>5 May</td>
<td>7 May</td>
<td>8 Jun</td>
</tr>
<tr>
<td></td>
<td>Spring *</td>
<td>23 Jul</td>
<td>7 Sep</td>
<td>9 Sep</td>
<td>29 Sep</td>
<td>2 Oct</td>
<td>9 Nov</td>
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<td>12 Nov</td>
<td>23 Nov</td>
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<tr>
<td>2002</td>
<td>Autumn</td>
<td>18 Feb</td>
<td>29 Mar</td>
<td>2 Apr</td>
<td>20 Apr</td>
<td>22 Apr</td>
<td>7 Jun</td>
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<tr>
<td></td>
<td>Spring *</td>
<td>22 Jul</td>
<td>6 Sep</td>
<td>8 Sep</td>
<td>28 Sep</td>
<td>30 Sep</td>
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<td>11 Nov</td>
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<tr>
<td>2003</td>
<td>Autumn</td>
<td>24 Feb</td>
<td>18 Apr</td>
<td>22 Apr</td>
<td>10 May</td>
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<td>13 Jun</td>
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<td></td>
<td>Spring *</td>
<td>28 Jul</td>
<td>12 Sep</td>
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<td>6 Oct</td>
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<td></td>
<td>17 Nov</td>
<td>28 Nov</td>
</tr>
</tbody>
</table>

*) The Residential school period appears prolonged because of the Olympic Class-free period (4 Sep to 2 Oct).

Since its adoption as a fully functional system in 1998, the online forums have seen a substantial uptake in use (Figure 2).

![Figure 2. Total Volume of Forum posts (6mo periods)](image)

**Annual Pattern of User Behavior**

Clearly the patterns of use over a twelve month period show a nexus between the two study semesters and high demand. The University also operates trimesters in parallel with the two main sessions. Although some forums are based on trimesters, and could potentially impact the sessional use profile, the trimester forums are low in number and insignificant in size and activity. Forums based on trimester subjects can therefore be discounted as influencing the present analysis of the annual behavior patterns.
There is a close correlation between the traditional holiday and University breaks and reduced levels of use (Figure 3; Figure 4). Christmas holidays, Easter and mid term breaks are clear examples. These patterns are surprising given that students study predominantly within the distance education mode. One may expect them to undertake most of their study during periods of spare time availability. This does not appear to be the case during the holiday periods. Minimums of use occur during holiday periods.

The pattern is exacerbated by the University calendar, which tends to follow traditional holiday periods. Although not entirely unique to online learning, but related to distance education by whatever delivery mechanism, the breaking of the nexus between the session calendar and the holiday calendar, may provide students with a greater opportunity to devote more time to their study.

However assumptions about cause and effect, particularly as they relate to the ordinariness of everyday life, need to be approached with caution. Because students are on “holiday” does not necessarily mean that they have any more available time for study. For example, women represent 60% of online forum users. During “holiday” periods, and with the possibility of children at home all day (rather than at school from 9am to 3pm), it may well be that women in fact have less disposable time available for study. Although the allocation of study time for distance mode students is outside the scope of this study, this parameter is now less masked by other influences, such as the online environment per se. We may need to undergo a mental attitude shift: rather than talking about ‘students who work,’ it may well be much appropriate to talk about ‘workers who study’—where it is irrelevant whether this is paid or unpaid work. In essence most of these students are comparatively resource rich but time poor.

Figure 3 shows the annual pattern of posts to all forums at Charles Sturt University from 1999 to 2003. The curves are very similar to each other, with 1999 showing two major peaks per semester, while the curves for 2000-2003 exhibit only one peak (see below). It is possible that the 1999 dual peak was influenced by the novelty value of the system. The pattern of views is similar but more balanced (Figure 4).
The curve for the (southern) spring term of 2000 differs from the others, largely because the Australian government directed universities to adjust their teaching calendars in such a fashion that the period of the Sydney Olympics (from 4 September to 2 October 2000) would be teaching free. This reduced the mid-year break and extended the mid-term break in spring. The forum usage, both posts (Figure 3) and views (Figure 4) is low throughout the Olympic period underscoring the observation that actual forum usage reflects the sessional study pattern with holidays as periods of low activity. Moreover, during the Olympic period forum utilization was even lower than during the spring mid-term break in other years.

### Sessional Pattern of User Behavior

An analysis of the sessions provides interesting insights into student behavior over the duration of a thirteen-week study semester. This analysis is based on the average posts and views for the period 2000 to 2003 (posts: n=589,359; views n=28,025,746). The years 1998 and 1999 are excluded from the averages as can be argued that these were the ‘start-up’ years of the forums, where both staff and existing students familiarized themselves with the technology and its opportunities. Beginning with year 2000 intake students and staff were using the forums as a mainstream activity. Figure 5 shows the average sessional usage of the forums for the period 2000 to 2003, with the spring 2000 term adjusted for the Olympics shift. The average ratio of views over posts was 47.6 : 1.

Patterns of use show a peak of activity at the beginning of a major session with the autumn session (and start of the academic year) peaking higher than the spring session. Clearly there is a user expectation and willingness to participate right from the beginning of the session—the participation does not have to “built,” it is ready and available. However, the fact that forum
activity during spring is less than during autumn may indicate that some users became ‘jaded’ and decide that participation is not amenable or advantageous for them.

![Graph showing the pattern of use for CSU online forums 2000–2003](image)

**Figure 5. Average use of CSU online forums 2000–2003 (in weekly intervals, expressed in % of all posts for the year)**

The pattern of use for a given term, be it autumn or spring, are overall the same: a much greater usage before than after the mid semester break. This is particularly the case with forum posts, which also outpace views (in percentage terms) (Figure 5).

The maximum posts occur during weeks 2 and 3 of each term. Posts then fall off during the mid semester break and rise again after the break, but only to approximately 60% of the original traffic. Although this may be explained by a reticence by the user to rejoin a community after a break, it could also be explained as a natural decline in posts (and views) as the session progresses. The curves run in sync during the period before the mid semester break, with posts far outpacing views (in annual percentage terms). While immediately after the mid semester break both posting and viewing activity recommence apace, posts soon drop off altogether, while views continue to the end of term. During the spring term they in fact slightly peak during the pre-exam week.

It would appear that new generation of information or active queries for information declines at that point, while rereading of existing posts becomes the prevalent occupation, most likely linked to end-of semester exam preparation.

**Patterns of Use throughout the Week**

Over the period of a week, the posting of messages is below (theoretical) average on Mondays and Tuesdays, but rises sharply to a peak on Wednesdays, remains above average Thursdays and Fridays, trailing off on Saturdays and Sundays (Figure 6). The viewing pattern, however is different. Students view forums exceed the average from Monday to Thursday, with a peak on Tuesdays (the busiest day for forum traffic).
Anecdotal evidence has suggested that the main study time for distance education was on Saturdays and Sundays—that assumption has largely gone uncontested. Clearly according to use of the forums, this is not the case for forums use. Both in terms of viewing and posting, weekends are by far the least utilized days.

Because so many students are part-time and are in the work force, it may well be that students access the forums from work where they may have faster Internet access and also access to better, or cheaper, printing facilities. It is possible that relevant forum messages are accessed and printed at work and then used for study at home on the weekends. It is also possible that students prefer to use the weekends for the study of their printed materials and textbooks. The fact that forum views peak on Tuesdays, but that forum posts peak the day after seems to lend support to the assumption that people view and print forum posts of interest at the beginning of a work week and rejoin the discussion the day after.

The low utilization of the weekend can have various causes, ranging from competing family and personal commitments to competition for computer and internet access by other family members, in particular school-age children.

Although the demonstrated daily pattern has been established for forums over a period of three years (Figure 6), the question arises as to whether this pattern exists in isolation to other online university services provided to users and whether there is a correlation with services provided to a completely different set of online users. To assess this daily pattern of forum use was compared with the daily pattern of a different university services targeted at the same user group, i.e. the student portal (my.csu.edu.au) and the digital university-student communications and notification system (e-box)(Figure 7).

**Figure 6. Patterns of Forums Use by Day of the week (average 2000 to 2003)**
It was found that the same weekly pattern emerged (Figure 7). This is not surprising since there is a high correlation between use of the forums and the portal, and although the portal is not the only method of accessing the forums, it is the most popular.

**Comparison with other learners**

In order to establish if the pattern is representative of Australian online learner behavior in general rather than just C.S.U. learners, a public site, NSW HSC Online (hsc.csu.edu.au) was analyzed (Figure 7). This site caters for a specific audience of New South Wales Year 12 students and is used heavily by students both in and out of formal secondary school classes (Green 1996; Gorman 2003). Even though NSW HSC Online caters for an entirely different group of learners (in this case senior secondary school students in the age range 16 – 20), the pattern of use is very similar to the C.S.U. environment. An increase in use over the weekend can be noted however.

An examination of public web servers should reveal whether user patterns change once groups of users other than learners are included in the audience. So as to keep the variables to a minimum, the proxy server (proxy.csu.edu.au) and the public web server at C.S.U. (www.csu.edu.au) were chosen (Figure 8).

CSU directs all its outgoing requests for web pages through a proxy server and copies of the files are temporarily cached to improve performance and to reduce traffic (Spennemann in prep). The CSU proxy shows a completely different level of demand, peaking towards the end of the week.
The public web server has a marketing focus and provides information to prospective students as well as providing general information. As such, the daily pattern still reflects the drop off on the weekends, however the weekday traffic appears to be stabilizing particularly over the Monday – Thursday range indicating that the pattern of behavior does begin to change as a different group is introduced into the audience.

The services provided within each of the previously discussed examples are quite different. However it is interesting to note that the user behavior within the C.S.U. environment (i.e. forums, my.csu and to some extent the public server) tends to be similar. However once the services are examined outside of C.S.U. learners, patterns of behavior begin to change.

It would appear that the patterns of daily use are similar for learners whether they are visiting forums, the portal, HSC Online and to a lesser extent the CSU public web server. Note that they are not the same group of learners (in fact they are even across two different educational sectors) but learners just the same. This is a quite unexpected outcome and demonstrates that user behavior is entirely driving the pattern and that the service or the timing of manager postings for example, are unlikely to influence the patterns of behavior.

**Comparison with on-campus students**

How does the C.S.U. forum use compare to on-campus presence? Even though pure on-campus students represent only 9.2% of the student population, with another 10.7% studying as blended learners, i.e. only some subjects in distance mode, they may skew the picture. The forum statistics obviously do not distinguish between the two—indeed, the advantage of the forums is to be able negate many of the requirements of on-campus presence.
Figure 9 plots the on-campus presence of students on all the main three C.S.U. campuses in 2003 (Albury-Thurgoona; Bathurst; Wagga Wagga) as constructed from the timetables and actual enrolment numbers (Spennemann 2004). Also plotted is the usage of on-campus computer laboratories, many of which have 24/7 access (Spennemann et al. in prep). Attendance fluctuates during the week with, understandably, no classes scheduled for the weekend. The usage of the computer laboratories is more level through the working week, with a few students using the labs during the weekend. Compared to these, the forum use is much more level throughout the week and exhibits a much higher usage during the weekend.

![Figure 9. Comparison of the weekly pattern of Forum views with that of on-campus presence of students and computer laboratory usage (in % of the week)](image)

**Implications**

It would appear that forum usage is determined by external factors, such as work week, access to machines and the like, rather than by the academic pattern. Thus it is imperative that the teaching and learning environment plans its activities around the actual usage pattern rather than trying to influence that pattern.

Clearly the reading pattern for learners has moderate use on Mondays, and a high use on Tuesdays, gradually tapering off to Sundays, with a slight increase on Sundays. The greatest ‘reaction’ to views occurs on Wednesdays, when posts are at their peak. Thus if the maximum exposure to new material or postings is to be garnished, then that material needs to be published later in the week (*i.e.* Friday to Sunday) in order to receive maximum exposure on Mondays. Patterns of work behavior by subject coordinators or forum managers for example will need to be adjusted only to the extent that new material needs to be posted during that time. If participation in the forum itself needs to be demonstrated (as part of an assessable item, for example), then this should be scheduled for the middle and later part of the week. It is highly unlikely that learning and teaching outcomes will be substantially increased by participation within the forums on weekends.
Patterns of Use throughout the Day

But if forums are heavily used during weekdays, does that mean that this usage occurs during the work hours (and thus probably from the place of work) or after hours, and thus from home? To assess this, the average usage of forums over the duration of a day, with the figures expressed in percent or the total views per day were calculated.

Online forums were used most heavily in the time band 8 am to 11 pm peaking at 1pm. Another smaller but significant peak occurs in the 8pm to 9 pm time band. Again it is surprising for a distance education focused enterprise that online forums were accessed so heavily in the 9am to 5 pm band. One again, this pattern is more interesting in that it more closely reflects traditional hours of access than it does non traditional patterns – the peak at 1pm most likely caused by lunch time access at the workplace or the CSU computer laboratories – again highlighting that “spare” time is a determining factor.

The time band 7am – 9am shows a remarkably steep increase in traffic indicating that a number of students access forums early in the mornings, possibly within the workplace. Certainly on campus traffic would have a minimal impact on traffic at this time.

The pattern of forum access, established over the past three years (Figure 10) is very high during the working day, peaking at 1pm, which is not consistent with previous surveys relating to conventional distance education study habits. As a result of Charles Sturt University’s high distance education intake, students may be accessing the forums from work during these times, which is supported by the peak occurring during work lunch times. High use also occurs at 8.00 pm, which is more consistent with previous study patterns for distance education students.

![Figure 10. Hourly Patterns of Use – Forums. The horizontal line indicates the 8am (lower line) and 9am averages (upper line)](image)

The traffic between 12 midnight and 1 am is worth noting. Presumably this traffic mostly originates from the overseas student cohort. These will be “real” visitations since forums operate under an authenticated environment, the traffic is unlikely to be automated system tools and
search engines (known as “noise”), common in public web environments. The distribution curve shows a steep rise between 7 and 9 am, a well-developed usage during the work day and a drop during the end of work-day and dinner period. Usage rises again after 7 pm with a high presence between 8 and 9 pm.

The rate of increase of traffic in the mornings is far greater than the decrease in the evenings which tends to have a lengthy “tail”. Surprisingly in order to support the same level of learner activity that occurs at 9 am (which is taken very much for granted in most institutions), the online environment would be required to be resourced until 11 pm. To support the same level of activity as occurs at 8 am (which is becoming the trend in many institutions), a service envelope stretching until 12 midnight would be required. The support required in the mornings is generally provided without question, however the notion of providing that same level of support until 11 pm or 12 midnight would be considered by many to be unjustifiable.

**Comparison with other learners**

Again the question arises as to whether this is a pattern in isolation of other online services and in isolation of other groups of users. The main on-line services for students, forums, my.csu and e-box, show similar patterns, with my.csu usage being higher in the mornings, at the start of the day, and e-box usage higher at the end of the working day during the census months of October 2002 (Figure 11). The “after-dinner peak” is present in all three. These curves are in contrast to that of the HSC Online service frequented by year 12 students. High school student usage starts later than university student usage. This offset is a function of the different circadian rhythms among teenagers (cf. Caskadon et al. 1998, DeWeerd et al. 2003). Furthermore, the HSC curve shows a peak during the main school hours, indication school-based access, a peak after returning home from school (between 16:00 and 17:00) and a peak after dinner, between 21:00 and 22:00. The main difference between is the prolonged high use among HSC Online usage during the evening. If we were to take online usage as a proxy measure for learning diligence, the high school students are much more dedicated learners.

![Figure 11. Hourly Patterns of Use of various Student services October 2002.](image_url)

How does this compare to the general Australian population? Spennemann (in press) developed a web usage curve based on data from five ISP-specific telephone exchanges along the eastern
seaboard of Australia (early 2004; Brisbane, Sydney x 2, Melbourne x 2) (‘Eastern Australia.’ Figure 12). Elsewhere Spennemann (in prep) assessed the average usage of government web pages along the eastern seaboard (State Government Websites of Queensland, New South Wales and Victoria, all first part of 2004), the demand for which is near exclusively of national origin. There is also a small rise in demand after the dinner time period.

The government websites have a well defined demand curve for the work hour period, with a small reduction during the lunch time period. By comparison, the CSU Forum demand is similar in the mornings, but less during the afternoons, but stays higher during the after hour period. The overall activity, on the other hand, shows that the bulk of the demand occurs between 3 and 9 pm. This pattern is most probably a combination of demand for web services both as part of business/work (9am to 5pm) and leisure (after hours), with the after hours period for school students (starting at 3pm) driving up the demand. Common to all is that demand drops off after 10pm.

![Graph showing diurnal variation in Forum usage compared to demand for pages requested from Government Websites on the Eastern seaboard of Australia and the general usage of online connections.](image)

**Figure 12.** Diurnal variation in Forum usage compared to the demand for pages requested from Government Websites on the Eastern seaboard of Australia and the general usage of online connections

**Comparison to on-campus students**

Let us now compare the CSU forum use (Oct 2002) to the student presence on campus (2003), as well as to the student usage of on-campus computer laboratories (average 2001-3) (Figure 13). The on-campus presence is well defined, with a significant peak in the morning and a smaller peak in the afternoon. The computer lab usage follows the general on-campus presence for scheduled classes, but with the demand starting earlier and lasting longer. There is a small tail into the later evening/early night. Forum use, on the other hand, has a much more pronounced use during the hours of the evening and early night.
Conclusion

Using a large-scale multi-year sample of Charles Sturt University online supported subjects, the patterns of annual, sessional, daily and hourly user behaviors in online forums have been developed and analyzed. It was found that, although the online environment has been developed for “any time, any place” learning, the main use is still with the “traditional” year (i.e. low during Christmas/New Year break), during session (i.e. low during session breaks and mid session breaks), “traditional” days (i.e. low on Saturdays and Sundays) and the “traditional” hours (i.e. peaks during 9 -5 office hours). The underlying reasons appear to be that students, while resource rich, are essentially time poor, juggling the demands of work, family and study. Where academics assume that holiday periods without scheduled classes and study workloads represent time-rich study opportunities, others may regard these as actually time-poor periods as out-of-school dependent children compete for time.

The diurnal analysis shows that learning does occur after hours when compared to internal students, but that very little difference exists in terms of weekend study—at least as forum viewing and posting is concerned.

The above has ramifications for resourcing the online environment and the level of support provided. For one, there is little need for costly weekend technical and instructional support. These savings are offset by additional costs requiring such support to be provided until the evening hours of 10 or 11 pm.

The data presented here, gathered over a four-year period, clearly demonstrate that the available technology does not influence study habits, but that work and study habits influence when the technology is being accessed.
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This Journal was established to facilitate collaboration and communication among researchers, innovators, practitioners, and administrators of education and training programs involving technology and distance learning.

An academic institution, Duquesne University, was chosen for its commitment to academic excellence and exemplary programs in instructional technology and distance learning. Duquesne University is supporting the Journal through its graduate program in Instructional Technology and its Center for Technology Education Innovation and Research (TEIR Center). In addition to its educational programs, Duquesne University has major training contracts for industry and government.

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