How are International STEM Undergraduate Students Using Technology to Support their Learning?

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In the UK, HEFCE’s report ‘Enhancing learning and teaching through the use of technology’ (March 2009) highlighted three different levels of benefits from technology:

- **Efficiency**: existing processes carried out in more cost-effective, time-effective, sustainable or scalable manners e.g. e-assessment
- **Enhancement**: improving existing processes and the outcomes e.g. lecture capture
- **Transformation**: radical, positive change in existing processes or introducing new processes

There is evidence of technology use in higher education sector to help with the first two but little evidence of transformation.

However anecdotal evidence of students using technology increasingly outside the classroom in informal settings.
Background: International Students in HE

- National Higher Education Picture:
  - 18% (435,500) of all UK HE students are international
  - Represents over 50% of all postgraduate students and 11% of undergraduate students
  - There are now more undergraduate students (230k) than postgraduate (205k)
  - Main subject areas: business and law, science, technology and engineering

[Source: HESA return 2013-2014]
International Students and their Studies

- Often find our learning and teaching methods ‘strange’ & ‘challenging’

- Anecdotal evidence that many use digital resources e.g. facebook, youtube and other social media to support their studies
Research Questions:

- what digital technologies do international undergraduate students use to support their learning?

and

- “how are they using these digital technologies to support their learning?”
Research Approach

Case Study Approach:

- Survey among undergraduate international students in the Faculty of Engineering and Environment (n=250)
  
  [covers built and natural environments, engineering, IT and digital technologies, mathematics]

- Followed by 12 in-depth interviews/observations

- To provide a deep understanding of how they are using these technologies

- Inform our own learning and teaching practice and delivery approaches.
Research Framework

Identified initial set of 10 Critical Success Factors (from the literature)

- Learning Community
- Collaborative Learning
- Educational Ecology
- Hardware/Software Platforms
- Time
- Space
- Learning Contexts
- Learning Activities
- Ability to use Hardware/Software
- Life Experience
Research Framework

Technology Enhanced Learning

Critical Success Factors

Seamless Capability and Gap

Informal Learning

Formal Learning

International Undergraduate Students

Engaging in activities using different tools

Giving peer feedback to improve ideas

Collaborating with others

Summative and formative assessment

Teaching in the class

Sharing observations with each other

Creating rich learning experiences

Assessing & learning practical ideas

Creative problem solving

Connecting what they see out of class with learning they have done in class
Key Findings: use of digital devices

<table>
<thead>
<tr>
<th>Type of Digital Device</th>
<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desktop computer</td>
<td>42% (104)</td>
<td>26% (65)</td>
<td>10% (25)</td>
<td>19% (48)</td>
</tr>
<tr>
<td>Laptop</td>
<td>88% (221)</td>
<td>6% (16)</td>
<td>2% (4)</td>
<td>2% (4)</td>
</tr>
<tr>
<td>Mobile phone</td>
<td>97% (243)</td>
<td>0</td>
<td>1% (2)</td>
<td>0</td>
</tr>
<tr>
<td>Tablet</td>
<td>32% (79)</td>
<td>14% (34)</td>
<td>12% (30)</td>
<td>31% (77)</td>
</tr>
</tbody>
</table>

Table 1. Frequency of Use of Digital Devices by Students (out of a total of 250)

Note some students did not provide an answer
### Key Findings: On and Off Campus

**Table 2. Frequency of Use of Digital Technology by Students**
(out of a total of 250)

*Note some students did not provide an answer*

<table>
<thead>
<tr>
<th>Hours of Use</th>
<th>1-3 hours</th>
<th>4-6 hours</th>
<th>7-9 hours</th>
<th>10+ hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>On Campus</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>57%</td>
<td>28%</td>
<td>10%</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>(143)</td>
<td>(69)</td>
<td>(24)</td>
<td>(13)</td>
<td></td>
</tr>
<tr>
<td><strong>Off Campus</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16%</td>
<td>34%</td>
<td>37%</td>
<td>14%</td>
<td></td>
</tr>
<tr>
<td>(39)</td>
<td>(84)</td>
<td>(94)</td>
<td>(34)</td>
<td></td>
</tr>
</tbody>
</table>
“When I don’t have my laptop with me ... my mobile phone comes in as it helps me to do this on the go”

“I do find the library a very suitable place for my studies ... it’s a very quiet place to concentrate and it have everything I need”

“I spend about two hours in the university using technology but three hours or more outside the university”

“I prefer to go home to study”
Key Findings: Popular Technologies to Support Learning

<table>
<thead>
<tr>
<th>Technology Tool</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet Websites</td>
<td>79% (197)</td>
</tr>
<tr>
<td>Blackboard (eLP)</td>
<td>78% (195)</td>
</tr>
<tr>
<td>Email</td>
<td>76% (191)</td>
</tr>
<tr>
<td>Social Media</td>
<td>52% (131)</td>
</tr>
<tr>
<td>Youtube</td>
<td>51% (127)</td>
</tr>
<tr>
<td>Document Sharing e.g. Dropbox</td>
<td>41% (103)</td>
</tr>
<tr>
<td>eLibrary e.g. NORA</td>
<td>40% (99)</td>
</tr>
<tr>
<td>Ebooks, discussion board, wikis, blogs</td>
<td>&lt;35%</td>
</tr>
</tbody>
</table>

Table 3. Most Popular Digital Technology Tools
(out of a total of 250)

Note some students did not provide an answer
### Key Findings: Main Purpose

<table>
<thead>
<tr>
<th>Purpose of Using Digital Technology</th>
<th>Response (out of 250)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communicate with other students</td>
<td>71% (178)</td>
</tr>
<tr>
<td>To ask questions</td>
<td>70% (175)</td>
</tr>
<tr>
<td>To engage in discussion</td>
<td>57% (142)</td>
</tr>
<tr>
<td>To share resources</td>
<td>45% (113)</td>
</tr>
<tr>
<td>To support formal assessment</td>
<td>44% (110)</td>
</tr>
<tr>
<td>To evaluate work of others</td>
<td>20% (49)</td>
</tr>
</tbody>
</table>

Table 4. Main Purpose for Using Digital Technologies (out of a total of 250)

Note some students did not provide an answer
# Key Findings: Main Purpose Cultural Difference

## Table 5. Cultural Differences on Main Purpose of Using Digital Technologies

<table>
<thead>
<tr>
<th>Purpose of Using Digital Technology</th>
<th>USA &amp; Europe</th>
<th>North &amp; East Asia</th>
<th>Middle East</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communicate with other students</td>
<td>91%</td>
<td>71%</td>
<td>71%</td>
</tr>
<tr>
<td>To ask questions</td>
<td>76%</td>
<td>66%</td>
<td>71%</td>
</tr>
<tr>
<td>To engage in discussion</td>
<td>55%</td>
<td>59%</td>
<td>51%</td>
</tr>
<tr>
<td>To share resources</td>
<td>69%</td>
<td>48%</td>
<td>34%</td>
</tr>
<tr>
<td>To support formal assessment</td>
<td>41%</td>
<td>45%</td>
<td>41%</td>
</tr>
<tr>
<td>To evaluate work of others</td>
<td>28%</td>
<td>22%</td>
<td>13%</td>
</tr>
</tbody>
</table>
Other Findings and Cultural Differences:
Communication and Feedback

- **Face to face** (77%) is preferred form of communication for working with others but over 50% also cited use of **social networks** and **email** with **messaging** and **phone** at just over 40%.

- **Phone** is particularly popular with students from Asia.

- **Messaging** and **social media** are most popular with students from **Europe/USA**, and is particularly low with students from the Middle East.

- **Discussion forums** are rarely used.

- More **feedback** is received by students via **Blackboard** (45%) and **Email** (42%) than face to face (32%).
Location and Environment

- **Library** (69%) is *preferred location* for effective study followed by home (56%) and classroom (54%), *online learning* was *lowest* at 23%.

- There are cultural differences for *online learning* with 31% of students from **Europe/USA** using it compared to 20% for those from the Middle East.

- **Europe and USA** students (29%) find *collaborative learning* more useful than those from Asia (14%).
Problems with Technology

- **Main issues** in using digital technologies are reported as *technical* (38%) with 29% reporting *Internet addiction* and 26% reporting a *lack of understanding* with the technology.

- Students from **Middle East** and **North & East Asia** reported **more problems** with technology than those from Europe/USA.

- A third of students from **Middle East** reported **poor understanding** of technology compared to under 15% from Europe and the USA.

- **Internet addiction** is higher for students from **Asia** (30%) compared to those from USA/Europe (25%).

- 14% of students from **Asia** report **social issues** with technology compared to <3% with Europe/USA.
Conclusions and Next Steps

✅ Students are **becoming more mobile** in their use of technology – devices and location

✅ They are using technology for a **variety of purposes** both **inside** and **outside** the classroom

✅ There are **cultural differences** in how students access and use technology

➢ This evidence can inform our approach to technology in learning e.g. document sharing more popular than eLibrary!!
Our Related Work

- NUSTEM: an outreach and widening participation project to encourage more young people (especially females and other underrepresented groups) into technology, physical sciences and engineering – see www.thinkphysics.org
- Using games to engage young people in science and technology, UK and Africa
- Evaluation of digital literacy in the wider community