BUILDING THE CAMPUS - INTRODUCING POST-GRADUATE STUDENTS TO LARGE-SCALE DIGITAL VISUALISATION PROJECTS

Panagiotis Patlakas
Southampton Solent University

Dr Chengzhi Peng
University of Sheffield

United Kingdom

Abstract

This paper discusses how the outcomes from the weCAMP-uCampus project can be used to facilitate the introduction of postgraduate students to large-scale digital visualisation projects. It describes the importance of ICT in architectural education, especially with regard to interactive visualisation projects such as uCampus. The rationale for introducing post-graduate students in the modelling process and the challenges relating to this type of research led teaching activity are presented. The managerial and coordinating procedures developed to deal with educational issues are described and their effectiveness is discussed. The paper concludes by summarising the lessons from this exercise.

Introduction

Architectural education at Higher Education (HE) level traditionally offers one of the most varied academic programmes. In a typical UK architecture course leading to professional accreditation, students are expected to take modules in both the sciences and the humanities, with the design studio remaining the central part of the curriculum (University of Sheffield, 2011). This is reflective of the requirements of architectural practice, where the designer is expected to have an appreciation of a range of disciplines and techniques, while keeping up with a constantly changing technological landscape. The latter, together with the broad scope of the studio, places a responsibility on the educator to seek innovation. The essence of the curriculum is in a state of perpetual flux, not only to accommodate industry requirements but also in order to prepare effectively the architectural thinkers of tomorrow.

Information and Communication Technology In Architectural Education

Information and Communication Technology (ICT) plays a major role in contemporary architectural education. Pentillä (2003) has shown that digital design tools have replaced traditional design methods, with Computer Aided Architectural Design (CAAD) integrated in practically all architecture curricula. However, simply utilizing CAAD tools in a design studio does not automatically mean an improved pedagogical experience and the technology is often used only as a replacement of traditional drafting tools.

Interactive Visualisation and Virtual Reality (VR) offer a far wider range of possibilities, allowing the student to engage with his or her design in a variety of roles. Petric, Ucelli, and Conti (2003) have illustrated the potential of these technologies in teaching and learning, while Moloney and Harvey (2004) have documented the use of game engine based collaborative virtual environments in architectural design. The continually increasing capabilities of the Internet have allowed the introduction of large-scale creative collaboration initiatives, as demonstrated by Hirschberg (2003). However, little work has been done with regard to the introduction of architecture students in large-scale research projects in interactive visualisation and 3D modelling.

The weCAMP-uCampus Project

The Sheffield School of Architecture is one of the most research-intensive architecture schools in the UK (RAE, 2008), with particular emphasis in the areas of sustainability and interactive architectural visualisation. In 2008 a research team led by Dr Chengzhi Peng started the development of uCampus, an interactive virtual modelling platform whose main aim is to support institutional learning and innovation. The project was funded by JISC, and was completed in 2010 (Peng et al., 2010).

The platform offers a simple interface that allows the user to combine three different types of 3D models: (a) contextual architectural models (Figure 1), (b) domain-specific data visualisation models, and (c) overlays of data visualisation on contextual models (Figure 2). In addition, there is the capability of navigating in the environment in 3D, in a fashion similar to that of standard first-person computer games. The software was developed in Java EE, and is deployed via Java Web Start. The 3D model format is eXtensible 3D Graphics (X3D), while the Scalable Vector Graphics format (SVG) is used for the 2D map. A ready-made set of 3D models in the DWG was purchased from Zmapping Ltd, and converted to X3D, in order to provide the architectural backdrop of the city landscape.

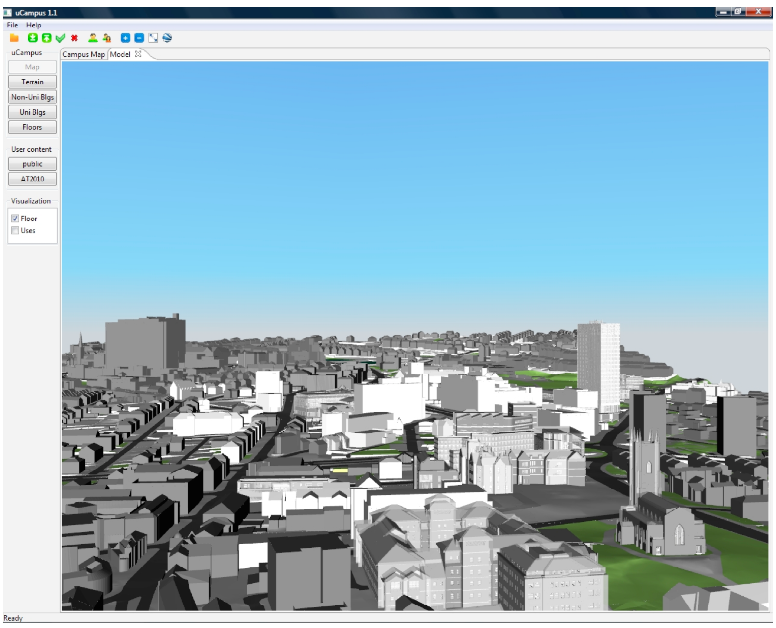

Figure 1. Panoramic view of the campus.

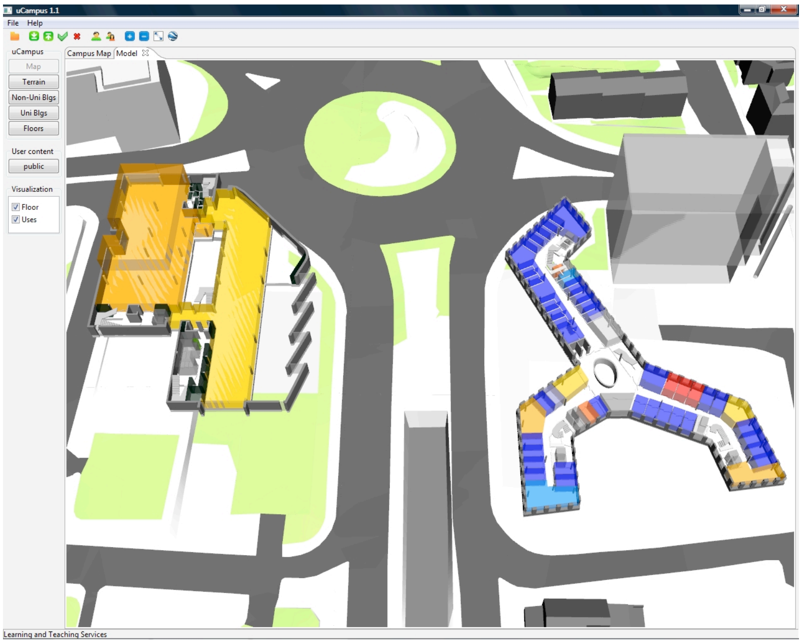

Figure 2. Example of data visualisation models.

Introducing Post-Graduate Students to uCampus

From the start uCampus was envisaged as not only a modelling and navigation platform, but also as a tool for architectural education. It is the focus of a module in interactive urban visualisation taught in the School's post-graduate programmes in architecture, where the students experiment with different proposals in both the building and the urban design scales.

During the development of the platform though, it became apparent that there was considerable potential in involving students further. The idea was to allow students not only to utilise the platform as users, but also take an active role in the production of the 3D models. It was thought that this could be done in a simulated "design office" environment, where each student would take the role of an independent contractor, receiving commissions for individual buildings.

It was considered that such an initiative would hold considerable benefits for the students. On the academic side it would provide them with the opportunity to engage actively with a research project that was cutting edge in its field. This was especially pertinent to the specific cohort, as the post-graduate programmes they were following also function as preparatory courses for doctoral-level research, and a significant number of graduates each year enrol in research degrees.

On the professional side, the students would have the opportunity to further their technical skills in CAAD and 3D modelling, to a level above what would be covered in a post-graduate course. In addition, the project would require of them to adhere closely to a professional-level specification, and produce output that would have to be immediately suitable to be integrated in a live, ongoing project. These skills are considered vital, not only because they increase student employability, but also because they have an impact on the quality of the designs of future architects (CABE, 2003).

Furthermore, there were benefits with regard to the student experience and the strengthening of the students' identification with the institution. It was envisaged that, enabling the students to contribute to a project that would remain a fixture of the School would allow them to feel they "left their mark," and that they had a part in the education of future students.

Finally, providing the students with the opportunity to be financially compensated for their time, in a task directly related to their subject of study, was considered beneficial, especially since in a UK context where there is currently significant controversy over tuition fees in HE (Collini, 2010).

Challenges and Solutions

While the benefits of introducing post-graduate students to such a project are obvious, they come together with a range of challenges and potential pitfalls. Some of these are either architecture or project specific. However, we believe that the majority apply to most disciplines. As such, we believe that the descriptions of those, and the methods we followed to deal with them, contain lessons that could be useful to pedagogues who are considering, or would like to consider, similar initiatives.

Learning, Not Producing

Perhaps the most important challenge that the academic is faced with in attempting such an endeavour is ensuring that the experience is pedagogically beneficent to the student. This is not always an easy task and there are a number of factors that push towards having the students as simply additional workers in the production process. The hierarchical structure of universities, the low levels of funding compared to the industry, and the researcher's natural ambition to achieve the best possible results, could all lead to a disregard for the pedagogic potential. This is clearly unacceptable from an ethical perspective, but also does not enhance the project in the long run.

The project leader made clear from the start that the students' involvement was meant to facilitate their learning. To that effect, the introduction of students to the project was arranged in such a way as to mirror the start of a new module, while a member of the research team was appointed as Technical Coordinator in order to lead and manage the students. On joining, students were given a formal seminar where they were introduced to the specifics of the platform and the output that was expected of them. Project-specific documents were developed by the Technical Coordinator, which functioned as the main study material, including a reading list for further independent learning.

The student deliverables were arranged in a fashion similar to course module assignments. Students were given a detailed brief and samples of good practice, including a description of the main points that would be checked (what would be the "marking criteria" in a project). On submitting, they were given suitable feedback and, if needed, they were to resubmit until they reached the required standard. The whole process was not dissimilar to a standard assignment with initially formative, and finally summative, assessment.

Alignment with the Curriculum

Establishing that student learning is an important target does not automatically mean that this can achieved effectively, as alignment with the broader curriculum can be a major challenge. While it is true that research projects typically follow and stem from the topics taught in the curriculum, this might not always be the case. If a clear and logical connection between the student's study and the project cannot be achieved, it is probably better that this student does not take part in the project.

The observations from the development of uCampus support this point. Originally, participating students were required to have taken a module with a close connection to uCampus. Indeed, the first cohort had all used uCampus before and was conversant with the requirements of the platform. Their contribution to the platform was received more as a continuation of the same module, building and expanding on the topics covered the previous semester. Generally, this group produced work of a very high calibre, while the feedback they gave on their experience was overwhelmingly positive.

Later on, an attempt was made to open the participation to students from all the Masters programmes of the School, as well as PhD students. The results were far less satisfactory and, while a number of students expressed interest, very few showed continuing commitment to the project. It is characteristic that today the platform has kept no models produced by students for whom uCampus did not align with the curriculum of their programme of study.

Equal Opportunities

Even with every care being taken for good alignment between project requirements and the rest of the curriculum, the students will typically have different skills and different levels of technical competence. In a taught module this is not necessarily a problem for the educator as the students can be assessed individually or in small groups, and the varying levels of attainment are reflected in their respective marks. In a research project though this is rarely the case. Instead, there is usually some sort of standardized deliverable and students are expected to produce similar, if not identical, results. It becomes important then to ensure that all students have the opportunity to achieve the desired aim, and that they are given the necessary support to do so.

Our project was a good example of this kind. The students had to deliver work to a professional standard, far above what would give a "Pass" mark at a typical module. The requirements of the project were made clear to the students in advance, and the technical specification was made available to them before they engaged with the project. Students that had taken the relevant module were required to have passed this, and to have illustrated a minimum level of technical competence.

At the same time, the students were made aware that support would be available. Students who were interested in the project but were unsure of their ability to fulfil the requirements were provided with private or small-group tutoring. In addition the Technical Coordinator provided feedback and technical help on a constant basis, supporting the students throughout their engagement with the project. We consider the latter to be a key ingredient for maintaining student commitment and ensuring the desired level of performance, especially given that some students might not be as adept as industry professionals in managing their own workload.

A Fair Deal

The nature of higher education is such that there are various ways for an academic to reward a student for his or her work. While in most industries one would expect monetary compensation for one's work, at a university environment this can take many forms. Extra credit, inclusion in a publication, or even simply performing an activity for its pedagogic value are all used to reward students who contribute to a research project.

While these approaches have their merits, and can be suitable for specific cases, we believe that in order to sustain commitment, achieve results of a high calibre and, perhaps most importantly, ensure students feel they are receiving a fair deal, monetary compensation is very important. This however is not straightforward for workloads that are not directly quantifiable. The University of Sheffield has a standard hourly rate for post-graduate students who take up part-time work, but the commissions our students received though had to be on a 3D model basis and, as they worked mostly from home, it would be difficult to track the hours spent by each student. In addition, the nature of 3D modelling is such that there can be considerable variations in the time it takes different modellers to produce the same result. At the same time we felt that per-hour compensation would be unfair for more technically adept students, as they would be effectively penalised instead of rewarded.

In order to address these issues, we compensated the students on a per-building basis. For every new round of commissions, the Technical Coordinator examined each building and assigned a nominal number of hours, based on the modelling complexity. While the industry standards for similar work were taken into account, we tried to be more generous as there would be time overheads to accommodate student learning and the feedback and assessment sessions.

At the start of every new round of commissions, the students would be sent an e-mail with a catalogue of the available buildings, the source drawings, and the value assigned to each. The students could then ask for specific commissions and would be given those on a first-come first-served basis. First-time contributors were ineligible for this system. Instead they would be given a small trial task, so they could develop a feel for the complexity of the task, the project requirements, and the workload involved. On successful completion of the trial task they would receive the relevant compensation and they could decide if they wanted to be involved more, and to what extent.

This system performed well, and we received no complaints from the students regarding either the level of compensation or the fairness of the procedure.

Workload balance

The project leader established from the start that involvement with uCampus should not come at the expense of students' normal course of study. The fact that students were financially compensated made this even more important, as there could be a temptation for some to prioritise it over their studies.

To ensure this would not happen, the project team took a range of measures. Firstly, the bulk of the models were commissioned over the summer, when the students had only their dissertation work and no taught classes. In addition, it was made very clear to the students, both in their introductory interviews and throughout that their involvement with the project was on the basis of continuous good performance in their schoolwork. Occasional informal enquiries were made to the academics that supervised the students' dissertations to ensure that the project did not interfere with their research work.

Finally, it was considered important to allow the students to stop their involvement with the project at any time. This placed some strain on the project, however the risk was included in the coordination process.

Conclusion

It becomes obvious from the above that the inclusion of the students in the development process of uCampus resulted in some challenges which do not appear in the typical research project. However, providing some ground rules are set and followed, and the proper managerial procedures are in place, the results can be highly beneficial, both to the student and the researcher.

In uCampus, the key elements were: a highly detailed specification, that left little room for misinterpretation; customized learning material for independent study, that assisted the students in improving their technical skills; ample support and feedback for the participating students, thus enabling high quality from all participants; and finally a risk management strategy that allowed the project team to have realistic expectations from the student work.

While the particularities will obviously change in each research project, we believe that similar procedures would be required to ensure success in most cases. The approach can be summarised in one principle: one is working with students, not experienced researchers or industry professionals. With this in mind, the required procedures will follow based on the type of research project, the specific discipline, and the particular student cohort.

We can say with certainty that the involvement of students in the development of uCampus was a great success. The project gained from the contribution of a committed, enthusiastic group of students who produced high quality output. Indeed, almost 75% of the models currently available on the platform were developed by the students, allowing for a comprehensive coverage and volume of data that would have been unattainable otherwise.

At the same time, the students reported to have found this a highly rewarding experience that allowed them to get introduced to a complex research project, enhance their technical skills, and improve their employability.

We believe there is potential to integrate similar activities directly in a design module, especially at a post-graduate level. This is especially pertinent in architectural pedagogy where the question of the relationship between research, scholarship, and the design studio remains open (Varnelis, 2007). Initiatives like uCampus can be viewed as an extension of the "design/build studio" concept (Hinson, 2007) in the digital realm.

From a more general pedagogical perspective we find that such initiatives would lend themselves well to concepts such as constructive alignment (Biggs & Tang, 2007), while the nature of student work for a web-based platform would make it a good fit not only in a traditional post-graduate programme, but also for courses that utilise e-learning and blended learning techniques. We found the development of uCampus a stimulating and educational experience and we are looking forward to utilise the lessons learnt in future projects.

References

Biggs, J., & Tang, C. (2007). *Teaching for quality learning at university*. Maidenhead: Open University Press.

Collini, S. (2010). Browne’s gamble. *London Review of Books*, *32*(21), 23-25.

Commission for Architecture and the Built Environment. (2003). *Building sustainable communities: Developing the skills we need.* London: CABE.

Hinson, D. (2007). Design as research: Learning from doing in the Design-Build Studio. *Journal of Architectural Education, 61*(1), 23-26.

Hirschberg, H. (2003). Transparency in information architecture: Enabling large scale creative collaboration in architectural education over the Internet. *International Journal of Architectural Computing*, *1*(1), 12-22.

Moloney, J., & Harvey, L. (2004). Visualization and 'auralization' of architectural design in a game engine based collaborative virtual environment. In *Eighth International Conference on Information Visualisation, IV 2004* (pp. 827- 832). London: IEEE Computer Society.

Peng, C., Powell, A., Roberts, D., Patlakas, P., Basu, P., Care, L., & Evans, H. (2010). uCampus: *A web-based 3D interactive visualisation modelling platform to effect participative and collaborative planning and design of future learning spaces* (weCAMP-uCampus Final Report). Retrieved from JISC http://www.jisc.ac.uk/whatwedo/programmes/ institutionalinnovation/ wecamp.aspx

Pentillä, H. (2003). Architectural-IT and educational curriculums – A European overview. *International Journal of Architectural Computing*, *1*(1), 102-111.

Petric, P., Ucelli, G., & Conti, G. (2003). Real teaching and learning through virtual reality. *International Journal of Architectural Computing*, *1*(1), 2-11.

Research Assessment Exercise .(2008). Architecture and the built environment. *RAE 2008 quality profiles*. Retrieved from http://www.rae.ac.uk/results/qualityProfile.aspx?id=30&type=uoa

University of Sheffield, School of Architecture. (2011). *MArch in Architecture Course Handbook 2011-12*. Sheffield: The University of Sheffield.

Varnelis, K. (2007). Is there research in the studio? *Journal of Architectural Education, 61*(1), 11-14.