
weCAMP external evaluation report

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Executive summary

The following is a summary of the key findings from our external evaluation of the JISC funded project to develop a web-based interactive visualisation modelling platform to effect participative and collaborative planning and design of future learning spaces.

- The project has been effective in achieving its intended aim of developing a 3D visualisation and modelling application (weCAMP) to help stakeholders in institutional building and space developments better understand and visualise existing and new spaces.
- In terms of creating a version of the application (uCampus) specific to visualising space at the University of Sheffield, the data added has far exceeded the project team's expectations at the outset of the project.
- Feedback from different stakeholders has confirmed that the software application has led to a significant improvement in their ability to visualise existing and planned spaces on the University of Sheffield campus.
- In addition, stakeholders identified other potential uses and further development of the application from which they could benefit which the project team had not envisaged at the outset of the project.
- The extent to which the application can be embedded in University's planning and decision-making processes is, as yet, unknown. However, the project team have undertaken some useful activity in the context of real campus development work that has enabled them to gain a better understanding of how stakeholders can be engaged in using the application to inform the planning and decision-making process.
- The project team have also made significant progress in developing a methodology to enable the application to be adapted for use in other institutional contexts. Documentation has been developed to support others wishing to adopt the technology.

In order to ensure that the project has a meaningful impact beyond the funding period and that the potential benefits of the software application are realised, we suggest this depends on:

- A member of the University's senior management championing and supporting the use of uCampus in future development projects and space planning activities, in order to ensure that the technology becomes embedded within the institution.
- The University and/or JISC investing further resources to enable the development of the application's capability to support some of the activities, initiatives and processes described in this report.

- The development and implementation of a strategy for raising awareness of the project and the software application, both internally at the University and externally amongst other higher education institutions and organisations, such as the NHS.

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1 Introduction

This report contains the findings of our external evaluation of the JISC funded project to develop a web-based interactive visualisation modelling platform to effect participative and collaborative planning and design of future learning spaces. The weCAMP project was undertaken by the University of Sheffield's School of Architecture between 1 October 2008 and 31 March 2010, with a view to:

- a. Producing an online visualisation modelling platform to facilitate collaboration and participation across a wide range of stakeholders engaged in the planning and design of learning spaces in higher education.
- b. Identifying mechanisms by which the learning and knowledge acquired during such planning initiatives is captured and archived for future reference.
- c. Becoming an integral element of the communication process for large projects undertaken by the University of Sheffield.
- d. Sharing the software outputs, the lessons learned and the experiences gained from the project with the JISC community.

The objectives of the project were to:

1. Develop a generic extensible web-based interactive campus visualisation modelling framework (weCAMP) that can be adapted to implement interactive campus visualisation modelling platforms of specific institutions.
2. Populate weCAMP with real estate datasets and deploy the University of Sheffield campus visualisation modelling platform (uCampus¹).
3. Develop exemplars of using uCampus to explore planning and design scenarios of future learning spaces, not only in terms of how they may look like but also in terms of how they may function.
4. Develop exemplars of applying uCampus to the participative and collaborative planning and design processes of specific campus building projects involving real users.
5. Promote participation in the planning process through the generation and dissemination of blogs/wikis on the uses of uCampus by the multiple stakeholders internal to the University as well as external professional planning and design practices throughout the project.
6. Report on the lessons/experiences of weCAMP and uCampus as institutional exemplars on effective planning and design of future learning and other campus spaces.

¹ Originally referred to as shefCAMP

2 About the evaluation

The purpose of our evaluation was to:

- Explore the key achievements of the project team, both with respect to the aims and objectives described above, and the intended and unintended outcomes and benefits for different stakeholders.
- Determine the effectiveness of project activity, management and resources in influencing achievements.
- Identify areas of transferable learning and good practice from the project.
- Assess the potential sustainability and future directions of the project.
- Examine the project team's efforts at dissemination, networking and collaboration.

To facilitate the evaluation process we constructed a logic model to aid communication with the project team and other stakeholders about the project strategy. In this way we were able to check that we had a good enough understanding of the project to frame our inquiry. The model was also a point of reference to reflect on any changes needed, and any differences in stakeholder perspectives about the model for change the project was attempting to effect. An abridged version of the logic model is included in Appendix A.

One of the issues that became apparent when developing the logic model was that some of the items listed under the 'project outcomes' in the bid document were unlikely to be achievable within the timescale of the project, given the scope and timing of project activities. The best that we could therefore hope to achieve when undertaking the evaluation was to assess whether progress was being made towards these longer term outcomes. This assessment, informed by outcomes and progress actually achieved, forms the basis of our judgements about the next stage of the work and what further bids for resource to continue work could be made.

In accordance with JISC guidance, our external evaluation comprised both formative and summative elements:

- The formative evaluation was undertaken during the project to inform the work in progress.
- The summative evaluation was undertaken towards the end of the project to provide evidence of achievements and success, although it also drew upon data collected throughout the project.

Examples of the types of questions that we used to guide our evaluation activity at the formative and summative stages (adapted from JISC guidelines, and based on our own experiences of evaluation) are summarised in Table 1.

Table 1: Summary of questions used at each stage of our evaluation

Formative stage	Summative stage
Have milestones for activities been met on schedule?	How does actual activity compare to that planned?
What is positively or negatively affecting progress?	What outcomes have been observed?
What should be done to improve progress, if necessary?	What benefits are stakeholders reporting?
Is project management effective in guiding project activity?	What connections can be inferred about the relationship between the project and its effects/impact?
How effective is project activity in engaging stakeholders?	What worked or didn't work?
What are their opinions about project activities and their relevance and progress in leading to benefits for them?	What could be done differently?
What lessons are being learnt?	What are the implications for improvement and sustainability of the activity in the longer term, and the achievements of longer term outcomes and impact?
What are the implications for changing the project plan?	What lessons have been learned that are potentially of value to others faced with similar problems or opportunities?
	How are these lessons being shared and being responded to?

The key sources of data used in our evaluation are described below.

2.1 Project Board meetings

Project Board meetings were held on five occasions during the course of the project in order to guide and support the project team. The Project Board comprised members of various departments from across the University of Sheffield and was chaired by the University's Pro-Vice-Chancellor for Teaching and Learning. Project Board meetings were generally well attended and a valuable source of data for the formative evaluation, particularly with respect to assessing progress and the level of stakeholder engagement during the course of the project. Minutes from the Project Board meetings can be obtained from the Project Director.

2.2 Workshops with the project team

We held two workshops with the project team in order to inform the formative and summative stages of the evaluation. The first workshop was held in May 2009 and focused on validating the logic model (using the framework in Appendix B) and identifying the key stakeholders of the project. The resulting list of project stakeholders is shown in Appendix C and was used to guide the interview stage of the evaluation described below. A second workshop was held in January

2010 and sought to ascertain the project team's views on progress to date, achievements and outcomes, stakeholder engagement and potential future directions. Appendix D contains the framework for the second workshop.

2.3 Stakeholder interviews

The summative stage of the evaluation was also informed by interviews with a range of project stakeholders, including:

- Students
- The Estates Department
- Learning and Teaching Services (LeTS)
- The Library
- The Students' Union
- Corporate Information and Computing Services (CiCS)

The interviews were undertaken in February and March 2010, either face-to-face or by telephone. The purpose of the interviews was to explore stakeholders' views on their engagement with the project team, the outcomes and achievements of the project, and the potential future directions and applications of the work undertaken. Members of the Project Board were invited to provide their views by email.

2.4 Other sources of data

In addition to the primary data collection activities described above, we also reviewed the project team's blog and other online documentation, piloted various versions of the uCampus platform and acted as participant observers at engagement events undertaken with different stakeholders, such as external architects and the Students' Union.

3 Findings

3.1 Key achievements

3.1.1 Development of technological outputs

Progress with respect to the development of technological outputs from the project has exceeded that envisaged by the project team at the project planning stage. The two main outputs that were planned were:

- weCAMP - the 'back end' web-based application for storing and manipulating data for visualisation purposes. This is a generic and extensible application that can be used by other developers wishing to create context specific 3D models.

- uCampus - a version of the application that has been populated with data specific to the University of Sheffield.

Progress has been exceeded in relation to two main areas:

- The capacity of the application for modelling and visualising physical space, and other properties such as its usage.
- The amount of data that has been captured to enable visualisation of these properties for the University of Sheffield campus.

Whilst the development of standards for the 3D architectural modelling was envisaged at the outset, an unintended outcome was the extent to which the capability has been developed to overlay these models with different spatial taxonomies, for example about space use. Data in relation to different categories that have relevance for understanding space can therefore be stored and filtered to produce visualisations according to stakeholders' particular interests. This has extended the possibilities for use of the application beyond the visualisation of architectural models and the engaging of stakeholders in the planning and design of external space, campus buildings and their relationships. Possibilities now exist for using the application for many other planning and management purposes. Some of these possibilities are explored in relation to the potential benefits for different stakeholders.

In terms of uCampus (the development of the application to the University of Sheffield context), the application has the capacity to generate over 300 models, viewed by terrain (selected OS grid references), non-University buildings and University buildings (whole and by floor). Originally it was envisaged that development would focus on modelling a selection of around seven campus buildings, some of which were in the process of re-development. The focus of specific building modelling changed slightly, influenced by University management priorities for development. uCampus now hosts data for 48+ hectares of terrain, 70+ University buildings, 90+ University building floors, and 20+ spatial taxonomy profiles (as reported in the project team's final report). Version 1.1. of the application has also been made available on all managed desktop PCs within the University. Although not within the current project remit, the project team has also found time to experiment with adding furniture to specific models where this has been found relevant for the stakeholders with whom they have been working more closely in the latter stages of the project lifecycle (the Students' Union and Western Bank Library refurbishments).

The Project Director described the output as a source of collated data about the current estates situation, importantly providing non-specialists with an alternative to 2D technical drawings to help visualise these data in 3D. The assumption is that this will enable decisions about future investment to be better informed. Given the way that funding is allocated for capital investment, which often needs to be spent within a short time (e.g. two years), there is typically a short 'lead

in' time to development work. Whilst there are existing approaches used within the University for capturing and recording space data using MICAD, this plays more of an 'accounting' role than a tool to aid stakeholder visualisation of buildings.

3.1.2 *Benefits for stakeholders*

The intended progress here was prioritised in relation to different stakeholders. The most important concerned the extent to which primary stakeholders in learning and teaching space at the University of Sheffield would consider the developed application useful in improving their 3D visualisation of space. The aim was that they would feel more informed in their participation in planning processes that would lead to improvement in learning and teaching space.

Some of the issues identified by stakeholders in relation to the planning of learning and teaching space were:

- A lack of flexible teaching space, which forces a more traditional approach to teaching and discourages academic staff from experimenting with newer pedagogical approaches.
- The need for a more 'joined-up' or strategic approach to space provision.

Feedback from stakeholders involved in the early stages of user engagement helped to highlight the value of a 3D campus model which could be used to help visualise the wider context within which new architectural developments would be placed. This value was recognised by both the postgraduate masters students in Architecture (MArch), who uploaded their own design models to uCampus, and representatives from an architectural practice who viewed a demonstration of the application. In particular the practising architects thought that understanding the wider context in which new developments would be placed was extremely important, but getting hold of accurate data to produce appropriate visualisations was very difficult. The software provided a means of linking between development zones so that buildings were not seen in isolation of existing buildings and wider development work. They also thought the application's potential to track what was happening with campus development over time would also be extremely useful for those involved in master planning and new developments. In addition to providing the context in which the potential impact of new development projects could be visualised, the MArch students were also positive about the benefits of using uCampus to work collaboratively and communicate about their uploaded designs.

The main test of the potential of the application in supporting University stakeholders in their planning of space came towards the end of the project in the context of a collaboration with the team responsible for refurbishment of the Students' Union (SU) building. The collaboration arose after the project leader approached the SU team responsible for managing the refurbishment after seeing a press release about the HEFCE grant that had been awarded for this work. The SU team responded to a subsequent demonstration of uCampus by requesting modelling of the

building, and the planned changes to it. The main officer involved in working collaboratively with the team in building models of the current building and planned refurbishment stated that by the time the textures and furniture were added to the model it *“was very impressive and brought much more life to the model”*. A key benefit was that *“it allowed us to show students how the building will change by providing us with some really good visuals”*. They were able to put this on a website² with associated discussion forum to seek students’ views. He was also able to use the models to help staff visualise the changes so that they could plan how they would use the space. The 3D model was found to be much more effective than 2D floor plans in facilitating this process. He also found it useful in planning signage and *“how putting in things like plasmas, floor screen projection etc will affect the overall look and feel of the space”*.

More recently, collaboration has begun with stakeholders with a key interest in the Western Bank Library refurbishment. Again, feedback from these stakeholders was very positive about the existing application in respect of how the 3D visualisation was a significant improvement over 2D drawings in terms of helping them to understand the space. Potential uses of the application, without any further development work, were considered to be in supporting the planning of staff office relocation, stock and capacity management in relation to the library resources, and helping library users to understand and find their way around the space and to find desired resources. The latter two of these are not specific to the refurbishment, but are ongoing issues. For example, old stock is continually being discarded as newer material is received, and the positioning of stock needs to be under constant review to ensure adequate capacity for categories of resources and their logical spatial relationship. The problem with 2D representations is that they provide no sense of vertical scale, which is crucial in the consideration of capacity.

“that for planning for the library would be absolutely fantastic, in terms of the resource we’d need to move all those books around, the time, and communicating with our users” (Library stakeholder)

Additional benefit was perceived if the models could incorporate data about furniture used for storage such as shelving, but the accuracy of models would depend on keeping data up to date. This was not considered to be onerous given the benefits, and resource would be generated as the need for other activities currently being undertaken to support this planning would become redundant.

These stakeholders also recognised the benefit the application would bring in terms of aiding communication about refurbishment plans with architects and building project managers.

Other stakeholders that have had some engagement in the project state that uCampus provides

² <http://www.sheffieldstudentsunion.com/category/future-union/>

“an opportunity to approach how we use and how we plan for the future of learning and teaching spaces in a more ‘joined up’ way.” (Learning and Teaching stakeholder)

“we look at bits of the estate in a very piecemeal kind of way, and I would hope that this software would enable us always to have that bigger view in our mind.” (Learning and Teaching stakeholder)

Feedback from key University stakeholders in the latter stages of the project has been very positive. Indicative comments that reflect the supportiveness of those that have engaged with the project team are:

“I could imagine that we could look with estates at some of the visual models and talk about how they could be used. Whereas at the moment when you talk about them you’ve just got to hold everything in your head. It’s always much easier if you can go to a visual representation.” (Learning and Teaching stakeholder)

“very helpful strategic planning tool” (Library stakeholder)

“Using the free to air software - free downloadable software is obviously a great thing for its future robustness and innovation.” (Project Board member)

“The completeness of the platform, the set of information is quite common place - but the potential of all the plug-ins could be brilliant.” (Project Board member)

“Overall, they’ve done a great job” (Estates Department stakeholder)

3.2 Project effectiveness

3.2.1 Application development activity

The Project Director explained that the success in relation to capability of the technology developed was due to the creativity and innovation of the development team taking the initial proposal, exploring potential boundaries and pushing these forward. However, in the early stages of the project there was some tension between the need for clear standards and specifications to bring rigour to the application development work, and freedom to allow this innovation.

“It is always a difficult balance. You want to have a very well-defined top-down framework imposed at the beginning. But as people start producing ideas, seeing real things coming out, you like something a bit bottom-up to allow that new possibility to occur” (Project Director)

In hindsight the team thought the standardisation and specification could have been defined a little earlier.

The team decided to build a prototype application very early in the project. There was consensus that this had been found to be extremely helpful in providing a focus for discussion and experimentation in relation to the application development. Before this common point of reference was available they had found communication very frustrating.

“it felt like we couldn’t talk to each other, we don’t speak the same language, we don’t know what each other is talking about, and we were all pointing in different directions. As soon as the first prototype came out we found common ground, a point of reference to explain ideas” (Project Director)

The project team reported that a major breakthrough in terms of populating the uCampus application with data was the standardisation of the methodology, which enabled the recruitment and training of students to undertake this task. These students were able to produce models that were indistinguishable from those produced by the project’s technical team. This student involvement was considered vital to being able to produce models quickly, which explains the team’s ability to far exceed their initial expectations in terms of number of models available on uCampus. Most of these students were from the group of taught Masters students in the School of Architecture who had been involved in some of the initial stakeholder engagement. Hence they did have some prior experience of using the technology. In addition to the unintended benefits these students may have received through the opportunity to gain some professional experience, one team member stated that this was a mutually beneficial relationship in the sense that

“we feed off each other, we get much more material produced much more quickly. This is an element that we hadn’t anticipated at all, and now it became a very vital part, not only for this project, but for any possible expansion”
(Project team member)

3.2.2 Stakeholder engagement and internal evaluation activity

Engaging stakeholders was a key activity for helping the project team to understand and realise the intended benefits of the application for stakeholders. The project team agreed that they had made less progress in this area than they had envisaged at the start of the project. Whilst there was some early formative engagement with MArch students, practicing architects, and the ongoing input from the Project Board, the intended engagement with wider stakeholders did not adhere to the planned schedule. There were two main reasons given for this.

The first related to the difficulty of engaging stakeholders in discussions about potential uses and benefits, but with only partially complete models. In this case, engagement was difficult for

stakeholders who did not necessarily have technical insight to abstract from the partially complete models to the potential benefits of the application. This was supported by feedback from one of the Project Board members, who stated that:

“I think it has obviously become clearer and easier to comment on and discuss as the model has become more developed and sophisticated. It needed a critical amount of data before I could be critical.” (Project Board member)

The Project Director reported that learning how to do this was more problematic than had been considered at the outset, and since the development of the technological outputs progressed much more quickly than had been envisaged it seemed more straightforward to focus on this and postpone the stakeholder engagement until models were more fully developed.

The second related to the usefulness of the formative feedback in relation to these partially complete models. The internal evaluator reported that there became a stage halfway through the project when nothing new was being learnt from stakeholder engagement to inform the future directions of the work. Since excellent progress was being made in developing the application it was decided to wait until the application was substantially more developed before seeking further stakeholder feedback. He stated that the team were now [January 2010] in a much stronger position to learn more from this engagement because *“we have a really robust system where we can go and say ‘this is the capabilities of it as it exists, now how can you see yourself using this as a practical application?’”*

The early engagement with the postgraduate MArch students involved them using the application to support their learning in the context of their own architectural design work. This was most helped the project team to clarify some of the key issues around usability of the application, and how its use might be integrated in a beneficial way with the use of 3D design tools such as SketchUp. The early formative feedback from practicing architects helped to confirm that issues such as being able to keep private architectural models that were under development were extremely important, and that developments such as the addition of spatial taxonomies and the integration with Google Streetview were valuable components that were not, to their knowledge, available in any other 3D visualisation tools.

Some negative user feedback from a practising architect about the usability of the application in relation to developing 3D architectural models helped to demonstrate the potential for misinterpretation of the technology, its capability, relationship with other design tools, and purpose in the planning process. It revealed an expectation that it could be used as a detailed architectural modelling tool with similar functionality to other tools such as Sketchup. Negative comments also related to the rendering and manipulation of the models. The application has been designed to work seamlessly with plug-in X3D viewers, but the capability of these is beyond

the control of the team. They reported that any improvement in these plug-in viewers could significantly improve the user experience and would require very little modification of the underlying weCAMP platform.

This feedback highlighted the need for the project team to manage more carefully stakeholder expectations during the engagement process.

“We underestimated their expectations. [] I think for any further user engagement, in particular engagement with professional design practice, [] we have to prepare ourselves in such a way as to manage expectations before they see these products to avoid any unfair outright rejection.” (Project team member)

Managing expectations was also raised as a potential issue in other discussions, such as those with Library stakeholders. Many potential uses and benefits of the system were recognised, but for some of these further development work would be needed to realise the benefits. At present there is no further resource to undertake this development work.

The later collaboration with staff involved in the Students’ Union refurbishment was thought by the team to be an important stage in the project in terms of testing the application in a real planning situation. According to the Internal Evaluator this *“has changed the direction of the stakeholder engagement.”* The project team decided to use the collaboration as a means of learning how to engage effectively with stakeholders in a real planning situation. Here the nature of the engagement was driven by requests for support, with the project team responding as far as possible to these requests. This was found to be an intense and time-consuming process but has been found valuable in informing how future collaborations might be managed. From the perspective of the SU stakeholders, the collaboration worked well because of early agreement about the aims of the collaboration and how the teams would work together, and good communication.

The project team has since been contacted by a firm of architects involved in another significant campus redevelopment. A member of the team stated that the experience of working with the Students’ Union

“should allow us a much more directed conversation about how they as an external design team could engage with the platform. [] This serendipitous delay in engaging with them has allowed us to potentially go to them with a much more focussed presentation about how they might engage with it.” (Project team member)

One group of stakeholders that the project team have not yet engaged with is University neighbours, such as residents and local businesses. The reason given for this was the lack of a clear purpose for doing so.

“through our experience of engaging on other projects with lay people, with neighbours, you have to have a reason. It’s not always appropriate to go to people and say ‘hey, we’re doing this research project, what do you think?’ unless it is something within that project that is real, that affects them or might affect them.” (Project team member)

Originally the team envisaged that neighbours would be involved *“if the University was planning a new building [] that you could talk to people about”*, but this clear sense of purpose has not arisen in the project life cycle.

Given the reasons already discussed for the more limited stakeholder engagement than was originally envisaged, engagement of neighbours was no longer considered a priority for the short remaining time of the project. One team member also thought that one of the initial drivers for including these stakeholders in a developmental project of this kind was concern about individuals’ privacy, if data about their personal external environment were held in the uCampus database. However, Google Streetview was released early in the project lifecycle. This provided much more detailed data than the team had originally had plans to capture.

3.2.3 Project management

Project management was organised in such a way that overall leadership was provided by the Project Director. Strategic project decisions were ratified by the Project Director, and a Project Board made up of representatives from key stakeholder groups from within the University of Sheffield. The project direction was informed by the generation and debate of ideas at both core team meetings, and Project Board meetings. Stakeholder feedback, when available, was also used in a formative way to inform these discussions.

The core project team reported that operational decision making and activity was managed in quite an informal way, largely because of the close working proximity of the team and the personalities of the group involved allowed for this to work effectively. The Project Manager stated that at this level the capacity of the team to self-manage was due to *“qualities of the individual team members”*. Meetings were quite frequent in the early stages of the project when the direction and operationalisation of the project was less clear, but much less frequent in the latter stages of the project when team members had greater clarity about the contributions required of them. Some semi-formal procedures were introduced half-way through the project, once the application had reached such a stage in its development that any changes to it would have an impact on work that had been done previously. This presented particular challenges with

respect to team communication, which the team addressed by recording ideas into different categories to explore how they would fit with existing features, and whether there were potential conflicts, resource and maintenance issues.

The relationship between the application development and the Internal Evaluation was also semi-formalised. The close physical proximity of the Internal Evaluator to the application development team meant that it was straightforward to keep them informed of learning that could inform the development work. However, the Project Director also highlighted the importance of keeping some 'distance' between the Project Manager and Internal Evaluator on the one hand and the application development team on the other. This was to ensure there was a sufficiently independent perspective, informed by other stakeholders, to critically question operational decisions and actions in relation to the broader strategic aims of the project. This was perceived as resulting in

“healthy discussion about what was technically possible [], and from our point of view how people were going to integrate and use it. I think this was really beneficial.” (Project team member)

It was also suggested that *“this relationship has helped build something better and more robust than it would otherwise be.”* (Project team member)

The Project Manager reported that the way the team had worked together meant that they always felt well prepared, had anticipated issues and dealt with them promptly, resulting in positive feedback from the Project Board about the progress being made. This also seemed to be the case with respect to JISC expectations and requirements:

“Whenever we ever go to speak to people at the JISC conferences [] it always seems to be that the major issues that come up we’ve started dealing with before they mention them, or we’re well on with it anyway.” (Project Manager)

The Project Board meetings were more formally scheduled for every three or four months. From the project team’s perspective, the meetings were treated as self-imposed milestones by which time some demonstrable progress needed to have been achieved. This helped in maintaining momentum in the project. The project team also found the feedback and ideas generated by the Project Board were invaluable in clarifying direction and priorities for the project team, particularly in the very early stages when they were faced with a very diverse range of options. For example, the team stated that it was the Chair of the Project Board that encouraged them to focus on the development of spatial taxonomies and filtering capacity of the application, and it is this that has resulted in the opening up wider possibilities for its use.

Project Board members were also asked about the extent to which they felt a management structure of this kind enabled them to provide input to developmental projects of this kind. Feedback was largely positive, with indicative comments being:

- The meetings were *“well organised, run and chaired.”* (Project Board member)
- About the usefulness of having non-technical people involved in the project and providing a different and broader perspective

Comments relating to the limitations of the meetings were:

“time for discussion was quite brief and I think there are some issues that needed considerable discussion, but time is always an issue.” (Project Board member)

“the technical nature of the information given sometimes prevented a more directioned but broader discussion.” (Project Board member)

Suggestions from the team and Board members’ about expertise or perspectives that were perhaps missing from the Project Board and hence informing the strategic direction of the project were:

- An external specialist in 3D models, to bring in industry knowledge in this area.
- Representation from academic staff with a more direct role in learning and teaching.
- An external representative from another University who may have worked on a similar project or been involved in pioneering new digital tools.

3.2.4 Project resources

The project team members were asked to reflect on the extent to which decisions about resource allocation and use had been adequate and helpful for supporting project activity towards achieving project aims. There was consensus that on the whole these were appropriate. The only difficulty was associated with the servers needed to support the developed application. Resource had been allocated for purchasing this hardware, but the only location available for housing this was in close proximity to the application development team. The noise of the running of this hardware did create difficult working conditions for the team, until the application was transferred to a ‘virtual’ server. It was also suggested by another team member that the server purchased would have been unable to support the number of requested transactions anticipated once the application was fully embedded within University processes. With this hindsight, the Project Director stated that he probably would not have purchased the hardware, and would have planned for the virtual solution at the outset.

3.3 Transferable learning and good practice

The project team agreed that the transferable learning was in respect of two main areas:

- The methodology for developing the application, and in particular with respect to populating it with data to enable the generation of models.
- How to use the application to support stakeholder engagement in campus development projects.

The technical team emphasised that transferable learning about methodology concerned how to specify, standardise and quality control the storage of large volumes of data for 3D manipulation. This included learning about the level of experience required of those involved in doing this. An important aspect of the methodology was to develop a prototype to aid communication in the early stages of the project life cycle. Also important was the fairly early development of a mechanism for a formal communication and consultation on proposed changes, and their potential impacts, resource and sustainability issues.

The application was also dependent on existing technologies and standards, such as X3D, 3D viewers, and Google Streetview. The team learnt about the strengths and limitations of integrating these into the development of a web-based 3D visualisation application. This learning is discussed in detail in the project team's own report.

Learning from the collaboration in relation to the Students' Union refurbishment provides the basis for understanding how to manage future collaborations.

3.4 Sustainability and future directions

The application development team described the technological output of the project as 'future proof' in the sense that it is extensible, robust, and maintainable by a suitably trained technician. Documentation has been produced to support maintenance and further development work. However, the data in uCampus will eventually become out of date as the University of Sheffield's estate changes over time. A stakeholder from the University's Estates Department suggested that one way of preventing this would be to create a live link between uCampus and MICAD (the primary source of the team's modelling data), so that any changes in the latter are automatically reflected in the former.

Following their experience of working with students, the project team thought that population of weCAMP with contextual data relevant to other institutions would need to be guided by one specialist with good CAD knowledge and skills. These skills would be needed to be able to interpret how to apply specifications outlined in the project output documents. However, they thought that only elementary CAD knowledge and skills would be required for building models. This has been tested by the team through their employment and training of architecture students

to undertake this task. One of the team thought that knowledge of architectural modelling would be important for developing models of buildings, since the architectural training helps to develop the ability to make the elementary decisions needed to translate 2D technical drawings into 3D data. However, the architectural training becomes less relevant to adding spatial taxonomy data e.g. about space usage. For those with an appropriate technical background, it was thought that a period of about two weeks would be sufficient to learn how to populate the database.

The project team discussed the importance of needing to embed the use of uCampus for supporting visualisation into University processes of stakeholder consultation. This was so that plans for new developments could be visualised within their wider campus context. Feedback from other stakeholders also reflected the need to progress embedding the application in planning processes. For instance,

“I would think that in the future there is scope to involve students in discussions about how space is developed. [] I think it’s something that you can look at and talk about together or you can look at in advance of a discussion, and then you come to it a bit better informed.” (Learning and Teaching stakeholder)

Other potential applications that have been discussed are its use for building management.

“I imagine it could enable us to have a better idea about how space is used and possibly when it’s used.” (Learning and Teaching stakeholder)

An issue that has arisen in stakeholder discussions, is the need now for training on the purpose of the software, how it can be used, and the advantages of using it so that it can be used in a meaningful way.

“it’s usability is critical I’m not sure I could use the model on my own.” (Project Board member)

However, the resource for this does not exist within the existing project scope. As is recognised by the project team and other stakeholders that have been engaged in the project

“it is so dependant on use and buy-in from the University. This is very difficult to achieve in my view with all departments so stretched. I also think it has to be tied in with any master planning.” (Project Board member)

In relation to the potential further development of the technological capability, suggestions from within the team, and from other stakeholders have been:

- To build a temporal dimension to the models, by date-stamping data so that it can be filtered according to this date-stamp.

- Linking the model to a room booking system, so that users could visualise the spaces available when making their booking decisions.
- Linking models to databases of library resources, to support users in finding these resources.
- Adding spatial taxonomy data about the use of learning resources (e.g. books, PCs) in communal learning space.
- To visualise wireless internet connectivity across the University estate and the location of computer rooms (which can be difficult to find).
- To create a mobile version of the uCampus application for use on smart phones, such as Apple's iPhone, with a routing option in order to aid wayfinding around the University estate.

3.5 *Dissemination, collaboration and knowledge sharing*

The achievement of longer-term outcomes of the project (i.e. those beyond the scope of the current funded period) depends to a large extent on collaboration and knowledge sharing activity.

The project team have already benefited from their involvement in the JISC network of project teams with a focus on innovation in learning and teaching spaces. This has resulted in a successful joint bid for further funding of £15,000 from the Benefits Realisation Small Project Funding support strand of the JISC Institutional Innovation Programme. The partners in this project are the iBorrow project team from Canterbury Christ Church University, and the SMART project team from Buckinghamshire New University. The aim of the project is to demonstrate how data can be captured, stored and represented to improve understanding of patterns of learning behaviours in technology-rich learning centres. weCAMP will be used to model contextual data from a technology-rich learning centre at Canterbury Christ Church University, to demonstrate its transferability of use to other institutions. The data used will be architectural data, overlaid by tracking data about the use of IT resources, specifically Netbooks. The role of the Buckinghamshire New University team is to act as critical friend. The benefit for them will be in helping them to define an area they would like to explore in a future collaboration relevant to understanding how their own technology-rich building space might be better understood.

In addition to this secured funding, the Project Director is also exploring the potential for collaboration with a JISC project team from Bolton University. This aim of this project would be to explore use of the technology in supporting the 'greening' of university estates. For example, one of the spatial taxonomies that could straightforwardly be added to uCampus is that of energy consumption, to enable comparison between different spaces that form part of the estate.

The project team indicated that it was their intention to complete a dissemination strategy before the end of the project, but this was not available for inspection at the time of writing.

4 Conclusions and recommendations

Appendix E provides an overview of the extent to which the project has achieved the aims and objectives set out at the beginning of this report.

The project has been effective in achieving its intended aim of developing a 3D visualisation and modelling application to help stakeholders in institutional building and space developments better understand and visualise existing and new spaces. In terms of creating a version of the application specific to visualising space at the University of Sheffield campus, the data that has been added has far exceeded the project team's expectations at the outset of the project, and includes several layers of data relating to the physical arrangement of space, but also other dimensions relevant to space such as types of learning and teaching space. Functionality of the application allows for filtering of this data to generate visualisations according to stakeholders' particular interests in the space. Stakeholder feedback has confirmed the project team's judgement that this is a significant improvement in the ability to visualise the University's estate.

In terms of stakeholder engagement with the application, the team made less progress with this in the middle phase of the project than they had hoped, but decisions about this were appropriately informed by stakeholder feedback received from early formative stages of internal evaluation activity. Engagement activity was significantly stepped-up in the final stages of the project, and the feedback that has been provided during the summative evaluation phase has been very positive about:

- The extent to which the application helps stakeholders understand and visualise learning and teaching space.
- The potential for it to be used in reviewing and planning estates development to be aligned with learning and teaching strategy.

In addition, stakeholders identified additional potential utility of the platform that had not necessarily been envisaged at the outset, and potential areas for further development of the platform that would also benefit stakeholders.

The extent to which the application can be embedded in University planning and decision-making processes is as yet unknown. The project was funded for an 18 month period, and it is unrealistic to have expected any evidence of embedding within this period. However, the project team have undertaken some useful activity in the context of real campus development work that has enabled them to gain a better understanding of how stakeholders can be engaged in using the application to inform the planning and decision-making process. Further embedding would now seem to be dependent on support from the University senior management that would enable the work to be taken forward. The Project Director has a scheduled presentation with the University Executive Board, but this is after the end of the funded project period. Hence it is not possible to

include the outcome from this at the time of writing this report. However, some of the stakeholders who have given individual feedback in respect of their other roles are also members of the UEB. Their feedback has been positive in terms of indicating their support for embedding of the application.

With respect to what has been learnt that is transferable beyond the specific context of the University of Sheffield, the project has made significant progress in terms of the methodology required for the development and adaptation of the application to other institutional contexts. The platform specifications and methodology have been documented as important outputs that can be used by others wishing to adopt the technology. Other useful learning is in respect of the approach to engaging stakeholders in using the platform for their own purposes, particularly for informing planning and decision-making in relation to learning and teaching space. The value of this learning has already been recognised to some extent by the award of further JISC funding to explore the possibility of realising these benefits in other institutions, and reporting on the success of this is outside the remit of this evaluation.

Based on the above conclusions, our recommendations are that:

- A member of the University's senior management should seek to champion and support the use of uCampus in future development projects and space planning activities, in order to ensure that the technology becomes embedded within the institution.
- The University and/or JISC should consider investing further resources to enable the development of the application's capability to support some of the activities, initiatives and processes described in this report.
- The Project Director should devise and implement a strategy for raising awareness of the project and the software, both internally at the University and externally amongst other higher education institutions and organisations, such as the NHS.

Appendix A: Logic model (abridged version)

Rationale for change	Resources/enablers/enabling activities	Main activities	Desired outcomes (funded project period)	Longer-term outcomes	Anticipated longer-term and wider impact
UoS engaged in intense period of campus regeneration involving significant capital investment.	Project team develop extensible web-based interactive campus visualisation modelling framework (weCAMP).	Project team initially implement uCampus on campus-wide basis only	uCampus users give feedback about their experiences of using it in the planning and design of learning spaces at UoS, and the support available for using it	Use of uCampus in a participative planning and design process improves the integration of UoS Estates strategy with the L&T strategy, leading to improved stakeholder satisfaction with learning spaces.	uCampus becomes an integral and embedded component in supporting participation, communication, and collaboration in large learning space projects in the institution.
Learning spaces need to accommodate changing expectations of staff and students with respect to flexibility and use of media and technology in supporting L&T.	Project team populate weCAMP with UoS estates data to create UoS specific 3D visualisation and modelling platform (uCampus).	Project team use variety of approaches to encourage internal and external stakeholders to use uCampus in the planning and design of learning spaces.	Improved institutional records of estates assets (quality and accessibility of data).	uCampus is used to access and provide information about the campus and its facilities.	Use of uCampus leads to a more joined-up and informed approach to developing a sustainable campus learning environment.
HEFCE funding for capital investment requires institutional strategy to be aligned with academic strategy.	Project team develop online briefing materials for uCampus users.	Stakeholders in the design of learning spaces at UoS work together in using uCampus to plan the development and use of future learning spaces.	Use of uCampus improves working relationships between different stakeholders involved in the planning and design of learning spaces at UoS and improves the basis on which decisions about learning spaces are made.	Use of uCampus improves institutional knowledge bank about what is learnt from projects to inform future developments.	Use of uCampus leads to more effective use and understanding of learning space.
Opportunity to address these needs has been presented by the learning and outputs from AHRC-funded		Project team iteratively evaluate user engagement with uCampus to inform its		uCampus is used in participatory planning	

Rationale for change	Resources/enablers/ enabling activities	Main activities	Desired outcomes (funded project period)	Longer-term outcomes	Anticipated longer-term and wider impact
<p>project (SUCoD).</p> <p>There is now wide ranging technological capability available that is not currently being fully exploited to help improvement in designing learning spaces</p>		<p>development and use.</p> <p>Project team develop material to share learning with internal and external stakeholders and engender debate about the technology and its use.</p> <p>Project team work collaboratively with other JISC project teams.</p>	<p>Project team have improved understanding of the value of uCampus in supporting the planning and design of learning spaces .</p> <p>Stakeholders and JISC collaborators recognise Project team as a source of expertise in the technology and its use.</p>	<p>and design processes for large scale estates projects.</p> <p>Lessons learned from project, and the sharing of these lessons, lead to further opportunities for innovatory projects and collaboration.</p>	

Appendix B: Workshop 1 framework

Questions for Logic Model Validation

Drivers for project activity

Do you think column 1 adequately reflects the challenges and opportunities for the stakeholders identified in your analysis and that the project is trying to address? Suggested amendments?

Benefits, outcomes, impact

This relates to columns 4-6

Column 6 attempts to describe the difference the project is trying to make for stakeholders.

Thinking about the different stakeholders we have talked about, does this adequately describe the change you want to effect?

Columns 4 & 5 separate the intended outcomes that are needed to achieve this eventual transformation between those that are achievable in the project period, and change that may be needed in the longer term by embedded activity but which is unrealistic in the short term.

Thinking again about the benefits for the different stakeholders you have identified:

Do the outcomes (column 4) realistically reflect the benefits for the different stakeholders that you think are achievable by the end of the funded project period? Suggested amendments?

Do the longer term outcomes reflect what you are trying to achieve in the longer term?

Project activities (Column 3)

Do the activities listed correspond with what you are doing or intend to do and are they logical/consistent with achieving the project outcomes?

Are there any that you see as more important/critical?

Conditions/resources (Column 2)

This describes important preliminary activities and influences that may affect the undertaking of main activity and therefore its effects? Are there any other critical factors on which the project depends which we need to explore in the evaluation?

Checking overall validation

Is there anything that we have not already discussed that you think would be a key indicator of 'success' of the project?

How would you like to think others would describe the project if they considered it successful?

What would you like to learn from the evaluation?

What do you think other key stakeholders would like to learn from the evaluation?

Appendix C: List of project stakeholders

Stakeholder(s)	Interest in the project	Importance
Internal		
Estates staff (capital projects)	Responsible for delivering new learning and teaching spaces on behalf of the University. uCampus will enable them to engage with UoS staff, students, senior management and other stakeholders during the planning and delivery of new learning and teaching spaces.	Critical
Project team	Responsible for developing and raising awareness of uCampus.	Critical
Senior managers	Responsible for make strategic decisions about the provision of new learning and teaching spaces. uCampus will enable them to make more informed decisions and keep up to date with new developments. It may also support their understanding and use of the existing estate.	Critical
Academic staff	Responsible for undertaking the University's learning and teaching activities and therefore primary users of the University's learning and teaching spaces. uCampus will enable them to contribute to the planning and design of new learning and teaching spaces and keep informed about new developments. It may also support their understanding and use of the existing estate.	High
Corporate Information and Computing Services staff	Responsible for providing and managing the information technology in new learning and teaching spaces. uCampus will enable them to contribute to the planning and design of new learning and teaching spaces and keep informed about new developments. It may also support their understanding and use of the existing estate.	High
Current students	Primary users of the University's learning and teaching spaces. uCampus will enable them to contribute to the planning and design of new learning and teaching spaces and keep informed about new developments . It may also support their understanding and use of the existing estate.	High

Stakeholder(s)	Interest in the project	Importance
Learning and Teaching Service staff	Responsible for developing and supporting implementation of the University's Learning and Teaching strategy. uCampus will enable them to contribute to the planning and design of new learning and teaching spaces and keep informed about new developments. It may also support their understanding and use of the existing estate.	High
MArch students	Primary users of the University's learning and teaching spaces. uCampus will enable them to contribute to the planning and design of new learning and teaching spaces and keep informed about new developments . It may also support their understanding and use of the existing estate and be used as a learning tool.	High
Project Board	Responsible for guiding, supporting and advising the project team and ensuring that the project achieves its objectives.	High
Students' Union	Responsible for representing the student body. uCampus will enable them to contribute to the planning and design of new learning and teaching spaces and keep informed about new developments. It may also support their understanding and use of the existing estate.	High
Administrative staff	Responsible for supporting the University's staff, students and senior management. uCampus will enable them to contribute to the planning and design of new learning and teaching spaces and keep informed about new developments. It may also support their understanding and use of the existing estate.	Medium
Estates staff (facilities management)	Responsible for the management and operation of the University's learning and teaching spaces. uCampus will enable them to engage in the design and planning of new learning and teaching spaces and keep informed about new developments. It may also support them in managing the existing estate.	Medium

Stakeholder(s)	Interest in the project	Importance
Library Services staff	Responsible for the provision of the University's. uCampus will enable them to contribute to the planning and design of new learning and teaching spaces and keep informed about new developments. It may also support their understanding and use of the existing estate.	Medium
Project sponsors	The client-side representatives during the development of new learning and teaching spaces. uCampus will enable them to make more informed decisions and keep up to date with new developments. It will also enable them to engage with architects, estates staff and other stakeholders.	Medium
External		
Architects	Responsible for designing and planning the University's new learning and teaching spaces. uCampus will enable them to provide better briefing and user consultation, and enable them to engage better with the University.	Critical
JISC	Responsible for funding the project	High
Other universities	Potential users of the weCampus platform.	Medium
Local residents	uCampus will enable them keep informed about new developments at the University and comment on the design of new learning and teaching spaces.	Low
Neighbouring organisations	uCampus will enable them keep informed about new developments at the University and comment on the design of new learning and teaching spaces.	Low
Other JISC projects	Responsible for undertaking projects on behalf of JISC. uCampus may have implications for their work.	Low
Prospective UoS students	uCampus will enable them keep informed about new developments at the University.	Low

Stakeholder(s)	Interest in the project	Importance
Sheffield City Council Planning Department	Responsible for advising on and approving new campus developments. uCampus will enable them to comment on the planning and design of new learning and teaching spaces and keep informed about new developments.	Low

Appendix D: Workshop 2 framework

Progress with platform development

Since last update, how far have you got with this and how does this compare with planned?

What have been the positive & negative influences on achievements?

Stakeholder engagement

How far have you got with planned stakeholder engagement?

What has influenced this and what do you estimate will be the impact on what you originally hoped to achieve?

Check if any stakeholders yet using in 'real' situation (e.g. SU). Who? In what ways?

Stakeholder feedback

Have there been any other feedback mechanisms?

What feedback has been received? How has it been handled? (Dissemination across team, decision making, response/action)

Benefits/outcomes for stakeholders

What intended/unintended benefits have been realised?

How do you know this? (feedback)?

Is there anything outside your control that has positively/negatively influenced these achievements?

Project management

Need to find out how effective organisation of work has been. What has positively or negatively influenced project progress e.g.

-decision making processes (e.g. frequency/membership of project board, frequency team meetings)

-division of labour

- level of resource for activity/achievements planned

-communication with stakeholders

-evaluation and feedback

Transferable learning

(Since May when last reported) What has been learnt from the project that has wider applicability than project?

Dissemination, networking & collaboration (Since last workshop)

What transferable learning has so far been shared? How, when, to whom?

Has any feedback been received, and if so what?

How has this influenced project development or plans for future work?

Are there publications available?

Tell us about the benefits realisation work – link with I-borrow project?

Future directions

What ideas do you have for future direction of work?

How these have been influenced by the learning from the project/connections made through collaborations or dissemination feedback?

What sort of resource would be required? What plans do you have in place to secure resource?

Appendix E: Summary of progress in achieving the project's aims and objectives

Aims/objectives	Progress
a. Produce an online visualisation modelling platform to facilitate collaboration and participation across a wide range of stakeholders engaged in the planning and design of learning spaces in higher education.	The project team have achieved this through the development of the weCAMP and uCampus software applications. The latter is available online at http://www.wecamp.group.shef.ac.uk/
b. Identify mechanisms by which the learning and knowledge acquired during such planning initiatives is captured and archived for future reference.	Progress towards this has been achieved through collaboration with the Student's Union and Western Bank Library refurbishment projects.
c. Become an integral element of the communication process for large projects undertaken by the University of Sheffield.	The extent to which the application can be embedded in University planning and decision-making processes is as yet unknown. The project was funded for an 18 month period, and it is unrealistic to have expected any evidence of embedding within this period. Further embedding is now dependent on support from the University's senior management.
d. Share the software outputs, the lessons learned and the experiences gained from the project with the JISC community.	The project has made significant progress in terms of the methodology required for the development and adaptation of the application to other institutional contexts. The platform specifications and methodology have been documented as outputs that can be used by others wishing to adopt the technology. The value of this learning has already been recognised to by the award of further JISC funding to explore the possibility of realising these benefits in other institutions.
1. Develop a generic extensible web-based interactive campus visualisation modelling framework (weCAMP) that can be adapted to implement interactive campus visualisation modelling platforms of specific institutions.	See points 'a' and 'd' above

Aims/objectives	Progress
2. Populate weCAMP with real estate datasets and deploy the University of Sheffield campus visualisation modelling platform (uCampus).	The project team has exceeded expectations in this respect. uCampus now hosts data for 48+ hectares of terrain, 70+ University buildings, 90+ University building floors, and 20+ spatial taxonomy profiles.
3. Develop exemplars of using uCampus to explore planning and design scenarios of future learning spaces, not only in terms of how they may look like but also in terms of how they may function.	The project team have used the application to model the new Students' Union redevelopment project at the University of Sheffield and obtain feedback from students and staff.
4. Develop exemplars of applying uCampus to the participative and collaborative planning and design processes of specific campus building projects involving real users.	The project team has begun collaboration with stakeholders with a key interest in the Western Bank Library refurbishment.
5. Promote participation in the planning process through the generation and dissemination of blogs/wikis on the uses of uCampus by the multiple stakeholders internal to the University as well as external professional planning and design practices throughout the project.	The project has maintained a blog (http://wecampus.blogspot.com/) throughout the project and held numerous stakeholder engagement events, for instance with students and external architects involved in projects at the university.
6. Report on the lessons/experiences of weCAMP and uCampus as institutional exemplars on effective planning and design of future learning and other campus spaces.	The lessons and experiences of the project team are captured in their final report to JISC.

Appendix F: About the evaluators

Diane Hart

Diane is a Senior Lecturer in Digital Business and Management Systems at Manchester Metropolitan University. From 2005-2008 she worked as an educational advisor specialising in educational evaluation at the University of Sheffield. She is currently in the final stages of completing a PhD, about using critical systems methodology for evaluating technology supported learning. She has nearly 20 years experience of working in higher education, 10 years of which was in the area of information and information systems management. Her research and professional interests are therefore evaluation, particularly educational evaluation and the evaluation of technology-supported learning, systems thinking and practice, change management, information and knowledge management and information systems management, organisational learning, and qualitative research methods.

James Pinder

James is a director of Positive Sum Ltd and has over ten years experience of undertaking applied research and consultancy projects on a wide range of issues relating to the built environment, including space design and management. Previous clients include Homes Retail Group plc, Nickleby FM, Summerfield plc, Sheffield Teaching Hospitals NHS Foundation Trust and Sheffield Hallam University. He was the principal investigator on a recent ESRC funded evaluation of South Yorkshire Housing Association's Henley Rise Eco Homes Scheme and also lead an independent evaluation of the Summerfield Eco Neighbourhood in Birmingham, on behalf of Family Housing Association. James was recently part of a HEFCE funded project at Loughborough University, which looked at how higher education institutions can develop better workspaces for their academics and researchers. He is currently undertaking an evaluation of the role of domestic renewable energy technologies in reducing fuel poverty, on behalf of the Eaga Partnership Charitable Trust, and is a Research Associate on the Adaptable Futures project at Loughborough University.