The Aesthetics Research Laboratory: putting beauty to the test

Esther Ratner BFA, MFA; Nicholas Raimondo B.Des (Hons.), M.Des, B.Ed
University of South Australia
esther.ratner@unisa.edu.au; nicholas.raimondo@unisa.edu.au

Abstract. This paper reports on the transformation of the tutorial component of the course, *Aesthetics of 3D Form*, into a model of a research laboratory. Students were challenged to extend their understanding of course content by working in teams to design and conduct informal pilot experiments aimed at analyzing the aesthetic success of three-dimensional forms. The experiments were underpinned by a 'hypothesis' (determined by students) and subsequent evaluation of the validity of this hypothesis provided the opportunity for greater engagement with more complex and abstract concepts covered by the course material. While this approach is well established and more empirically viable when implemented within a science curriculum, the adopted laboratory model in this informal adaptation is unique to the education of designers in architecture, interior architecture, and industrial design. To test the efficacy of this model as a means of better engaging students−when compared to traditional tutorial activities−an evaluation exercise was conducted with the support of a Teaching and Learning Grant. Pre and post-experience questionnaires were conducted and the class was observed by the evaluator, resulting in positive feedback on the new pedagogical approach. Students found this experience-based learning initiative engaging and the staff was impressed by the critical dialogues that ensued following the experiments.

The plan, implementation, and results will be disseminated and discussed as valuable, both for student experiential education generally, and for providing a means to help students make evidence-based decisions about their designed buildings, interiors, and products in a viable teaching-research nexus, bridging the theory and practice gap. The *Aesthetics Research Laboratory* proved an engaging vehicle through which students could explore the practical implications of various aesthetic concepts and to move beyond simple conceptions of beauty as being 'in the eye of the beholder.'

1. INTRODUCTION

This paper reports on changes made to the tutorial component of the elective course, *Aesthetics of 3D Form,* taken by students of industrial design, architecture, and interior architecture at the University of South Australia. The subject matter for this course addresses the myriad factors that affect the quest for beauty in designed products, buildings and interiors.[1] While aesthetics is of paramount importance in the education of the design student who will become professionals charged with giving form to our material culture[2], the subjective nature of this arena frustrates both educators who struggle to adequately communicate key indicators for success in form-giving, and students who feel that their teacher's marking reflects personal taste and does not communicate universal factors that they can learn and apply. In a study of marking variance in product design education conducted by Pritchard & Albon (2003) there was a 100% variance in the marking of aesthetic criteria by the evaluators tested. It, therefore, is not surprising that there is confusion about how to produce and subsequently judge the qualities of beauty in products, spaces, and buildings.

Having taught the course for a number of years, the course coordinator deemed it successful in introducing students to the terms and concepts associated with aesthetics, but considered it unsuccessful in helping students to apply and evaluate this information in their own design work. This drawback is identified by Bransford et al. (1990, pp. 115-116) when he states that the "basic problem [in] traditional instruction [is that it] often fails to produce the kinds of transfer to new problem-solving situations that most educators would like to see."

It was determined that the application of learned knowledge could be improved by implementing changes to the tutorial component of the course. Traditionally in Australia, a theory subject is taught with a one-hour lecture followed by a two hour tutorial. The tutorial for a design related course facilitates one of three common activities: discussion on the topic to understand course content, student reports on related subjects to extend course content, or student project assignments to apply course content. The course coordinator believed that discussion or oral reports as conveyance strategies for this subject were inadequate for the student to make the connection between the knowledge and applying it. Having the students create 3D projects and then evaluating them was more successful, however, the students−while always preferring design projects to written reports−complained that the projects for this theory

[1] Course content challenges contemporary usage of the term, 'aesthetics' as synonymous with 'appearance'−as applied in the common phrase, "appropriate aesthetic"−towards the traditional usage relating to the perception, experience, and attributes of beauty.

[2] Skaggs (2002) lists "aesthetic aptitude" as important for industrial designers. Other design fields' competencies are inferred.

subject added excessive workload to their already stretched schedules and drew valuable time away from their core studio courses.

One tutorial activity that was trialed proved the impetus for the course alteration that followed. Students were given equal amounts of air-dry clay and asked to make a miniature vase that was to be as beautiful as they could produce. Upon completion of this task, the vases were anonymously lined up and the students were asked to individually rank them in order from the most beautiful to the least. They were to use their own personal aesthetic criteria to guide their decisions. The rankings were tallied and a couple clear "winners" were identified. Interestingly, the students preferred simple elegant forms with some geometric precision that would have rightfully been aesthetic choices had the vases been machined in metal. But this was clay. A discussion followed about the relationship between aesthetics and materiality. And so with new, more specific, criteria, students improved their aesthetic sensibilities and could see that other choices were more aesthetic based on the material attributes of clay. In reflecting on this exercise, it was clear that it engaged the students more than the traditional tutorials, and that it allowed the students to apply and evaluate conceptual thinking; make the intangible, tangible.

The success of the vase exercise led to the transformation of the tutorial component of the *Aesthetics of 3D Form* course into a model of a research laboratory. This model, called the *Aesthetics Research Laboratory*, asked students to work in interdisciplinary teams to design and implement informal pilot experiments to test a hypothesis they have posed based on aesthetic theory. This represents a new kind of experience-based learning for these students in that the exercise models science practice as different from−yet capable of augmenting−design practice. Heretofore, student project time constraints necessitate limiting the number of prototypes produced to generally those that would provide feedback on functionality or use-ability issues, bypassing the creation of myriad models to test subtle aesthetic decisions. The plan was to isolate aesthetic decision making in a quasi-laboratory setting and formalize the assessment methodology.

The Aesthetics Research Laboratory was trialed for one year and deemed successful enough to continue as the tutorial model for subsequent years, however the determination of success was based solely on the observations of the course coordinator and positive feedback on the course evaluation instruments. For the second year of implementing this curriculum, the course coordinator decided to test the efficacy of the model as a means of improving student engagement. Here 'engagement' refers to usage as defined by Krause (2005, p.3) as "…a catch-all term most commonly used to describe a compendium of behavours characterizing students who are said to be more involved with their university community than their less engaged peers." Engagement encompasses factors such as time and energy spent on university tasks (Krause, 2005), and association with a learning community (Zhao and Kuh, 2004). Literature supports the contention that learning outcomes are improved the more students are engaged with the learning process (Kuh, 2003).

The assessment task that will be reported here sought to ascertain if students felt that this new model of tutorial activities engaged them more than traditional models that they were familiar with. The plan, implementation, and results will be disseminated and discussed as valuable, both for student experiential education generally, and for providing a means to help students make evidence-based decisions about their designed buildings, interiors, and products in a viable teaching-research nexus. The *Aesthetics Research Laboratory* proved an engaging vehicle through which students could explore the practical implications of various aesthetic concepts and to move beyond simple conceptions of beauty as being 'in the eye of the beholder.'

2. COURSE OVERVIEW

This 'Aesthetics Laboratory' project was undertaken during semester 1, 2009 as part of the *Aesthetics of 3DForm* course. This is a single-semester elective course offered to students within the School of Art, Architecture and Design at the University of South Australia. The course runs for 13 weeks and consists of a weekly theory lecture (1 hour duration) immediately followed by a 2-hour tutorial session.

The aim of the course is to develop the students' aesthetic vocabulary and sensibilities with form decision making towards improving the beauty appeal of designed outcomes. The curriculum and learning objectives of the course demonstrate some of the challenges in striking an appropriate balance between content- and language-rich curricula (covered by lectures) and the practical 'designerly' application of these principles in a studio environment. Of particular interest here is the development of students' conceptions as to the nature of 'design work': Dakers (2005, pp. 73-89), in a consideration of 'socially constructed' learning in design & technology education, points out that the promotion of design as a process of 'internalization' or skill development often results in students' perception of design as an exclusively 'internal' or individual activity. As such one of the objectives of this project was to explore alternative tutorial models whereby students could explore theoretical aesthetic concepts within the group-work context, without recourse to 'typical' forms of theory assessment such as essay-writing, student presentations and individual tutorial exercises. It was anticipated that the 'aesthetic laboratory' format would encourage greater student engagement with (and hence understanding of) these concepts by encouraging students to participate in a process of group discussion and collaboration, trial and error, hypothesis,

experimentation, evaluation and communication of results.

2.1 Student Cohort Characteristics

Students undertaking this course are enrolled in an undergraduate degree program in architecture, interior architecture or industrial design, with a small number undertaking a professional Masters in Architecture. The students that participated in the *Aesthetics Laboratory Project Evaluation* comprised a reasonably even distribution of students from the architecture and interior architecture programs with a minority of industrial design students (only two). The student cohort age ranged from early 20s to mid-40s with most students representative of school-leaver undergraduate student age, and gender balance was reasonably even. The course has no formal prerequisites but it is assumed that all students have had significant prior experience – primarily through core courses completed as part of their degree – in the design, fabrication and appraisal of buildings, interiors or products for which 'aesthetic merit' is a key consideration. In addition, all students had undertaken and passed at least two prior history and theory courses at 1st and 2nd year level, giving all students a degree of familiarity with 'typical' modes of delivery in courses for which conceptual and theoretical concepts are the primary curriculum content.

2.2 Pedagogical Goals

The tutorial component of the course. *Aesthetics of 3D Form,* was conceptually transformed into the *Aesthetics Research Laboratory.* While the laboratory model is well established in science curricula, it is unique to the education of designers in architecture, interior architecture, and industrial design. The benefits of scientific inquiry is extolled as a way to teach students to gain knowledge informed by experimentation and observations, rather than relying on personal experience or second-hand sources (Bransford et. al. 2004), and−in the case of aesthetic appreciation−personal taste. Thus, the methodology of identifying and testing aesthetic indicators, with the aim of exploring the validity of an aesthetic 'hypothesis,' is needed in a subject area, which can suffer from a lack of truly objective and critical learning due to its apparently subjective nature.

The experiments tested aesthetic theory in a way that allowed students to better comprehend criteria that may be used to assess the visual appeal of design projects. And because this criteria is seldom adequately articulated by the staff, it is the intention of the course coordinator to combine information gleaned from studying the student pilot experiments with personal scholarship to document and disseminate a set of assessment criteria for the evaluation of aesthetic appeal of three dimensional design projects. It is apparent, therefore, that this exercise fosters research culture in teaching and learning, now identified as the 'teaching-research nexus' (see Debowski, 2006 and Neuman, 1994). Adding *The Aesthetics Research Laboratory* to the *Aesthetics of 3D Form* course now satisfies eight out of the nine ways to foster a teaching-research nexus as identified in the following list compiled by Gabrielle Baldwin of the University of Melbourne Centre for the Study of Higher Education (CSHE), (2005. p. 4).

- "Drawing on personal research in designing and teaching courses [here relying on the course coordinator's expertise];
- Placing the latest research in the field within its historical context in classroom teaching [achieved in this case through required readings describing current research into aesthetic attributes];
- Designing learning activities around contemporary research issues;
- Teaching research methods, techniques and skills explicitly within subjects;
- Building small-scale research activities into undergraduate assignments;
- Involving students in departmental research projects [listed here to include the entire list, however this project did not contribute to a departmental research project];
- Encouraging students to feel part of the research culture of departments [here students believed that their experimental outcomes would be communicated to design staff in order to develop clearer indicators for aesthetic success in marking projects];
- Infusing teaching with the values of researchers;
- Conducting and drawing on research into student learning to make evidence-based decisions about teaching [documented in this paper]".

In addition to meeting educational goals specific to the course subject matter in a teaching-research nexus, the new practice was conceived as a means of improving student engagement. Subsequent research into strategies for enhancing student learning validated this approach as meeting positive pedagogical goals. Going back to the oft quoted "Seven Principles for Good Practice in Undergraduate Education" compiled by Chickering and Gamson, (1987), two apply here: "Good practice encourages cooperation among students" and "Good practice encourages active learning," (ibid. p. 1). Current research suggests that these practices enhance student engagement as indicated by the inclusion of "active and collaborative learning" as one of the benchmarks of student engagement identified by a series of studies conducted by the National Survey of Student Engagement (NSSE) (Kuh, 2003. p. 26).

The fact that the student experiments were developed in interdisciplinary teams mandated collaboration. This group focus was a strategy implemented to make best

use of the inherent benefits of a collaborative learning approach; the well-developed skills and dispositions of students enrolled in a range of 'design-led' programs such as architecture, interior architecture and industrial design was anticipated to work in favor of the 'collaborative classroom' (Kozulin, 2004 pp. 3-7), this being based on the Vygotskian principle that 'social interaction' is a key contributor to successful learning and greater student engagement (Vygotsky, 1978). Studies have shown that collaboration improved learning outcomes when compared to individual work (Prince, 2004, cites two studies by Johnson, Johnson and Smith (1998) and one by Springer et al. (1999). And collaboration is a particularly important skill for design students who, as professionals, will work with numerous stakeholders in their design practice. [3]

The pedagogical model promotes 'active learning' as defined as "learning by doing" (Gibbs, 1998) as contrasted with 'passive learning' such as listening to a lecture (Biggs, 1999) and could more specifically be described as a shift toward a more 'constructivist' approach to the delivery of this theory course, whereby students were given new opportunities to 'construct' their own learning and to make sense of aesthetic concepts within an experiential and experimental learning environment. It is acknowledged that the concept of constructivist learning–and the design of learning experiences towards this type of learning–must be approached with a measure of caution, recognizing that 'constructivism' may be regarded as a rather foggy metaphor for learning, a 'paradigm' or 'theory' (Fosnot, 1996) as its 'central claim is the rather generalized idea that (human) knowledge is acquired through a process of active construction' (Fox, 2001 p. 24). Nonetheless, the value of this approach in the interests of transcending 'empty-vessel' modes of teaching and learning which may limit students' understanding to short-term memorization and repetition is recognized. Throughout this project, it was intended that students' development of specialist vocabulary, awareness of historical and theoretical knowledge and application of theoretical concepts should proceed alongside the more explorative aspects of their aesthetics laboratory experience.

3. THE AESTHETICS LABORATORY

3.1 Project Description

The aesthetics laboratory consisted primarily of modifications to the tutorial component of the course. The objective, conceptual and theoretical content of the lectures was retained, as was the typical lecture delivery format; however changes to the tutorial sessions were directed toward students completing the following 'laboratory' project:

This 'laboratory experiment' was not intended to apply rigorous scientific methodologies to the testing of aesthetic concepts (as, for example, experiments did not utilize a control group), nor was it intended to generate quantifiable statistical data as a scientific laboratory experiment might be expected to deliver. The intent instead was to provide a vehicle through which students could critically analyze and discuss aesthetic issues using appropriate vocabulary directed towards key indicators for success in form-giving. As such the validity of the 'hypothesis' itself was to an extent immaterial, and certainly the actual results documented during these laboratory experiments were of little true scientific value. Nonetheless, this mode of delivery represents a clear and productive departure from the accepted 'theory tutorial' format which relies heavily on formal presentations and discussions without any physical application of course content.

Students were challenged to extend their understanding of course content by working in teams to design and conduct informal pilot experiments to analyze the aesthetic success of three-dimensional forms.

To this end, the pilot experiments of student groups were underpinned by a 'hypothesis' (determined by the group) which the experiments were designed around; students' subsequent evaluation of the validity of this hypothesis provided the opportunity for greater engagement with more complex and abstract concepts covered by the course material. The purpose of this 'hypothesis-experiment' approach was twofold: firstly, to provide an appropriate focus for the activities to be designed and implemented by students during tutorial sessions, and secondly to provide students with the opportunity to adopt a 'generative' approach towards their own learning. It was anticipated that this approach may go some way towards addressing some of the more challenging aspects of reflective practice with regards to identification of an appropriate 'focus' for the study of a particular problem or concept; a problem often encountered in the study of aesthetics which, as mentioned, can often lead to students' judgments relying upon internalized reflections upon nothing more than untested personal taste.

This was implemented with the support of a Teaching and Learning Grant to test the efficacy of this experiential learning initiative for increasing student engagement.

Students' designs for Aesthetics laboratory experiments were sourced from a group of suggested focus areas which dealt with key areas of aesthetics theory and reflected the content of the course lectures. The resulting laboratory experiments and their underlying hypotheses varied greatly and included, for example:

[3] Miller & Olds (1994. p. 312) reports on a questionnaire sent to 177 companies and government agencies "to collect data on the organization, management, evaluation, and communications activities of representative industrial design teams". "About 75 percent of the companies and agencies surveyed used design teams of 6 members or fewer and nearly 75 percent of these teams were multidisciplinary in nature."

- A test designed to ascertain whether a person's experience of a material alters according to the senses used to experience it; the hypothesis was that "people are attracted to natural flooring materials rather than synthetic or machine-made materials", regardless of the individual senses used to experience it (touch or sight).

- An animated sequence generated with 3D modelling software which was designed to test the principle that "dynamic representation" (that is, moving, morphing and animated surfaces represented over time) facilitated a deeper understanding of the design intent of a piece of architecture – in this case, a 'dynamic' wall – rather than a static representation of the same object.

- An array of materials of varying texture, temperature and humidity designed to test the hypothesis of "sense before touch" – that is, the idea that one can 'sense' the attributes of a material by simple proximity, rather than actually needing to handle the material.

- A test designed to test the idea that branding is a sort of 'aesthetic overrider'; that a knowledge and awareness of the branded 'value' of a designed object (in this case, sunglasses) affects the individual's perception of the aesthetic value of the design.

All of the laboratory sessions were completed during a 2-hour tutorial session and were followed up by a presentation of the experiment's design and hypothesis, findings, analysis of results and students' reflection on any unexpected results and possible improvements. This took the form of a written report and Powerpoint™ presentation delivered by the student teams at the conclusion of the semester.

4. ASSESSING STUDENT ENGAGEMENT

4.1 Research Study Goals

Bransford et.al. (2004) stress that new curricula needs to be evaluated to ascertain effectiveness in practice. Towards this end, the course coordinator received a Teaching and Learning Grant to hire an evaluator to assess of the efficacy of this new tutorial model. The goal of this research study was to ascertain if the *Aesthetics Research Laboratory* engaged the students more than more traditional models. This is a very specific study comparing tutorial models, and therefore could not use existing instruments that measure student engagement. For example, a study that compares active learning (problem-based learning) to passive learning (sitting in a lecture), (see Biggs, 1999), would not be appropriate since the nature of all tutorials is to add active activities to support the passive lectures. A study that measured engagement based on time spent on project tasks would not be appropriate since these students would have had to undertake both models within this course in order to make an informed comparison or accurate data from the prior years, that had utilized the traditional activities, would have had to have been collected. Thus, it was necessary to rely on students making the comparison between tutorial experiences they are familiar with from other courses to compare with this new model.

It was also important that the students interpreted engagement as a positive attribute understanding that the definition of 'engagement' can be interpreted negatively as akin to "engaging in a battle," where the university culture may seem like foreign soil (Krause, 2005. pp. 9-10). In order to ameliorate the negative interpretation, the instrument used to measure student engagement in this course revision avoided terms that could be interpreted negatively. We wanted to know if students preferred one teaching model over another, allowing preference to support the assumption that students would be more engaged doing work that they preferred over work that they did not.

4.2 Data Gathering and Methodology

Data gathered for this project fell into three rough project 'phases': students were asked to undertake a 'pre-test' questionnaire before the commencement of class in the first week, followed by a similar 'post-test' at the conclusion of the course 13 weeks later. In between these two 'tests' was an extended period of participant observation over the course of the semester, during which the 'aesthetic laboratory experiments' were designed, set up and executed by students. The data gathered for the purpose of evaluating the level of success of this project was primarily qualitative, supported in some areas by the collection of quantitative data in the form of surveys (pre-test and post-test) and a semantic differential (post-test only). This qualitative data took the form of short text-based answers written in response to questions posed in the pre- and post-tests, and in weekly notes taken by an observer during the weekly tutorial sessions. These notes were generated from 'participant observation' related directly to the classroom experience of each individual 'laboratory experiment' and the discussions that followed; this observation was undertaken most often in an 'observer-as-participant' identity as identified by Waddington (2004, p. 13), in which the observer limited his participation to more superficial contact and facilitation of discussion.

4.2.1 Pre-Test

The 'pre-test' undertaken prior to any formal delivery of course material had two distinct functions: firstly, to give some indication as to the overall learning preferences of this particular group of students, and secondly to act as a 'yardstick' with which to measure any change in students' conceptions as to which modes of tutorial delivery are likely to result in more successful attendance, participation, enjoyment and learning outcomes. These were addressed in the form of a simple table (see below), for which students were asked to rate their preferences on a scale from 'No Importance' to 'Very Important':

	No importance	*Not very important*	*Neutral*	*Important*	*Very important*
Formal verbal information provided by tutor					
Discussions between students and tutors					
Practical work (autonomous in-class projects)					
Practical work (group in-class projects)					
Practical work (autonomous projects done outside of class)					
Practical work (group projects done outside of class)					
Laboratory type experiments					
Role play or other participatory group exercises					
Presentations by student groups					
Individual presentations					

Figure 1: Pre-Test Learning Preferences Table

Accompanying this was a series of simple questions asking students to identify which of these 'modes of tutorial delivery' would, in their opinion, lead to improved attendance, participation, enjoyment and more effective learning. The categories that students rated were selected as being specific to theory design course tutorials.

4.2.2 Post-Test

The 'post-test' was constructed in a similar manner, but included a semantic differential which was designed to aid students in 'rating' their experience of the aesthetics laboratory tutorials as opposed to a 'typical theory tutorial' (which, as previously noted, all students have a level of familiarity with). The design of this semantic differential took particular note of common criticisms of such instruments, in particular those put forward by Al-Hindawe (1996); as such, a 7-point semantic differential scale was adopted with eight pairs of contrasting adjectives chosen for their relevance to common characteristics of 'engaging learning' (Carini, R. Kuh, G. & Klein, S. 2006), and to engaging aspects of the Aesthetics of 3D Form course adjudged by the by course coordinator and tutor. Efforts were made to use complementary antonyms for opposing pairs, thus avoiding possible ambiguity or misinterpretation (Al-Hindawe 1996 p. 3).

	1	2	3	4	5	6	7	
Enjoyable	:	:	:	:	:	:	:	Not enjoyable
Surprising	:	:	:	:	:	:	:	Unsurprising
Interesting	:	:	:	:	:	:	:	Uninteresting
Engaging	:	:	:	:	:	:	:	Disengaging
Challenging	:	:	:	:	:	:	:	Unchallenging
Informative	:	:	:	:	:	:	:	Uninformative
Motivating	:	:	:	:	:	:	:	De-Motivating
Personal	:	:	:	:	:	:	:	Impersonal

Figure 2: Post-Test Differential

As with the pre-test, the post-test included a section comprised of short written responses to questions related to students' experience of the aesthetics laboratory. These questions were intended to give a clearer idea of the level of success achieved by this particular tutorial format: in the exploration of 'attributes of beauty' that might previously have been taken as subjective rather than objective, in the exploration of theoretical course materials introduced in the lectures, and the more in-depth contemplation of course material through the design and execution of laboratory experiments.

4.3 Limitations & Disclaimer

It must be stressed that the 'aesthetics laboratory' was a pilot project intended to test the 'once-off' effectiveness of an innovative tutorial model for a particular group of students. As such it should be kept in mind that the sample group from which observations and data were taken was extremely small (20 students), and any quantitative research data should be treated accordingly. Efforts have been made to 'verify' such data by qualitative means – hence the importance of verbal feedback, participant observation and students' written responses over the course of the project – however it is anticipated that some discrepancies may occur owing to the limited scope of this pilot project. As such, the reliability of data gained from in pre-test and post-test surveys must not be taken as absolute; all data gained from these tests was self-reported by individual students and thus must be approached with the consideration that different students have different learning experiences and the results gained from such instruments will no doubt be reflective of this (Zhao & Kuh, 2004, p. 130). Again, owing to the 'pilot' nature of this study and the relatively small sample group from which data was obtained, any interpretation of statistical results must be approached with a measure of caution as the sample group was too small to make meaningful generalizations as to the wider applicability of these results.

5. RESULTS

5.1 Pre-Test Results

The pre-test results provided some initial data with which to compare the relative success of the aesthetics laboratory tutorials. Results of the initial 'learning preferences' survey completed during the pre-test showed a strong preference in this particular student group for tutorials which include some element of practical project work (both individual and group-based), and discussions between tutors and students. 'Formal verbal information' (ie. lectures) was rated surprisingly well, whilst 'laboratory-type experiments' was rated quite low – keeping in mind that at this 'pre-test' stage this was probably taken to mean 'scientific methodologies' rather than the 'aesthetic laboratory' that the students were shortly to participate in!

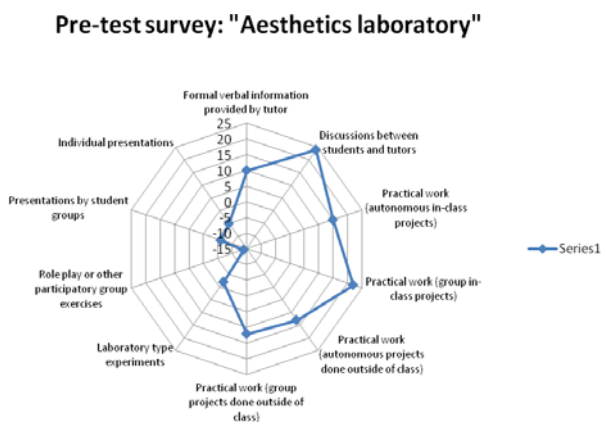


Figure 3: Pre-Test Survey Results

Students' short written answers to the questions accompanying the survey mirrored these results: there was a strong indication that 'informal discussion between lecturers/tutors and students' would lead to greater engagement, participation and learning outcomes, especially helping students to gain "feedback and assistance and generate ideas from one another". 'Practical group projects' completed in-class were held to "create and allow a group to talk to one another to finish the task... it engages with all students as a class to complete particular tasks". Tutorial formats generally held to encourage student participation involved some level of group work with a practical focus, although there seemed to be a reasonably even spread of opinion as to whether this would be better facilitated by in-class projects, or by group projects intended to be completed away from the classroom.

5.2 Participant Observation

Notes taken during the 'participant observation' phase of the project supported these initial survey results. Throughout the course of the semester, the importance of informal discussion during and immediately following lab sessions was well evidenced; in many cases, the instructors felt that impromptu group discussions immediately following the laboratory sessions were of the most value both in terms of students' consideration of the course material and in terms of students' enthusiasm and engagement. Often these discussions focused on any unexpected results of laboratory experiments, and students' subsequent attempts to make cognitive 'sense' of these results with the aid of their instructors. For example, in one laboratory session the students had designed a laboratory experiment that required class members to 'feel' a range of ten materials in a series of individual boxes (materials ranged from fairy floss to 2-minute noodles, ice water and novelty goo), in order to test the validity of a 'Sense Before Touch' hypothesis. The key aesthetic idea was that an appreciation of the many aesthetic dimensions nature of a material can be achieved through more complex sensory inputs than simple 'looking' or 'touching' - essentially a kind of 'sixth-sense' judgment. As the experiment progressed there was a surprising correlation between the 'material sensing' ability of individuals and the actual nature of the materials themselves. Subsequent discussions focused on likely causes of this correlation; ignoring (for now) the existence of a measurable 'sixth sense', the discussion led students to concede that individuals may possess a greater than expected sensitivity to small differences in the character of the environment (such as air temperature or humidity) affected by a given material. The implications of this in terms of the 'aesthetic experience' of different materials were then discussed.

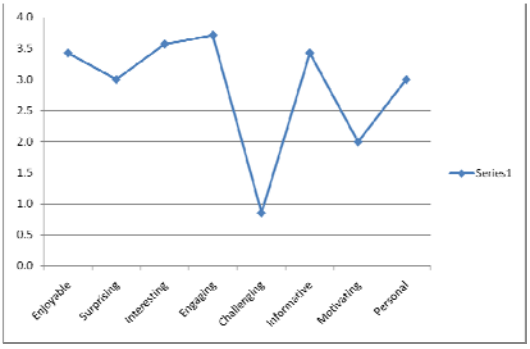
The unexpected or surprising results gathered from laboratory experiments were rarely accepted out of hand; students often made attempts to explain results either in terms of reframing hypotheses or pointing out weaknesses in the experiment design. For example one group, whilst attempting to measure the influence of branding on consumers' perception and experience of taste (using a range of cola brands), eventually attributed their unexpected results to small irregularities in the temperature of the samples. The relatively weak initial hypothesis and experiment design led nonetheless to a discussion on the variable 'conditions' determining aesthetic experience. Similar experiments attempting to prove that branding in some way 'overrides' the 'authentic aesthetic experience' of a product (using a range of branded and non-branded sunglasses in one session, and a range of perfume scents in another) delivered unexpected results. Given the fact that the sample group of respondents was not representative of a typical cross-section of the population this is hardly surprising, but the lack of an expected confirmation of the somewhat mundane hypothesis forced students to question firstly the data-gathering methods used, the experiment's reliance on empirical data to deliver measureable results, and the unanticipated value of the (unplanned) post-experiment discussion. In the case of the sunglasses experiment, the hypothesis was subsequently altered in the students' final report: 'branding' was no longer a primary 'aesthetic overrider', and the conclusion instead was that "aesthetic opinions can change as people become more intimate with a product, and that branding is not necessarily a major factor." In all of these cases, the key learning facilitated by the experience was gained through unstructured (and often unplanned) group discussion, leading to a general consensus in many cases that, in the case of aesthetic design and judgment, 'scientific studies' should be tested and qualified by 'real world' experience and consideration of context. It is felt that this process of 'concreting' learned theory content reinforced students' understanding of aesthetic factors as 'external and objective' rather than purely internal or subjective in nature. In addition, the course instructors were surprised by students' willingness to modify, reframe or even reverse their initial hypotheses and to make definite statements about conclusions reached at the conclusion of their experiment; very few groups arrived at a conclusion that the aesthetic principles in question were 'unmeasurable' or infinitely

variable and dependant on individual perceptions. The desire to make rational sense of difficult or unexpected experiment results in many cases allowed students to explore course content in greater depth and to draw links between different aesthetic ideas.

It is interesting to consider that the positivist idea of 'hypothesis-experiment' and the use of quasi-scientific method to frame these tutorial sessions may have had some bearing on students' expectations as to the 'ideal' results of their aesthetic laboratory experiments. Even the use of terms such as 'hypothesis' and 'laboratory' carry with them a certain range of expectations with regards to how exactly the aesthetic laboratory might be expected to operate and, as a result, how students might be expected to think and work. However this need not be considered a drawback; indeed, the types of conversations following tutorial sessions where hypotheses were disproved - or delivered unexpected results - suggest that this approach provides at least some opportunity to stand in what Schön (1987) would refer to as the 'swamp' where practice-based results can be tested against 'higher, harder' rational approaches. In particular, for aesthetics, the types of problems encountered in drawing a balance between 'soft ground' and 'hard ground' are perhaps more often than is usual encountered in bringing *theory* to link more strongly to existing *practice*, rather than the other way around.

The 'post-test' highlighted some areas of strength and weakness in the aesthetics laboratory tutorial model. Overall it may be seen that in terms of students' overall impressions the aesthetics laboratory outscored the typical theory tutorial in almost every category (see below); however given the small number of respondents and the minor variance in many of the adjective pairings it would be inappropriate to infer any total superiority of the aesthetics laboratory as a model of course delivery.

Post-Test Results



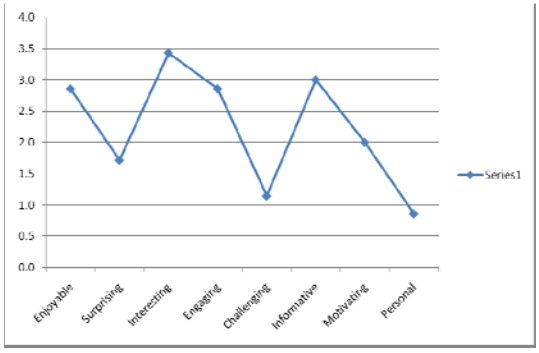


Figure 4: Semantic Differential results – 'Aesthetics Laboratory' (top) and 'Typical Theory Tutorial' (bottom)

Nonetheless, the data did indicate some clear areas where this pilot group felt that the laboratory model offered some clear advantages: the laboratory model was rated as more 'surprising', more 'engaging' and significantly more 'personal' than the 'theory tutorial' counterpart. These results mirror to a large extent the impressions gained from participant observation during the course of the semester, and were well supported by students' accompanying written responses in the post-test survey. Given that the aesthetics laboratory offered students many opportunities to engage in active learning in a group environment, that they were encouraged to discuss aesthetic concepts in a range of structured and unstructured forums and that personal contribution and reflection were a key priority in both the experiment design and feedback processes, these results were encouraging. Students' written responses generally emphasized the efficacy of the laboratory model in "testing the ideas and opinions of others against your own", and providing a vehicle through which the practical implications of theoretical ideas could be explored. Interestingly, a common theme running through the vast majority of written responses was the recognition that the experiments allowed students to develop an individual 'aesthetic judgment' but then required them to test this judgment against the (often different) judgments of their classmates in order to arrive at a sound conclusion.

Areas of weakness identified in the post-test analysis were in students' opinion of the level of 'challenge' issued by the laboratory model, and the strength of explicit correlation of the theoretical course content with the informal discussion entered into during the tutorials. It is interesting to note here that neither the aesthetics laboratory nor the 'typical theory tutorial' were rated as particularly 'challenging'; of course, further clarification may be required to define what exactly is understood by students' perception of 'challenge', but generally speaking, this pilot program highlighted some areas for improvement in this new tutorial model. Only one respondent commented that the laboratory model was not effective because "theory lectures" and "aesthetic laboratories... are completely different subjects. Theory lectures are about the idea in writing, and aesthetic laboratories are about depicting these ideas and reviewing them" – but interestingly, this

same rationale was given by most other students as a way of confirming the effectiveness of the laboratory model. This nonetheless may point to a residual feeling on the part of students that 'academic challenge' comes from more traditional modes of delivery: essay writing, research and sober discussion. For their part, the instructors do feel that subsequent modifications to the aesthetic laboratory should emphasize more fully the process of identification, development and justification of students' 'aesthetic hypotheses' prior to their laboratory experiment, focusing in particular on the strength of the relationship between the final hypothesis and the formal course content introduced in lectures and readings.

6. SUMMARY COMMENTS

It is felt that the *Aesthetics Research Laboratory* tutorial model offered some clear advantages in the delivery of the *Aesthetics of 3D Form* course material, in particular in the interests of increasing student engagement with the course content. Data gathered through the pre-test and post-test, supplemented by participant observation, showed that the *Aesthetics Laboratory* was effective in catering to students' preferred learning activities, leading to a generally positive evaluation of this model in terms of student participation and engagement.

It is also felt that the 'constructivist' aims of this experiential project were realised; the practical and collaborative application of theoretical concepts resulted in successful achievement of understanding through a process of active construction on the part of the students. The aims of the course to counter a tendency to understand design activity and aesthetic attributes as internal, personal or subjective processes seem to have been achieved, especially in the strength and value of the collaborative group work undertaken in the design and execution of individual laboratory experiments, and the group discussions that became a mainstay of the *Aesthetics Laboratory* sessions.

Some weaknesses and future points for focus were identified; the 'challenge' issued by this tutorial model was rated fairly lowly, perhaps indicating that a more explicit emphasis on academic rigour as part of the design and analysis of laboratory experiments would be appropriate. In addition (and possibly related to the previous point), the instructors felt that the actual process of arriving at a sound hypothesis could benefit from further development; some experiment designs were either too simplistic or were not optimized to reflect the kinds of aesthetic judgments required. In some cases the links between hypothesis and theoretical course material were weakened due to a process of evolution or compromise due to practical constraints of experiment design. Should the *Aesthetics Research Laboratory* become a regular feature of the course, the development of teaching resources aimed more specifically at addressing these weaknesses at the beginning of the semester might go some way towards addressing these problems.

Nonetheless, the *Aesthetic Research Laboratory* sessions were generally held to be successful, particularly in the facilitation of greater student participation and group dynamics. This creation of a 'classroom learning community', treating the classroom "as the locus of community-building by featuring cooperative learning techniques and group process learning activities" (Zhao & Kuh, 2004 p. 116), goes some way towards enhancing students' engagement with the course materials - including students' self-reported outcomes, satisfaction and enjoyment, participation, personal development and learning effectiveness (Zhao & Kuh, p. 115). In addition, the laboratory sessions made a valuable step toward addressing some of the inherent problems in limiting the contemplation of aesthetic concepts to inward-looking, theoretical or purely cognitive learning modes, by providing a vehicle by which students could bring these concepts to life in a participatory, practical, experience-based, and reflective learning environment, bridging the gap between theory and practice.

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