Generating an architectural brief for a twenty-first-century engineering education working and learning environment.

Alicen Coddington and Llewellyn Mann
Swinburne University of Technology
Corresponding Author Email: acoddington@swin.edu.au

SESSION C2: Interdisciplinary and cross-disciplinary engineering programs and learning environments.

CONTEXT This paper reports on the process undertaken by the Engineering Practice Academy at Swinburne University of Technology to broker and construct an architectural brief for a working and learning environment for a new engineering course. An architectural brief is a document that specifies the requirements and frames a project in regard to the project values, visions, and objectives. The construction of an architectural brief that is responsive to a specified espoused culture, values and objectives requires shared appreciation and meaning between the project stakeholders and decision-makers; this can be a complicated process as it entails the brokering of perspectives. In this case, representatives of the Engineering Practice Academy (Academy) who participated in the generation of the architectural brief were conduits of their own and collective desire for how engineering education and learning environments can be and should be delivered now and into the future.

PURPOSE To generate the conceptual content for an architectural brief that is viewed as a socio-spatial artifact.

APPROACH Stakeholders of the Academy participated in two participatory design workshops that addressed the built environment of the Academy as a signifier of an espoused culture. The workshops were organised around Schein's (2010) structural model of organizational culture and a reflection-in-action process was used to structure the workshop activities.

RESULTS The workshops became a catalyst for the generation of the textual content for the architectural brief that was co-owned by the project stakeholders of the Academy who are advocates of the future environment and the emerging culture of the Academy.

CONCLUSION Brokering of shared meaning and practices is paramount to ensure that cohesive understanding of practices, identities and positions amongst project-stakeholders are negotiated, and ownership of a project and the eventual built environment are formed. The case presented in this paper is an example of one process for generating shared meaning and delivering an architectural brief viewed as a socio-spatial artifact for an engineering working and learning environment.

KEYWORDS Engineering working and learning environment, brokering, shared meaning

Introduction

This paper reports on the process applied by the Engineering Practice Academy at Swinburne University of Technology to broker and construct an architectural brief for a working and learning environment for a new engineering course. This paper details the initial phase of a longitudinal study that is investigating being-and-becoming a twenty-first-century engineer and the ontological conditions that enable such a process within a university. Being-and-becoming is influenced by authentic learning through and about practice, engagement with others and, the artifacts that produce the material world (Dall'Alba, 2009a, 2009b; Dall'Alba & Sandberg, 2010, 2014; Heidegger, 2011; Sandberg & Dall'Alba, 2009). This paper applies the understanding that the artifacts that create the material world in which education and knowledge are delivered can afford meaning and the construction of engineering practice knowledge.

When completed, the Engineering Practice Academy (Academy) environment will be a purpose-designed space for educating future engineers and preparing them for twenty-first-century engineering practice. The new Bachelor of Engineering Practice (Honours) degree at Swinburne University of Technology is a new approach to engineering education, where students will join and work within a functioning engineering practice set up on campus for their four years of study. They will work on industry projects, community-based projects and other activities as if they were in practice from their first day. Students will be mentored by academic and industry mentors, and graduate work ready. The built environment in which the Academy will be situated is being purposely designed to enable the culture and activities of the Academy. The process to design the built environment is a shared responsibility between Academy stakeholders, university decision-makers and the employed architect.

Project stakeholders (university decision-makers and facility managers) engaged with university planning and construction, are conduits of the values and vision of a university. The built environment of a "university can invite or reject dwelling through its built-in vision and enterprise, emerging from the values, views and virtues of those who envisioned it" (Nørgård & Bengtsen, 2016, p. 8). Meaning, the built environment of a university is a signifier of the values and vision of the university and thus, "supports and promotes particular being and becomings in education while stifling and preventing others" (Nørgård & Bengtsen, 2016, p. 8). This paper delivers an account on the process undertaken by the stakeholders of the Academy who included university decision-makers, Academy employees and, engineering educators to construct and articulate the espoused culture, values and objectives of the Academy. The outcome of this process was the generation of the conceptual content for the architectural brief of the Academy's desired built environment.

The production of an environment that is responsive to a specified espoused culture, values and objectives require shared understanding between project stakeholders in regard to what the espoused culture, values, and objectives will be. The creation of mutual understanding is complex and requires stakeholders to broker their perspectives and positions on the given project. Shared understanding requires the relational understanding of the individual and the collective with respect to who will be using the environment and the value of the environment to those users. An understanding of the individual is important because it asks that stakeholders interrogate their assumptions and to acknowledge the assumptions of others. An architectural brief is part of the initial stages of the conception of a built environment, and it is a "decisive interactive element" (Ryd, 2004, p. 248) that is a product of the social structures of the stakeholders who constructed it.

An architectural brief is a socio-spatial artifact created by societal assumptions in regard to the occupation and usage of an environment. An architectural brief "rather than prescribing the end solution" (Haug, 2015, p. 50) documents requirements and frames the project with respect to project values, visions and objectives. Stakeholders who construct an architectural brief are therefore projecting their visions of occupation. In the case of this project, stakeholders who participated in the generation of the architectural brief were conduits of

their own and a collective desire for how engineering education can be and should be delivered now and into the future.

A values-lead environment articulated through a participatory design approach

A built environment is “coded with signifiers of value and power” (Charteris, Gannon, Mayes, Nye, & Stephenson, 2015, p. 41) that can be welcoming towards some individuals and “unwelcoming towards others” (Nørgård & Bengtsen, 2016, p. 8). Stakeholders of the Academy participated in two participatory design workshops that addressed the built environment of the Academy as a signifier of an espoused culture. Participants accepted the perception that universities, and the fact that the Academy, being situated within a university had an opportunity to address systemic issues in engineering education and had an obligation to advance personal, academic and societal value of engineering education. The built environment that will house the Academy is just one of the strategic signifiers and manifestations addressing the ontological conditions of being-and-becoming a twenty-first-century engineer. The outcome of the participatory design workshops was a co-constructed architectural brief. The participatory design workshops were structured around Schein’s (2010) structural model of organizational culture whereby, culture is a product of individual and collective assumptions, espoused values and, artifacts.

Participatory design is “about negotiating values” (Iversen, Halskov, & Leong, 2012, p. 88), the values of prospective end users, project champions and project stakeholders. A participatory design process can be considered a values-led approach that facilitates and generates through designed activities a consensus of shared values and shared meaning for a project. A participatory design approach is, therefore, a “mutual learning process and a co-construction of problem and solution” (Bredies, Chow, & Joost, 2010, p. 167) between participants and the design facilitators, who are considered co-designers of the solution. A designer, regarded as a maker of things and “sometimes he makes the final product; more often, he makes a representation - a plan, program, or image - of an artifact, to be constructed by others” (Schön, 1995, p.78). The stakeholders of the Academy who contributed to the participatory design workshops were considered designers of the espoused culture of the Academy. The participants were conduits of the articulation of an authentic engineering practice, where there will be relationships between university and society that “are in and for each other” (Nørgård & Bengtsen, 2016, p. 14) in the support of being-and-becoming a twenty-first century engineer.

This paper focuses on the first phase of articulating the built environment as an artifact of the espoused culture of the Academy. Within the context of Schein’s (2010) work, artifacts are a visual and verbal signifier that afford meaning and provide material context to a situation. Applying Schein’s structural model of organizational culture presented a theoretical framework in which to deliver workshop activities and also undertake a reflection-in-action process whereby, the insights from workshop one was communicated and enacted upon before and within the succeeding workshop. Reflection-in-action provides a frame to acknowledge that culture is emergent and it is through the cycle of implementation and reflection that informed development occurs, leading to a desired co-constructed outcome.

Research method: Participatory design workshops

Participatory design workshops are designed to challenge participants assumptions regarding the given system, service or product in question. Furthermore, participatory design as a method presents the belief that:

> *all people have something to offer to the design process and that they can be both articulate and creative when given appropriate tools with which to express themselves (Sanders, 2002, p.1).*

Participants who engaged in the Academy workshops involvement and exposure to the Academy varied from being a founding member of the Academy to being newly appointed employee within the Academy. In total, there were eight participants with seven participants in workshop one, six participants in workshop two and five participants in attendance at both workshops. The workshops were designed and facilitated by two design researchers who were at the time external to the academic staff of the Academy. The facilitators were presented with the single constraint being, that the outcome of the workshops needed to be an architectural brief that communicated the requirements of a working and learning environment for engineers that were grounded by values.

The two workshops were structured to implement a reflection-in-action process meaning that the workshops were designed to facilitate a process of individual work and reflection followed by sharing and collective participation. Structuring the workshops in such a way provides the opportunity for individual voices to be heard and understood before a collective voice is created. The workshop facilitators compiled the visual and textual data produced during the workshops, synthesized it and returned an insights report to the participants before the succeeding workshop.

Workshop one focused on generating shared-meaning through the articulation of individual and collective current and future assumptions of the Academy. Activities included:

- Generation of a visual language: participants were presented with an assortment of images and instructed to select five images that represented their vision for the academy. Participants were further told to document through text, specifically words that depicted activities and behaviour, why they had selected the images. Participants shared the outcome of the task and the language formed became the foundational descriptors for the built environment within the architectural brief.
- Generation of a statement of intent: participants were instructed to write down a single point-of-view statement for the Academy using the words generated in the previous task. Participants collectively evaluated the generated point-of-view statements looking for similarities, differences and eventuating in a single shared statement of intent.
- Create a vision for a desired future state: Participants were then separated into two teams of four and instructed to produce a utopian vision story of the Academy, a story from the perspective of a student and the point of view of an industry partner. The participants were instructed to answer four questions that addressed (1) desired activities undertaken in the Academy, (2) a reaction or quote about a future users' initial encounter with the Academy, (3) a response or quote that expressed a future user sustained experience with the Academy and, (4) an urban legend about the Academy. Participants imagination and assumptions controlled the accounts of the multiple prospects of the Academy. The stories became a conversation piece for what the social and material environment of the Academy could and should be if the various utopian stories were to happen.
- Statement of intent reflection: Participants were instructed to reflect on the previously generated statement of intent. Participants collectively produced the statement of intent: *A collaborative community and dynamic practice engaging and empowering engineers by disrupting convention to improve the world.*

Workshop two built upon the outcomes of the activities conducted in workshop one. Workshop two was focused on the generation of espoused values and unpacking the desired culture of the Academy. Activities included:

- Addressing Schein's approach to organisational culture: Participants were instructed to brainstorm their assumptions and exposed values for the Academy individually. Participants were then instructed to communicate and describe the artifact and symbols which presented relevance to the assumptions and values because assumptions, exposed values, artifacts, and symbols do not exist in isolation and thus each level of culture needs to be identified and addressed. Participants then individually reflected and provided feedback on their peer's work using an I like / I would like to know more activity;

framing feedback as a positive keeps communication channels open. Following individual reflection, participants were instructed to have an open discussion focusing on the statements identified as being *I would like to know more*.

- Concentrating on artifacts: Participants were directed to use the lexicon generated in workshop one in conjunction with the outcomes from the previous task to brainstorm an ideal built environment of the Academy. Participants were guided to select a value of the Academy and address perceived challenges or barriers that impedes this value. Participants were then instructed to generate a spatial consideration concept that would overcome this perceived challenge or barrier. Participants completed the task individually than shared back to the group.

Results: Brokering shared understanding

Including individual and co-constructed content within the architectural brief transforms a document from being an individual constructed artifact to being a socio-spatial artifact that is co-owned by project stakeholders. The two workshops became a catalyst for project stakeholders to communicate and co-construct the values and cultural framework to inform the working and learning environment for being-and-becoming a twenty-first-century engineer. The resultant outcome from the workshops was a considered architectural brief that presented dimensions of delivering twenty-first-century engineering practices. The architectural brief provided information on:

- The context of the project that included the property details and background on the Academy.
- The Academy's espoused values.
- The project objectives that communicated the Academy being an activity-based working and learning environment for staff, researchers, students, and industry.
- A section titled, *this is not*, that outlined what the Academy wished to avoid in regards to both cultural and environmental structures.
- Project considerations that outlined how the Academy environment needs to engage with the social fabric of Swinburne University and the wider community.
- Components of the built environment that would facilitate a flexible, and transparent working and learning environment.

Workshop participants generated the textual content for the architectural brief. The textual content was produced during the *visual language* activity and provided the lexicon for the architectural brief (refer to figure 1). The *visual language* activity highlighted that why participants are attracted to an image varies and the language used to describe the activities and behaviours an image depicts to them differs. No participant who selected the same image used the same descriptive words to explain why they had made the selection. The outcome of *visual language* activity underlined that the lexicon used to describe environments relies on a number of similar words however, there is disparity in the understanding of what these words mean and represent. Words such as; open, private, multi-layered, inspirational, engaging and, professional to name but a few are words that produce ambiguity when commonly used as descriptors by both those who create particular environments and those who occupy them. The *visual language* activity brokered not only the individual's desires for the Academy built environment but also mitigated understanding of. For example. what a collaborative environment represents both physically and metaphysically and what a collaborative environment would symbolise within the context of the Academy.

Human aspects I **Mastery** I Futuristic I **Inspirational** I Playful I Open I **Industrial** I Interaction I Professional I **Collaboration** I Multi-layered I Creative I Colour I Experiment I Transparent I Next Generation I Reflective I **Engaging** I Friendly I Desirable I Present I Open + Private I Inspired by nature I Informal I Making stuff I **Community** I **Connected** - staff + students I Joyful I Sound - silence, buzz, white noise I Formal I Outside I Different Space I Evidence I Raw - Unfinished I Connected to outside I **Educating the whole person** I Virtual / Physical - seamless I Zones I **Empowering** I Flexible I **Personal - sense of home - sense of place - sense of belonging** I Distinctive I Serving a purpose I Has a hum

Figure 1: Co-constructed lexicon that informed the textual content of the architectural brief. Words that multiple participants used were presented in bold.

Through a reflection-in-action participatory design workshop process, participants engaged in a cycle of individual work and reflection followed by sharing and collective participation and participants identified five working espoused values for the Academy. The workshop process confirmed that the sooner a consensus of shared meaning of stakeholders is brokered, the more the architectural brief will reflect the expressed requirements of the espoused values. The five working espoused values being:

- equity and diversity,
- respect,
- working and learning are social,
- collaboration and,
- openness.

The five values were considered working espoused values because through an iterative process of reflection and implementation the values will be tested and refined as the Academy develops and expands. The working espoused values, as shown in figure 2, continued to evolve since the completion of workshop two and was taken into a further two workshops that were designed to specifically address the generation of the espoused values for the Academy.

Creating shared meaning before an architect is contracted provides the foundation to consider and question the spatial consideration of the future built environment concerning whether the proposed outcomes will support or hinder the application of the espoused values. Academy stakeholders, expanded on the meaning of each value and how the built environment could be viewed as a manifestation of that value. For example, the recognition that working and learning are socially transpired in the architectural brief as:

> *The environment will encourage and facilitate the curation, sharing, iteration and documentation of both individual and collective working, learning and knowledge generation. The environment needs to facilitate: team-working and individual working modes for all occupants (staff, students and industry). The division between shared and owned and individual and collective environments is important. The inclusion of an open kitchenette / cafe space with a large communal kitchen table: traverses socializing and working.*

The value of openness and specifically the sub-definition of *we cannot prescribe or predetermine what will be experienced* was characterised within the architectural brief as:

> *The creation of an emergent environment that is scalable and malleable. The environment needs to adapt over time and be responsive to new practices that materialize in response to changing activities, projects and occupants. The environments need to be designed in such a way that they can be adapted depending on the requirements of the occupants and the projects. The environment needs to be scalable in as much that if the current proposed rooms*

do not provide adequate space for the activities, projects and occupants of the Engineering Practice Academy modifications and/or additional rooms can be incorporated at a later stage.

Articulation of a practices purpose within an architectural brief is crucial because a brief is the "communication of instructions about intention and objectives" (Ryd, 2004, p. 231) and if the project stakeholders who are representatives of the university are not on shared ground, clear communication is potentially jeopardised.

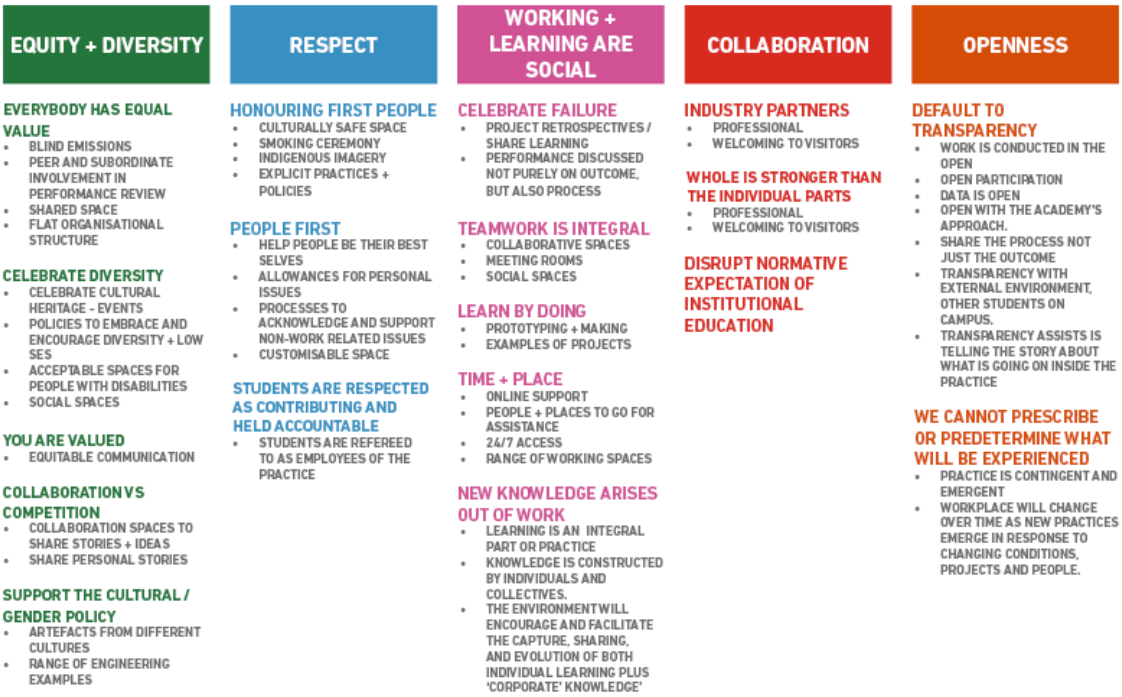

Figure 2: The working espoused values of the Academy that informed the content of the architectural brief.

Conclusion

The construction of a twenty-first-century working and learning environment for engineers is complex because it brokers the boundaries and positions of humans who are directly and indirectly involved in the project. Brokering a consensus of shared meaning and practices is paramount to ensure that negotiation of understanding, practices, identities, and positions amongst stakeholders is formed, and ownership of the project generated. The case presented in this paper is an example of one process for producing a consensus of shared meaning and an architectural brief viewed as a socio-spatial artifact.

This interpretive study proposed that the key challenge inherent in the generation of shared knowledge is brokering individual positions and perspectives. Brokering involved negotiating shared meaning through facilitated participatory design workshops. The workshops were structured to promote both personal and collective working and reflection time allowing for individual voices to be understood before a collective, harmonious, voice is constructed. The workshops produced an environmental lexicon for the architectural brief, a shared consensus of the mission statement, cultural meaning, values and outcomes to inform the architectural brief.

Culture and environments are intertwined and political because of project stakeholder's perceptions and individual perspective that typically extend the parameters of the project. An

individual's perspective is influenced by historical, cultural and material factors that extend the boundaries of the project. However, without understanding the espoused culture and activities of an environment, it is difficult to communicate to an architect the intention for such an environment.

Acknowledgements

The authors wish to acknowledge the employees and partners of the Engineering Practice Academy and Swinburne University who endorsed and supported this research.

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