The folio and critical stages in students' experiences with Design and Technology in school settings.

By

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Abstract

All students in NSW schools study Design and Technology, which is the core technology subject offered in the Technology and Applied Studies 'Key Learning Area'. Students study D&T for 200 hours between years 7 to 10, but in most instances the prescribed component can be undertaken in the first two years of high school. Many schools are offering elective D&T programs for students in years 9 and 10 and these programs are frequently chosen by students wishing to extend their experience with design and technology.

One of the questions of critical interest to teachers and curriculum planners relates to the perception that students have of D&T and how they engage with it. The author's professional interests in D&T classroom activities led him to undertake a qualitative study that was structured to maximise researcher involvement with two-year ten class groups in two separate schools over a school year. The author conducted 75 field observations and 30 student interviews.

The question of how students experience design in relation to technology within schools has relevance to both curriculum developers and teachers alike. This paper explores the aspect of students' engagement with the requirement of the design folio when studying Design and Technology for their School Certificate in NSW. This exploration permits the intended outcomes for a substantial component of Design and Technology to be contrasted with actual classroom practice. What emerges is the critical importance of a grounded connection with the design process through folio work that 'informs' design processes in useful and relevant ways.

Introduction and Background

In response to the NSW government's White Paper Excellence and Equity: NSW Curriculum Reform (Metherell 1989), eight key learning areas were established for NSW secondary
school students. At issue was a 'widespread community unease with the quality and focus of education currently provided to young people in schools' (Metherell 1989, p. 9). It was argued that many young people were not learning the right things, gaining essential skills and that they lacked motivation. The magnitude and rate of social, economic and technological change within Australia were noted as revealing the inadequacies that were particularly evident in the secondary school system.

Of further concern was the fragmented and uneven provision of courses that often overlapped. Some courses reinforced gender stereotypes. The most obvious illustrations of the two phenomena described could be found in the traditional domains of Industrial Arts and Home Science. In order to redress the perceived concerns an integrated approach that incorporated many aspects of the traditional materials based subjects were fused into a subject called Design and Technology. With the addition of a particular focus on design as a systematic process, the Design and Technology Years 7-10 syllabus was added to a range of subjects offered within the Technological and Applied Studies Key Learning Area (TASKLA) that was introduced into NSW secondary schools in 1991.

The Design and Technology Years 7-10 syllabus consists of a mandatory 200 hours of course work that facilitates learning in a broad range of technologies through design. Design in this context involves practical experiences in designing, making, evaluating, using computers, communicating, marketing and research. However, the course can be extended for a further 200 hours by doing additional course work. The intent of the syllabus generally was to provide opportunities for students to learn about technology and for them to learn through technology by 'doing' technology and this was to be achieved by working with design processes. The syllabus document describes design as 'the concept that links human ingenuity to selected activities in order to meet needs and find solutions.'

The technology component draws on the UNESCO (1985) definition, 'to utilise tools, resources and systems to solve problems and to enhance control over the natural and made environment in an endeavour to improve the human condition' (Design and Technology Years 7-10 Syllabus, 1991, p. 1).

In most NSW secondary schools students can complete the mandatory component of the Design and Technology course in years 7 and 8. However, many schools offer a range or elective courses from the key learning area of Technology and Applied Studies to students in years 9 and 10 as well.

Many of the concerns identified by Metherell (1989) echoed similar concerns that were experienced in the UK throughout 1980s, which resulted in the introduction of a new subject - Design and Technology in 1990. Banks (1994, p. 204) identified 'technological capability' as one of the key forces driving the change because of a perceived need for people who could 'do as well as know'. Eggleston's (1992) optimism about the introduction of Design and Technology in the UK revealed more than a national desire for technological capability. Eggleston envisioned the introduction of Design and Technology as a means of legitimising the role of traditional craft teachers as well as the study of technology generally. It was argued that the subject promised a 'genuine infusion' of intellectual and practical activities without having to resort to 'suspect devices'. This legitimacy would therefore elevate the recognition and status of technology in schools and remove the former barriers by virtue of the trans-disciplinary nature of technology. Coupled with the contemporary relevance of technology, the appeal to both students and teachers was 'self-evident'. Design and Technology was thus defined as 'a subject that is concerned with the identification and solution of problems in the use of materials that occur in the social systems in which our students will be adults' (Eggleston 1992, p. 7).
The union of design with technology can be justified by the rhetoric of politics, economics and pedagogical principles, however, the practical realities that confront the daily operations of the Design and Technology classroom tell another story. Eggleston (1992, p. 14) suggests that the relationship between design and technology, "consists of using technology to achieve solutions that satisfy sound design criteria and using design to achieve solutions that satisfy sound technological criteria." While the relationship appears to be equal, logical and simply a matter of each component satisfying the criteria of the other, the statement does not take into consideration the very fluid nature of both design and technology when applied to real situations. For example it is argued that design and technology have always overlapped in that most design activities involve technology and most technological activity involves design.

Such statements beg the question of balance and the desirable mix of each component. This issue becomes acute when design and technology forms the basis for a school subject under artificial conditions rather than being drawn together in a client/professional relationship within the commercial sector, which has a completely different set of conditions. The introduction of design into a traditionally craft based approach to technology has not only challenged the dominant culture of the technology classroom, but it has brought with it added requirements. In many craft based technology classes the design component had not been prominent. Students may have engaged in many of the activities that comprise design but an emphasis on the skills required to produce a well finished product was paramount and therefore assessment focused on the quality of the finished product. The product became the embodiment of technological activity. However, the introduction of design required an added dimension of written work in the form of a folio that had not been required previously.

The initial intention of the folio was to spare good students with good designs the frustration of examiners not noticing them and awarding appropriate marks (Kimbell 1997, p. 6). The nature of design assessment is focused on process rather than product and this requires documentation. Cole (1995) noted that a process portfolio provided the dimension of authenticity and therefore gave students the means of demonstrating growth and performance on a given task. Quite apart from the difficulties associated with assessing design (Kimbell 1997), Wright (1994) argued that the scope of technology activity in schools should not be limited to design alone and that important technological concepts should not be relegated to the chance encounter of the design brief. Williams (2000) noted a variety of pedagogical approaches to the study of technology of which 'design method' was only one. Furthermore, he reiterated Hennessy and McCormick’s (1994) rejection of the idea that the study of design within technology is reducible to a simple set of steps. Designers are confronted with context specific problems and decisions so these authors argue that flexibility is important in order to facilitate skills and understanding of the sub-processes that may vary with different problems (p. 104).

Hogan (1991) denied that such a 'thing' as the design process exists at all.

These concerns that were raised by teachers and researchers have important implications for students studying Design and Technology. How do they make sense of the imposed processes and integrated materials and contexts that constitute the study of Design and Technology?

Some Guiding Questions

How do students connect with the design processes? How do they experience designing in the classroom? What impacts does the classroom impose on design experiences for students of Design and Technology? These questions are addressed within the framework
of the broader study. However, the role and function of the folio in school based design and technology classes partially addresses the engagement that students have with the design process in school. How students compile or construct and use the folio along with its integration into the design experience are sub themes of the school based design experience. The extent to which the folio informs students' design processes is discussed in this paper.

The impact of the role of the folio can be viewed as a watershed in the students' design experience. For some the requirement is positive and enabling, for others folio work appears to frustrate progress. The focus on students' engagement with the folio provided a reference point for a larger (PhD) study exploring how students 'navigate' design activities in school settings.

The Design Classroom

Design students in school settings do not refer to the design classroom as such. They talk about doing Design and Technology, D and T, DT or Techies. The areas with machinery, workbenches, materials stock and tools were most frequently called the workshop. Sometimes students would specifically talk about the areas using the predominant material that traditionally dominated the space, for example, woodwork, metalwork or sheet metal. The two sites that were studied were not identical in this respect. Aerington College had a workshop area that mainly used wood materials with only a small alcove for metals. Maranatha High had a larger space with a better balance between the two traditional materials. Both had 'clean' spaces attached to the workshops.

At Aerington the 'clean space' was created from a glass partitioned enclosure within the workshop area whereas at Maranatha the equivalent space was more of a traditional classroom (room 13). Room 13 used to be a technical drawing room but has more recently been used as a general classroom for a range of other school activities because of the increasing need of teaching space at the school. At Aerington the clean space was partitioned within the workshop but its inclusion diminished the workshop space and provided a tight squeeze for a regular class group of seventeen students.

There was more than creative tension between the workshop and the 'clean spaces'. The spaces juxtapose the making and the designing and generally speaking, students had a preference for the workshop activities.

The Folio Connection

The word folio is mentioned once in the Design and Technology Years 7-10 Syllabus. In that instance the reference relates to the skills objective of communication and applies to the outcomes for the Additional Course. In section 5.1 it requires students to 'document, in folio form the Design Project using a variety of written and graphical means' (Design and Technology Years 7-10 Syllabus, 1991). The requirement for the Mandatory Course is less specific about the f...

Between five and six percent of year 10 (School Certificate) students in NSW study Design and Technology as an elective. After the course had been fully implemented in 1995, the percentage of students studying Design and Technology increased by half of one percent for each year except for the 1999 - 2000 period where the increase was one tenth of a percent. Hogan's (1991, p. 22) prediction that the subject might not catch on seems to have validity. The technology and applied studies subjects that students were choosing after completing the mandatory course of Design and Technology include the traditional skills and materials based subject 'Technics' and 'Food Technology'. The number of students electing to study Computing Studies for their school certificate has doubled in the last decade.

Table 1

Students studying elective subjects offered within Technology and Applied Studies.

Expressed as a percentage of the total number of School Certificate students in NSW.

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Design and Technology as a year ten elective subject has had modest growth in the ten years since its introduction and it may yet be too soon to question the optimism that preceded the introduction. Had curriculum developers misjudged the design culture and the expectations of Technology and Applied Studies students? The examples of the 'incident' and the 'episode' in room 13 contrast the challenges and the rewards for the participants in school based design experiences. What emerges is the complex balance between matching the expectations of the new focus on process in Design and Technology and adequately
meeting the expectations that students bring to the study of design in technology in school settings.

The Incident in Room 13: Getting the paperwork out of the way

It is early in term three and the students have recently returned from the mid year holidays and spent the first week back at school doing the year 10 reference tests. The students are keen to get going on their projects but Harry, the Design and Technology teacher wishes to take stock of their progress. The prospect of a 'theory' class excites neither Harry nor his students. The evidence that something different is about to happen becomes obvious by the reluctance of the group to move to room 13, and this annoys Harry. His tone reveals his agitation. The rhythm and pace of the normally relaxed and informal gathering of students in the technology facility has been disrupted. The students amble along the short corridor from the workshops where they had initially assembled and take seats in a regular looking classroom that has single desks connecting at the ends making four rows with a centre aisle, and a chalkboard with notes from a previous class.

Dismissive of the students' complaints about 'doing theory', Harry laments the delays that many had experienced in getting materials and getting help from him. He urges the class to start work on a new project that is suitably limited in scope to be manageable and to give them a sense of achievement. He proceeds to sell an idea of a low cost child's toy made from simple materials using available technologies. Many of the students are unprepared for the theory class despite threats of detentions for not bringing their pens with them. Nevertheless, Harry distributes A3 sheets and dictates the parameters of the design brief, 'a two or three wheeled toy, preferably two wheels, that small children could handle.'

Jennifer enquires about the cost of a scooter and Harry hastily admits that they could buy one more cheaply than the students could make one, but the costs can be kept to a minimum if the students choose to use the skateboard wheels that Harry has in stock. Nigel asks if they could make a child's toy that has four wheels. Harry's reluctance to concede to an extra wheel unleashes cries of 'not fair' and 'why not?' from several of the students. While the fate of the forth wheel is being decided, Errol rolls his A3 sheet of paper into a cone shape and merrily toots through it. Alan blows raspberries on the back of his hand. Greg bounces a skateboard wheel on his desk and Brian speaks loudly, demanding that he needs to 'go get a pencil'. Ian, Rohan and Ray sit quietly. Karen wants to know how a skateboard wheel might be used on a young child's toy, but agreement has not yet been reached on how many wheels are permissible and her timid inquiry goes unnoticed.

Harry's motives for the 'theory' lesson surface in his agitated response to the proceedings.

'Some of you don't realise that I'm trying to help you. I don't think you are aware that this is an academic subject and, like it or not, it requires written work and practical work. You get upset when I have to mark your practical out of sixty per cent. Even if you make a perfect job all you can get is sixty percent. I'm trying to help you with the other forty percent. Have you got a pencil?... Your brief should read, a toy with two to four wheels that are no larger than 300mm. It is not to be a skateboard but a skateboard assembly can be used. Look this has got to be in your folio so let's get it right...'

Source: Field Notes - ObsMar21July24.

The bargaining ceases but the restless banter continues. Karen and Jennifer converse quietly, Ian, Rohan and Ray debate a technical point loudly, Kelvin, Chris and Andy make
notes on their A4 sheets of paper and Jamie observes the 'intruder' who is observing them. Nigel squares his shoulders when Harry commends those in the class who continued project work during the holidays because he knows that he is the only one who qualifies for the praise.

Harry lists other possible headings for the folio and dictates content to be included. For a third time he expresses disappointment that forty percent of the possible marks have to be given for communication. His concern for the final grades for his students is reciprocated by further restlessness:

‘Look I really am disappointed with your ratt-att-att-tatt. (The incessant disruptive behaviour and general noise. But this observation seems to spur the culprits onto greater heights.) Two things before we go. Don't think in terms of dropping the other project. And make a start thinking about the new project. Go to bed thinking about it and wake up sketching. You can start some sketching now and continue it at home for homework.

We'll get a bit of the paper work out of the way first. Get started on the sketch of the wheel connection. Then pass it by me before you leave.'

Source: Field Notes - ObsMar21July24.

The students immediately prepare to leave room as the bell sounds and as he pushes his way to the door, Brian asks Andy if he can have a copy of what he has written...

The incident in room 13 was the one observation throughout the whole data gathering process that stood out. It epitomised the antithesis of all that a design classroom should be, but the essential elements and the reasons for instances like it will be recognised by many teachers and students of Design and Technology. This incident initially provoked emotions of annoyance because it seemed apparent that Harry had the students' best interest in focus and that his view of the larger picture was not fully appreciated by the students. They did not have the full advantage of Harry's insights into and frustration with certain aspects of the syllabus. At a later stage the lesson seemed typical of students being students, whereas more recent analysis of the incident in room 13 highlights an obsession with assessment and as a result the 'straight jacketed' role that the folio seemed destined to pay in school settings. The role of the folio and explanations of how students experience design at one level can be understood in the ritualistic performance of the room 13 incident.

It is pivotal to the half of the story that deals with the folio, which is itself, nearly one half of the output (40%) from the design class. The artefact that is required is a product or system and a folio that tells something of how the outcome emerged. Yet it appears to be one of the most problematic areas of the design experience for the students. Is this is due to the requirements of the Design and Technology subject being drastically different from the expectations that the students have for design and technology? Many students expressed that they were keen to make something during the Design and Technology class and perhaps they did not factor in the extra demands of the folio. A tacit recognition of this was evident when Kevin (Aerington's D&T teacher) allowed his students to make a project of their own choice late in the school year without any written requirements, as a 'reward' for their entrepreneurial team projects that dominated their year 10 design experiences.

Perhaps the exercise of preparing the design folio seems to the students to be so banal that they postpone it until it is absolutely necessary for assessment. Either way the preparation of the folio appeared to be an onerous task for the students. The students did however
complete the folio with a form of grudging resignation with one notable exception, which is explored later.

The first part of the incident in room 13 is about delay. Delay in both materials and access to the teacher's expertise. Harry laments these limiting factors along with inefficiencies of students not being able to do more on their projects during school time. His method of dealing with the lag was to move on. But the students were fed up, and Harry was frustrated too. Harry was drawing on his extensive teaching experience by recognising that the students maybe finding their current projects stale. By urging them to move to a new design challenge and assuring them that they could complete the current projects in parallel with the 'new problem' added to their frustration. The students would have been happier to have completed what they were doing but their rate of progress did not match the approaching assessment time frame.

**Working Outside the Syllabus...**

Discussions with Harry revealed that he felt teachers are nervous about allowing students the opportunity to do something different or engage in some activity that may vary from the apparent expectations of the syllabus. His colleague's critical observation that the 'testing' or experimenting by students with the components of their projects had clearly contributed to the apparent unease about what students should be doing in Design and Technology.

The theme of the quality of students' project work emerged in the form of this creative tension between colleagues. The tension was not directly imposed from outside the context of the design and technology classroom but from within. Harry felt that 'trade' standards have a limited place in Design and Technology classrooms. Furthermore, he argued that unrealistically high 'trade' standards, which focus mainly on craftsmanship and project quality, do impose restrictive parameters on students' engagement in design activities.

There were obvious tensions between Harry and his teaching colleague Rob Banton. Rob was the conservative younger colleague who played the role of the disciplinarian and housekeeper. At times it appeared that the machines, tools and the processes of design and technology were of primary importance for Rob and that students should adhere to appropriate ways for working within the greater technological framework that the design and technology facility provided. For Harry, it was quite a different matter. Harry wanted his students to engage in the activities of designing and making in uninhibited ways. The mundane matters of keeping the room tidy frequently emerged d as being of lesser importance. For Harry it was quite important that students connect with design and technology in ways that mattered to the students themselves, and the obsession with assessment and the superficial compiling of evidence that attended students' designing activities was almost held in contempt.

For Harry's colleague the experimenting or testing that students were engaging in represented a frivolous waste of time. They should spend more time 'working' according to Rob. However, it was not clear what Rob meant by 'working' but within the context of the conversation there was a perception that both structure and surveillance were lacking in the students' design activities. Harry does not see the testing, experimenting or playing as time wasting and his conclusion that 'students need to learn form their own experience and at their own rate' is consistent with his belief. For Harry the 'connection' with design is more important than a formal progression through the design 'process', nevertheless he was keenly aware of the aspects of assessment that represent the pragmatic realities of school life which became evident by the incident in room 13.
Despite an apparent contradiction in belief and practice, Harry stated that design is about solutions to problems that students have. Yet there are school pressures that diminish the ideal design experience. The pressures of assessment provide the best example. Under the craft based approach to technology the projects could be objectively ranked according to the quality of 'craftsmanship' and finish. The assessment of process presented a new dilemma.

'In the pragmatic eyes of the teacher the product of the exercise becomes the file or notebook or portfolio evidence which may complement the outcome of the technological assignment or task. The objective of the teacher very quickly becomes the production of well presented evidence as opposed to the enhancement of the understanding of the process.' (Shield 1996, p. 55.)

Harry speaks at length about valuing specific aspects of the folio in the context of teachers being nervous about students’ work not being up to standard. With respect to the project the teacher's ego is dented when project construction is not satisfactory if compared with 'trade standards'. Harry argues that since many teachers come from trade backgrounds their sensibilities are offended when substandard student work is revealed to others (particularly other teachers). The idea applied equally to experimental work. The other teacher's conception of what was 'worthy' experimental testing did not correspond with student conceptions of what was important for them to know or to do in order to know. Harry favoured discovery learning at its most basic level. He also identified the 'embarrassment' or what appears to be a 'technological cringe' that teachers seem to have toward the folio because it should provide the evidence that rigorous design process has been systematically conducted. And this is not always apparent at interim stages throughout the life cycle of project development. Nevertheless, Harry valued the interim stages of development work on the folio in what he called the 'rough stuff'.

'Well I do, I value the rough stuff. I'm an intelligent designer and at the moment I'm working on an undercarriage for an ultra-light. I've got a lot of sketches by the bed and round the room. When I think of something in the night I sketch it out or write it down. There's quite a bit really and I don't want it lost. I suppose it is a folio in a way. I tell my wife to leave that part of the cleaning up to me. When I feel that a component will work I circle it or tick it. I don't reckon that you can get a result without the rough workings - it's all valuable. Trouble is with year twelve the folio is broken down into so many small marks, three for this five for that. The kids end up just making stuff up for the folio for assessment. It's just pretty pretty for the examiners.' Source: Field Notes - ObsMar12aMay10.

To Harry the rough record is essential for his own engagement with design, because good ideas can be lost if not recorded, but more importantly he sees the rough workings as being essential for getting a result. He wants his students to share his valuing of the record and its usefulness for getting a result. In this instance Harry believes that the folio is important for informing the design process and essential for a satisfactory design outcome (project). He does not subscribe to the 'pretty-pretty' view of the design folio for the examiners that the syllabus tends to unwittingly foster.

Although the students tended to prepare design folios that were directed to assessment criteria rather than reflexively informing the design process, there were instances where the students enthusiastically communicated between themselves using the folio as a reference.
Showing, Sharing and Comparing: An Episode in Room 13

When producing the project students frequently had occasion to show their folio or folder to others. This activity can serve as a cursory form of assessment of how the student is progressing. The showing and comparing on this level are of the kind that students do with their peers. Kelvin's experience illustrates this kind informal peer review that lead to a robust exchange of design ideas.

Kelvin flicks over the pages of a plastic display folder. He has some bold pencil sketches of a billy kart type vehicle that fill up the whole page. The sketches communicate quite clearly a top view and a side view. The sketch of the wheel connection detail that Harry had the students draw in a previous class is clear and Kelvin talks enthusiastically about the grass karts. This is unusual for Kelvin because he does not often have much to say. 'On TV the other night on Get Away they had these karts that go down hill on grass at about 60 kilometres an hour. You sit up on a tyre for a seat and you steer with your feet. They really go fast. I think I'll make one of them.' Kelvin eagerly concludes.

Chris enters room 13. 'Did you see those grass karts on Get Away the other night?' Chris blurts out loudly. Ian enters room 13 after Chris and more calmly explains that several of the boys in the class had seen the program Get Away on TV and got some good ideas for making karts of their own. 'I taped it and I'll bring it in if you like,' Ian offers. Kelvin announces, 'We've all decided to make one. They will be a bit different because we'll do our own designs.'

Chris opens his folder and shows some his sketches and ideas. One of his drawings is computer drafted and dimensioned. His dad he helped him with it at his work. Chris explains about the size and says that he felt comfortable with the choice because 'it seemed to be right'. 'We have designed it to suit me. It is the right length for my body size,' Chris asserts confidently. Someone asks, 'What about the material sizes?' 'Dad thinks that the axle materials and the centre piece are made from 50mm x 25mm mild steel and the steering rods are 25mm x 25mm, Chris says.

Kelvin and the researcher talk about the small trains that are pulled around at carnivals or shows. I explain that it is important that each carriage follows the one in front and that many ice-cream stands would be wiped out if this aspect of the carriage design were not considered. (Kelvin laughs.) We discuss how the mechanism works with a diagonal bar connecting the front axle to the rear axle and as the front axle is turned one way the rear one is turned the other way. This makes sure that the back of the carriage follows where the front has been.

I ask Kelvin why he has drawn the pencil sketch of the kart like Chris'. Chris' drawings show connecting rods between the front and rear axles that turn the same way simultaneously rather than opposite to each other. Kelvin says he isn't sure why but he doesn't seem to take offence at the inquiry. Nigel enters room 13 and studies Chris's drawings and proclaims that they won't work. 'The thing will go side ways down the hill. What is the point of that?' Nigel asks with self-assurance. Chris tries to tell him that the front axle turns more than the back one so the kart can therefore be steered safely. Nigel poo-hoos the idea.
The boys move to the front of room 13 and start making chalk sketches on the board. They all talk at once and each boy is trying to explain his point loudly. If they took turns they would find that they are arguing the same point, although they use different information. Chris says that he is going to make a wooden model of the kart to demonstrate his point. He asks me to join him. Ian uses small wooden sticks to demonstrate the opposite effect. Nigel offers Chris ten dollars if his concept works without going side ways. Ian and Chris get busy with materials. Nigel and Kelvin both appear content to observe.

Nigel interrupts and informs me that Chris's idea can't work. Within a few minutes Chris has a crude stick model of his kart on the bench. It is not constructed well enough to model the tracking behaviour of the vehicle on the smooth masonite bench top. The boys return to room 13. Kelvin suggests that it will work better on the carpet in there...


The class seems to have developed its own momentum for these boys with this particular project. They became extremely interested in the task and appeared to be quite unaware of distractions. There appeared to be two distinct sorts of design taking place, a 'premeditative' designing and 'situated' designing. From the researcher's observations it seemed that not a lot of design is done beforehand, even though the syllabus and teachers encourage this practice. Students seem to engage in situated design for most of the time. This is characterised by them having a fairly clear idea of what they want to do but they often needed technical help in order to move to the next stage of the project.

The grass kart was perhaps atypical because it captured the imagination and boredom with the premeditative design elements was conspicuously absent on this occasion. The early stages in the life cycle of the design project were frequently problematic for students because of the lack of connection with the process and interest in the project. But on this occasion the students happily fed off each other's ideas and shared them. Several of the boys had well developed sketches and drawings in plastic covered folders. They had not been asked to produce these for assessment at this stage, yet they used this information to share understanding about the steering mechanism and the general construction of the vehicle. Their criticisms and robust discussion provided excellent opportunities for clarifying their ideas.

Wanting the product provided strongest motivation for producing an outcome on this project. The aspects of the folio did not appear to be onerous because the information gathered and sketches made were of vital importance to the smooth functioning of the vehicle. The boys could see the point of the folio on this occasion. They needed the information and appeared eager to get as much of it as they could. They used their folios and folders to share the ideas that they had gathered to that point and did not appear to be concerned that their folders were not in pristine condition for presentation. They shared what they had at the time and there appeared to be some competition among the boys to get the next bit done first. Both Kelvin and Chris had prepared well-developed sketches within a matter of a few days of commencing the project.

Finding a project that captured the imagination proved to be quite liberating for both Kelvin and Chris. These boys had been the 'silent partners' on other projects but getting 'hooked' on the idea of the go-karts became both liberating and empowering for them. They argued about aspects of how they felt the thing worked and how they could modify aspects of the design to suit their own needs. This time Chris emerged as the leader on the project. This was a complete role reversal for him because he had shadowed Nigel with the solar car
challenge project. In this instance Chris provides a good example of the use of external help. In Chris' case, the help came from his father. But this was one of only very few occasions where Chris shone. For much of the time he spent doing the 'gofer' work for Nigel. He was not an equal partner.

Others had good intentions but Chris actually produced a very sophisticated working drawing early in the life cycle of the project. With his dad's help, Chris was able to present himself at school with material, components and sketches ready to see the project through to completion. With many of the school projects there was a clear possibility that even though the student had a good idea and had planned the project well, the availability of materials had the potential to become a barrier to completion. Either because of the inability or unwillingness of the school to purchase them or because of limited funds on the part of the students. The latter proved to be Kelvin's problem.

Tool and process skills also presented barriers. In Chris' case his father assisted with both materials and some tool skills. Chris had a good idea on how to go about making the project and a good sense of what to do next on this particular project. However, with projects of this complexity the success frequently depends on external help because of the shear weight of demands on the teacher's time and expertise.

Folio Assessment

Students were reserved about discussing the assessment function of their folio throughout interviews however they duly noted that this was a legitimate function nevertheless. They mentioned the communicating aspects of the folio during interviews but the ways and types of communication became apparent in the field observations. For example many of the students felt that the teacher needed to know how the students were going with their design projects and felt that the folio was an appropriate means of achieving this type of communication. In most instances the teacher would take visual stock of student progress however there were instances where more formal means of communicating progress became necessary and the game of 'gaining grades' commenced. From the teacher's perspective gathering entries in the marks book is a necessary part of the role of teaching. From a student perspective maximising that entry appears to be essential whether the mark is earned or not. Brian and Nigel poignantly demonstrated the negotiated aspects of formal folio assessment during a Design and Technology class while the teacher's attention was diverted elsewhere.

Brian sits at Harry's portable desk. Nigel looks over his shoulder as the pair examine Harry's marks sheet. Nigel bursts out laughing. I move closer to learn what is so intriguing and amusing. He explains for the researcher's benefit, 'He's got a mark against my name for my project and folio and he hasn't seen them yet.' He slaps his knees in hilarity as he says this. Brian suggests that he could easily change his grade for a better one if he wanted to because Harry has entered the grades in pencil, but responsible Nigel reckons he could tell. Harry returns and the boys manage to be at a safe distance from his portable desk when he arrives and resumes his seat. Brian then asks Harry how he arrives at the grades that are written in the book. Harry's answer is revealing. 'It depends on how much you have done, how much you need to do and how much I have to do to get you there...'

Source: Field Notes - ObsMar19June12

In this instance, Nigel sees the folio as a bit of a joke. His discovery that he has been awarded a grade before the teacher has seen his work amuses him. Brian, with whom Nigel
shares his joke, is more interested in the possibility of altering the pencilled grade to a more favourable one, but Nigel's recognition of his teacher's detective powers serve to keep him honest. Perhaps Brian does not see the irony in quite the same way that Nigel does.

Perhaps Brian has noted the fact the grade is recorded in pencil and therefore represents a temporary entry. On the other hand he may not make the link between the usefulness of the folio in the design process and he may see it merely as an assessment device where the grade is negotiable rather than being linked to evidence of clearly recorded and identifiable design effort. Nigel by contrast was aware that his teacher would have some idea of how his project was progressing and that his teacher would have some idea of the likely standard of his folio based on previous efforts.

The mismatch of realities does not alter Nigel's apparent perception of the folio. Yet Nigel works with two folios, one folio for submission and the other to inform the design process. The one that informs the process is a ripped diagonal piece of cardboard casually stowed in the bottom of his locker. The assessment folio is the one that is carefully crafted on computer often quite late in the design cycle (even for Nigel), which could be anything from a few days to the night before the due date.

Kelvin and Chris' folios served a functional purpose on the one project that really captured their imagination. From an assessment perspective Jamie's folio was necessary in order to 'pull him through'. Brian wanted to put as much in as possible to maximise his grades, and Nigel saw the assessment process as a joke. A joke, which he took rather seriously just the same. His assessment folio was carefully prepared and it contained all of the identifiable assessable elements neatly presented in a plastic sheet display folder. His marks reflected his teacher's expectation that he would score well. Nigel knows how to play the game of school. The game was easy because the rules are relatively clear to him. However, his designing operated at a personal level beyond the school.

**Folio Views**

During the earlier part of the school year references to folio involved issues of communication, clarification and confirmation of ideas. The folio became a record for these ideas for later assessment. However there appears to be a negotiated phase that precedes assessment that comes toward the end of the year. It is during the negotiating phase that students became reassured about what to include in the folio in order to render the documentation acceptable for assessment. Brian's reflections are most telling:

Researcher:

I notice you've got to do a folio. How do you value the folio?

Brian:

Oh I think it's a good thing. I think I amongst others should use it a lot more. I do use it and I do put my designs in it and I do write things down in it, design briefs and what ever Mr Gane gives us and I try to keep it all together. I think it is a good thing but I think there is too much placed on it. Too many, I wouldn't say marks, but you know you lose marks because you don't have a certain amount of drawings in there and that sort of thing. I think if you've got one or two drawings in there that explain and show everything, that's pretty much what you need. I don't think you need hundreds of gross little sketches or anything. That's the sort of thing that Mr Gane is looking for, I know that. So what I tend to do now is just scribble in it and just do different little things
in it just to fill up room to show that I've done it and just write underneath, this was an idea that I had. You know it's not just doing anything, not a drawing, but some sort of kart I'll do it and make a bit of an abstract thing to it to take up a bit of room so it gets me extra marks. I think it definitely helps because you can look back on it later on and say well look at that, this is what the design was and this is what we did and how we did it. And if you wanted to make it again I suppose it would help. I think it was definitely worthwhile.

Researcher:

When do you do most of your work on the folio?

Brian:

Umm, well I'd say most of the work would be done at the end of my... Say when I've finished a project I get in there and fill in all the gaps. I probably draw one or two pictures maximum before I start the project and at the end I might draw another two or three and do a bit more of a write up and usually an evaluation and that all that sort of stuff. So it's mainly towards the end of the project and also if it isn't fully completed by the end of the semester, I'll also fix it up and tidy it up, do a few more drawings and do a bit more writing here, explaining a few things and getting ready to hand it in.

Source: Interview - IntMar4Sept12Brian

The intersection of the observed folio instances and the folio 'rhetoric' from the interviews contained the essence of the role of the folio in the design and classrooms that were studied. The design that was observed lacked the logical algorithmic structure that the syllabus-approach to design method seems to imply. The students appeared to adopt a pragmatic approach to all aspects of the project. They did what seemed to them the next most sensible thing to do. Often that implied waiting for the teacher's advice and students found this time particularly frustrating. It would be reasonable to say also that the advice that they were seeking was not 'design' advice as much as it was technical - if a sensible distinction between the two can be made here. Students knew what it was that they wanted or needed to do next but often times were just not sure how to go about doing it.

Flexibility and ownership of ideas and the design project have been shown in the literature to be critical factors for student progress. However, being flexible and attempting to impart ownership to design projects that students have no demonstrated interest does not allow them to make the design connection and therefore benefit form understanding technology through design. Discovering the project that a student really wants to do, and can do, impacted strongly on the student's sense of purpose and inturn influenced the folio connection. Connected students' folios inform the design process in useful ways and assessment becomes a secondary consideration to the pleasure of engaging the technological imperative - *I want therefore I make.*

**Summary and Conclusion**

Since the introduction of the new Design and Technology syllabus in NSW there has been a challenge to the culture of the way technology has been encountered in school settings. The expectation of higher levels of written work as evidenced by the requirement of the folio has added a new dimension to a subject that previously relied on materials and manipulative skills. The product-oriented project was the chief outcome of the traditional project approach that was assessed mostly by the quality of its assembly and finish.
After ten years and despite the government's technological capability thrust the design approach to studying technology does not have more than six percent of all School Certificate students in NSW voluntarily enrolled in the Design and Technology school subject. When given the choice of elective studies at the School Certificate level a third of NSW students have chosen the traditional skills and materials based subject 'Technics' in this current year. Similarly, one third of students have chosen Computing Studies as an elective.

This paper focused on the role and function of the folio with in the study of Design and Technology at the School Certificate level. It has explored students' engagement with the folio requirement and described the contexts where the folio is ritualistically produced for assessment purposes. By contrast design engagement to the point where students have a strong personal interest has produced a connection with folio work and design processes that produce uncharacteristically high levels of activity that are internally driven and where the teacher plays a modest facilitating role.
References


