

PATT 29

Plurality and complementarity of approaches in design & technology education

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Marjolaine Chatoney, ed.

École supérieure du professorat et de l'éducation, Aix-Marseille Université

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Welcome to 29th PATT conference

Plurality and complementarity of
approaches
in design & technology education

in Marseilles, France, 7-10 April 2015

PATT 29 is hosted by the École supérieure du professorat et de l'éducation (ESPE), Aix-Marseille Université – and the laboratory of research in education “Apprentissage, Didactique, Évaluation, Formation” (ADEF – gestepro team), Aix-Marseille Université. PATT conference will be as usual focused on school design & technology education and teachers' education. Our ambition is to arrange common seminar and social events.

We hereby welcome international colleagues to this golden opportunity to share and learn more about the latest on-going and completed research in the field of technology education research, spanning from early years school through to upper secondary education and teacher education.

The overarching theme of PATT 29 is “Plurality and Complementarity of Approaches in Design & Technology Education”. The papers in these peer-reviewed conference proceedings all reflect this board theme, but they also relate to a variety of key areas in school technology education. Research topics include, for example, aspect of learning, teaching and assessing; Science, technology, engineering & mathematic (STEM); linked with languages; together all these research areas are representatives of plurality and complementarity of relevant approach for design & technology education.

PATT association

The **P**upil's **A**ttitudes **T**owards **T**echnology association (PATT) is an international organization based in the Netherlands. It aims to promote research in technology education. It brings together educators, researchers and professionals in the field of technology education and training. It is mainly intended to promote international trade on innovation, design and teaching engineering. This association is presided over by Professor JM. De Vries of the Delft University. Among other activities, since its creation in 1985, PATT organizes every year one of the few scientific meetings that bring together professionals in technology education coming from many countries around the world. PATT conferences have been held in the Netherlands, Israel, Kenya, Poland, Scotland, South Africa, USA, Sweden and New-Zealand. This is the first time that France is responsible for hosting this event. Indeed, during the Stockholm conference PATT26, the general meeting adopted decision to entrust the organization and responsibility of the 29th PATT conference to the GESTEPRO research team, EA 4671 ADEF Aix-Marseille University (AMU) and the *École supérieure du professorat et de l'éducation* (ESPE). The 29th PATT will be held at the *palais du Pharo* – 58, boulevard Charles Livon, 13007 Marseille – from Tuesday 7th April to Friday 10th April 2015.

The PATT 29th conference will be a moment of exchange focused on technological education and teachers' training. Issues, methods and advances in research and teaching engineering related to this field will be tackled. It is also an opportunity to introduce contributions of interdisciplinary research fields (sociology, didactics, philosophy,...). These scientific meetings are intended to accommodate all research actors but also all those who are concerned with technology education (teachers, trainers, policy makers, managers). Teachers of the ESPE and their students are invited.

The PATT conferences are highlights into the life of the researchers' community who are interested in technology education. PATT contributes to the current research on learning, teaching, training and the dissemination of technology education and practices and cultural relationship to the technological environment. Current issues of technology education refer to some of the major concerns, in particular to the struggle against the disaffection of science and technology education (especially for girls). Another important issue relates to the decompartmentalization of disciplines which aims to bring closer education technology lessons of math and science.

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Thank for your help and for your time!

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Reflective writing for design & technology: shifting the focus from justification to critique



Belinda von Mengersen

Lecturer Technology (Textiles)
National School of Arts
Australian Catholic University
25A Barker Road
Strathfield NSW 2135
Australia
Phone: +61 2 9701 4499
belinda.vonmengersen@acu.edu.au

Abstract

Justification: an acceptable reason for doing something; critique: a critical analysis (Hornby, 1995). Reflective writing in Design and Technology (D&T) is usually undertaken towards a project's completion. However, reflective writing limited to the post-analysis phase is not conducive to the higher order thinking which contemporary pedagogical theory (in particular, Inquiry Based Learning, or IBL) aspires to. This paper suggests that when reflective writing is only incorporated immediately prior to summative assessment – a phase in which the student typically has no agency and is certainly preoccupied with essential criteria – it becomes a mere justification of the students' decision-making and outcomes, instead of a critical, embedded analysis of the design project, enabling future learning.

Keywords

Reflective writing, critique, justification, literacy, assessment

Introduction

The inclusion of reflective writing has been shown to enhance literacy, critical thinking and self-efficacy in Design and Art (D&A). Overall, this has resulted in a general shift in the tone of student documentation from the mode of 'justification' towards a mode of 'critique'. Could reflective writing offer similar learning outcomes for Design and Technology (D&T) students?

Whilst writing is incorporated to some extent in the fields of D&A and D&T, its potential as a tool for thinking and reflecting has perhaps not been fully realised. Traditionally, subject choices like D&A or D&T are considered practical rather than theoretical, and less dependent on skills that may be perceived as academic, such as writing. As Owen-Jackson (2013) asserts: "subjects focused on knowledge are perceived as 'academic' and those focused on skills as 'practical,'" (2013, p.64). Consequently, some students are drawn to these areas in avoidance of formal academic writing assessment tasks, as Childers, Hobson & Mullin (1998), Orr, Blythman & Mullin (2004) and Owen-Jackson (2013), have identified. Orr, Blythman & Mullin also go on to say that in their field (Design and Visual Art Education), "the role of writing [has been] questioned" (2004, p. 75). There is a viewpoint that through the artifact, the student communicates without the use of verbal language, using a visual language that is 'wordless'. However, the reality – shared by D&A and D&T – is that the curricula require students to "create, design and write" (2004, p. 75). Furthermore, and of crucial importance, is the knowledge that curricula "are assessed via the textual and the visual" (Orr and Blythman, 2002, p. 1).

In D&T, assessment often takes the format of the prototype and the design record or portfolio – a combination of written, diagrammatic or illustrative tasks that informs a practical component like a design prototype. The written components of a design folio most often include some element of reflective writing or written evaluative statement. The role of the folio is to document design development and evaluate the outcome. Despite common perceptions, therefore, written tasks are a crucial component not only of assessment, but also, ideally, of the courses' inherent thinking and problem-solving requirements.

Reflective writing and key factors

Students' reflective writing can offer insights into their comprehension and engagement. When, however, they have employed a mode of justification, as opposed to one of critique, significant differences can be identified. Justification can often be characterised as a post-production activity in which students seek to present theories in support of already-completed work. Contrastingly, critique occurs throughout the planning and creative processes, underpinning discoveries and accurately mapping the work's conceptual identity. Disparities between these two modes – influencing both the quality of work and students' capacity to execute reflective written tasks – can be categorized as relating to timing and vocabulary.

Timing

The practice of reflective writing appears to be more meaningful when used throughout the working process, rather than just in the last stages and final evaluative statements linked to assessment outcomes. It is important to consider at what points in the design/make/evaluate model (Sanders, 2012) evaluation should occur. Race (2007) reminds us that students in an assessment situation tend to write what they think the assessors want to see, or in the mode of justification. Barlex (1994) emphasises the need for timely undertaking of evaluative practices. He offers practical suggestions for both assessment task design and assessment practices that shift the focus of written evaluations in D&T from a mode of 'justification' – by the students to their assessors – to a mode of 'critique' – in which both have a "dialogic" (Bain, 2012) role.

Barlex (1994), questions the placement of written evaluation exercises only at the end-point, once project work has been completed. In addition, he proposes that students should be collaborators in both evaluation and assessment:

This [matter] concerns the assessment of the performance of pupils throughout a project. It is clearly more complex than evaluating a product...

In assessing a pupil's performance on the various stages of a project you have to consider when such assessment should take place in addition to how it should take place. Ideally, the assessment should take place as the project develops. In this way the rose-coloured hindsight of both pupils and teachers can be avoided. (p. 137).

Hennessy and McCormick (1994) also discuss some limitations of assessment in D&T, focusing on the documentation of the design process:

Our research... is investigating the question of whether or not pupils are assimilating and developing a coherent view of the design process. One of our central hypotheses is that pupils may merely try to accommodate teachers' aims through superficially and mechanically following the prescribed procedures, whilst simultaneously adhering to their own product-oriented agendas, thus creating a 'veneer of accomplishment'. (p. 100).

Barlex (1994) suggests the use of a checklist (essentially a simplified version of the assessment rubric) to support a more dialogic and incremental approach to assessment and evaluation. Such a method would be similar to those more dialogic assessment practices employed in the field of D&A, where beneficial outcomes such as enhanced vocabulary, critical thinking, and self-efficacy have already been identified.

In a common model of reflective writing, the informal use of a design journal or workbook is combined with a formal process of design evaluation. Barlex (1994) addresses the problematic paradox created by this:

The intention of the workbook is to reveal the pupil's thinking and decision-making as it has developed throughout the project. It is not intended that it should be produced retrospectively once the practical work has been finished, although such practice is, unfortunately, not uncommon (pp.137-139).

While such a folio documentation process is intended to make the working visible, the problem solving itself does not always progress in a linear fashion, as highlighted by Hennessy and McCormick (1994). Therefore a linear assessment model, designed to mirror the documentation model, may not be the most effective appraisal method.

Many technology education researchers are suggesting ways to improve the synergy between thinking and making or knowing and doing. A pertinent question was recently raised by Martin and Owen-Jackson (2013): “Is design and technology about making or knowing?” (p. 64). They address this question from an historical and contemporary perspective, considering how these different philosophical foci have influenced curriculum and assessment task design. Their findings indicate that intense cognitive learning is required to advance skill-based and practical projects, and that these spheres of learning cannot really be separated into either skill-based or scholarly. They conclude that “good D&T teaching requires a judicious combination of both skills and knowledge” (p. 70). The work presented in this paper proposes that reflective writing can be used to enhance the required balance between skills and knowledge or theory and practice in D&T by engaging critical thinking, observational practices and dialogue around project development and assessment practices.

In the worst-case scenario, the reflective writing of a student in the mode of justification reads like a list of excuses related to the “imperfection and insufficiency” (Saito, 1997, p. 1) of the final prototype. In the best-case scenario, the reflective writing of a student critically analyses each stage of the design process and reflects upon their incremental decision making as well as the final prototype. Arguably, ‘critique’ and critical analysis rely upon the skills of reflective writing (Padget, 2013). Ideally, the student needs to be able to adequately communicate the development of their reflexive thinking through their reflective writing practice.

Vocabulary

Orr, Dorey-Richmond and Richmond (2010) describe how reflection promotes learning but remind us that the skills for, and literacy in, reflective writing cannot be assumed. In D&A it was commonly found that not only were the skills for reflective writing assumed, but that the meaning of the practice itself was often left entirely open to individual interpretation. This resulted in both educators and students deriving different understandings of what was actually required (Camino, 2010).

In technology we use a range of formal and informal reflective writing practices within design documentation and folios like a ‘design journal’ (informal) or a ‘design record’ (formal). The aim of the inclusions of these in assessment is to make the design process, or ‘design-thinking’ (including incremental decision-making based on experimentation), deep learning outcomes and higher order thinking visible. A deep learning outcome in technology might be described as an increased technological literacy or an increased capacity to synthesise both the theoretical and the practical design components or constraints and respond effectively to them through the application of appropriate materials, techniques and evaluation models.

Lockheart and Wood (Lockheart & Raein, 2012), founders and editors of the Intellect journal *Writing in Creative Practice*, conclude after ten years of research that language and literacy remains the key to reflective writing practice. They have described their ongoing interest in the “designerly” (Cross, 1982) use of language, the role of writing for designers and how it can inform students about their own practice through creative and critical thinking. They assert the importance of “linguaging” (Lockheart & Raein, 2012, p. 285) in the evolution of the design research process.

The introductory creative reflective writing tasks applied by von Mengersen (2013) were based on vocabulary building for increased literacy in the mode of reflective writing. The creative and often less-formal qualities of these reflective writing tasks were intended to make the process more student-centred, visible and less formal – more innately linked to the actual process (often in a less-linear way), and providing insight into the creative learnings achieved. The learning was seen to be most effective when:

- Learning journals are used regularly;
- Creative writing methods are introduced;
- Both primary and secondary modes of reflective writing are used (to encourage meta-cognitive awareness);
- Secondary stages of reflective writing are used for summative assessment opportunities and primary stages of reflective writing are used for formative assessment opportunities);
- Reflective writing is used as a tool to promote both creative and critical thinking; and
- Writing tasks consciously build more unique and meaningful vocabulary.

These aspects have been tested in an ongoing research project (The Studio Writing Project 2010-2014) by von Mengersen (2013) with visual art undergraduate and cross-disciplinary design and visual art post-graduate students. This study has clearly indicated that reflective writing tasks which support an

expansion of each student's individual vocabulary were among the most meaningful, clearly increasing student self-efficacy.

In seeking to equip students with the skills for effective reflective evaluation, it seems necessary to ensure they have the meta-language to do so. Lockheart and Wood's focus on "linguaging" (Lockheart & Raein, 2012, p. 285) encompasses key terminologies that students can use to demonstrate, and perhaps even prompt, higher order thinking in relation to their design process. The table below outlines the differences between terminologies aligned with justification (employed post-production) and critique (ongoing, embedded reflection). It illustrates some of the fundamental differences between disparate terms that need to be understood and addressed in order to more effectively embed reflective writing practices within curricula and assessment design in D&T.

In D&A there has been a movement to develop an alternative term to be used for assessing rigour in design practice. Lockheart and Raein, inspired by Wood (Lockheart & Raein, 2012, p. 286) have proposed 'inquisition' because it is more closely aligned to the principles of 'critique'. Critique, as a philosophical learning and teaching practice in D&T, can be described first and foremost as a close-reading, and secondly, as a sustained reflective analysis. Keirl (2005) describes the concept of critique in relation to D&T education: "Critiquing aids selection of thinking styles. Thus sophisticated critiquing is a form of metacognition. It is reflective and deconstructive." (p. 9). A regular practice of writing has been shown to support both close-reading or increased understanding and the capacity to apply skills of reflexivity. However, in D&T students' skills and vocabulary for the practice of reflective writing can easily be assumed, embedded as they are in tasks like the selection and application of cognitive organisers. Reflective writing for critique suggests that the practice of *critique* should be ongoing, intrinsic to every stage of the design process, and further, that vocabulary for reflection and critique needs to be developed. It is evident that both fields (D&T and D&A) are concurrently seeking to refine literacy terminologies necessary for the demonstration of higher order thinking and, essentially, a shift from justification to critique.

Literacy and the use of vocabulary, it seems, are both crucial to the success and 'quality' or meaningfulness of reflective writing. The literature review in D&T and D&A and the research (The Studio Writing project) clearly indicate that vocabulary expansion and individualization support student efficacy in reflective writing practices related to self-directed design projects. Therefore, if we want to continue to improve the quality and validity of reflective writing in D&T, we need to play closer attention to vocabulary. One simple question may be: are students using the vocabulary of 'justification' or 'critique'? Keirl (2005) suggests that critique is expressly linked to "more powerful meaning-making opportunities for students' learnings about technologies" (p. 1). If it is the students' reflective vocabularies that make their cognition and meaning-making visible to us, the educators, surely we need to enrich the pedagogy in this area of D&T education. Padget describes his "belief in the primacy of language in the learning process and how this links with creative learning and teaching and critical thinking" (Padget, 2013, p. xi) – therefore highlighting the point that without precise, specific metalanguage with which to articulate their learning, students' efforts cannot be either fully expressed or adequately measured. In reality, and for the purpose of assessment particularly, our students must demonstrate what they know through writing or language. Writing is an assumed mode of communication in many D&T assessment models, including written exams and digital or analogue design portfolios; therefore, vocabulary is vital. Arguably our students are assessed as much by what they write as by what they make. We assess their comprehension, their critical and creative thinking through both the product and the written word. Thus, it makes sense to question when, how and what we are asking students to write. Reflective writing has arguably become a normative practice in D&T, linked to summative assessment and written design evaluations. This research suggests that a creative approach (von Mengersen, 2013) alongside continual (formative) evaluation (Wesley et. al., 2010, p. 73) may be far more beneficial, with reflective writing practices having been shown to support both critical and creative thinking (Moon, 2008; Padget, 2013). In D&T, both critical and creative modes of thinking are widely acknowledged as vital to "good" design (Wesley et. al, 2010, p. 39). Keirl (2005) has described critique in D&T education as a "disposition" (p. 8). In light of this research, it may be considered that reflective writing has an important role to play in the ongoing evolution of a question-focused design discourse and the evolution of a 'disposition' of critique in D&T education.

Table 1: Literacy Terminologies	
Justification typically:	Critique typically:
provides a list of excuses for a poorly researched, tested and executed prototype	provides a comprehensive summative analysis of the design problem and uses language to evaluate the outcomes
is limited in scope, tends to focus on one or two aspects of the project that did not go according to the 'plan'	is capable of effective synthesis between theoretical and practical aspects of the design process
indicates a limited capacity to adapt and overcome obstacles within the design process	indicates a capacity to explore a wide range of incremental options within the design process
relies on one big idea and an assumptive process rather than a progression of incremental design decisions	offers an expanded view of possible design solutions and considers variables and major/minor adaptations
has left the documentation to the end and shows a lack of synthesis between the evaluation and the prototype	indicates through the documentation process a deep synthesis and organic parallel development; incremental progression within the documentation reflects the detailed nature of the design-based decision making that has been undertaken
has compartmentalisation of the documentation process from the design and prototype generation process	has the research, experimentation, reflective and evaluative observations embedded within both the prototype and the documentation
indicates limited technological literacy and comprehension	indicates a high degree of technological literacy and overall comprehension
indicates limited capacity to take risks and modify ideas during the design process	indicates an impressive capacity to invest in the design project, to take risks and innovate

A closer consideration of the relevant metalanguage may provide further insight. By examining side by side the verbs associated with each mode of thought, it becomes simpler to identify which are promoting extension and higher order responses. Such knowledge is a powerful tool in the construction of assessment and curricula.

Table 2: Metalanguage and Meaning	
Justification	Critique
Synonyms for justify: <ul style="list-style-type: none"> • explain • support • warrant • legitimise • establish • confirm • defend • excuse • validate • substantiate • absolve 	Synonyms for critique: <ul style="list-style-type: none"> • analyse • review • notice • assess • judge • comment • evaluate • appreciate • appraise • critique • elucidate

("justification", 2014; "critique", 2014)

Note that the vocabulary of justification seems to imply a certain defensiveness. By contrast, the vocabulary of critique seems characterised by a certain freedom, where the outcome is not so strictly defined. The critique metalanguage, essentially, suggests that any criticism is observational, and opens up concepts or works for inspection or examination.

In light of the differences between the two vocabulary sets, it may be useful to ask ourselves some questions when designing D&T curriculum and assessment tasks:

- What role does reflective writing play?
- What are students' attitudes towards reflective writing as a practice? How do they define it? Do they value it?

- How can vocabulary for reflective writing be expanded?
- How can reflective vocabulary enable critical and creative thinking?
- When do students have an opportunity to learn skills for reflective writing?
- When do students have a chance to practice their skills for reflective writing?
- Are there any formative assessments that include opportunities for reflective writing?
- Can students relate the practice of reflective writing to design thinking?
- Are there any opportunities for students to re-visit their insights?
- When does the task of reflective writing take place? At what point in the curriculum and assessment process?

This paper has by its nature asked more questions than it has answered. A brief literature review has been conducted to provide some context for an ongoing discussion into reflective writing and how it may practically support the application of 'critique' as a philosophical concept in D&T. This discussion draws primarily from research conducted in Design and Visual Arts education and indicates how D&T educators face some similar challenges and may, therefore, be able to integrate approaches from D&A that have been successful. The key conclusion that can be drawn (from both D&T and D&A fields) is the fundamental importance of language and literacy in critical thinking around design practice. This paper suggests that the application of critique as a holistic design-thinking practice may be enhanced by the timely inclusion of critical reflective writing tasks embedded throughout the design process in D&T. It asks educators to reflect upon how, where and why they are integrating reflective writing tasks. It suggests that both curriculum and assessment design can be modified to encourage this type of cognitive learning task in a less 'loaded' or formative model, alongside a post-project (summative) assessment-focused one. It is clear that reflective writing can be an important tool in the construction of questions – a vital aspect in the practice of critique. According to Keirl (2005, p. 8), "critiquing is about questioning rather than answering". It would seem that there is further scope to explore the relationship between *critique* and its application through reflective writing. Ideally, this may inform a shift in terms of student thinking and writing from the mode of 'justification' towards the mode of 'critique'.

As Moon (2008) discusses, reflective writing enables critical thinking. This paper outlines provisional research, and asks:

1. Could a shift in focus from justification to critique enable critical and design thinking? Could it be considered as another form of "cognitive" or "communicative" modeling (APU, 1994)?
2. How can reflective writing be used to embed authentic critical thinking practices throughout the design process?
3. Could a shift in focus support self-efficacy and increase technological literacy?
4. Could a regular reflective writing practice enable students to visualize their learning, think critically and evaluate throughout the process of making?

The initial research outcomes suggest that a regular reflective writing practice could lead to:

- More authentic reflective practices, documenting a shift in student perspective and awareness – what Fink (2003) describes as "significant learning" and Harfield (2012) as "transformative learning" (2012);
- Anticipatory thinking – what Atkinson (2012) has described as "the intangible designerly thinking" or "tacit design intelligence";
- A more "dialogic" assessment practice (Bain, 2012);
- Creative problem solving and taking risks (Atkinson, 2012; Bain, 2012);
- Life-long learning or self-learning (Harfield, 2012) or autonomous learning (Bain, 2012).

Conclusion

The nature of *critique* is that of an ongoing inquiry, where the construction of questions is primary. This philosophy can underpin a more effective evaluation process that is embedded throughout the breadth of design development rather than being limited to final reflective statements. Justification is primarily summative, whilst critique can be both formative and summative, with the broader aim of encouraging higher order thinking, life-long learning and above all a questioning or disposition of inquiry. Reflective writing practices encourage metacognitive process through expanding vocabulary, literacy and insight. This paper suggests that the two key factors in applying reflective writing are timing (the placement of writing tasks within design learning) and vocabulary (equipping students with the language literacy and terminology for accurate, more meaningful engagement and self-awareness). In the best sense, reflective writing is possibly about writing to understand even more than writing to be

understood (Ong, 1986). A focus on *critique* rather than justification aims to embed the culture of sustained questioning that ideally should reside at the heart of any learning environment or endeavour.

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