The Utility of Technacy Genre Theory in Technology Education: A Case Study into Food Technology Teaching

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ABSTRACT
There are many and varied forces that shape school curriculum, but one that is of specific interest discussed in this paper concerns the perception of Food Technology secondary curriculum in Australia. Maintaining and fostering a coherent and accurate perception throughout the food technology career, from school leaver to professional undergraduate studies, is critical for both the evolution of the field of knowledge and the need to keep up with increasing world demand for food technologists and food innovation. Food Technology is a well-established secondary school elective in curriculum offerings, yet a contradiction has emerged between the ‘school view’ of Food Technology and the ‘professional view’ of the same – career pathways are confused due to the use of identical labelling to describe two different practices, causing a significant problem for the food industry profession. With both the school sector and the professional sector each asserting their respective perceptions of Food Technology as correct, a method for clarifying and classifying the nature of the disjuncture between the two claims has been illusive. This paper asserts that at the heart of the problem was the lack of a theoretically valid and reliable framework that may help clarify and articulate exactly what form of technology capability is being taught in secondary schooling according to current curriculum. The research reported here draws on an empirically tested framework – Technacy Genre Theory. The framework offers an indexing system that can define the nature of the degree of agreement between two forms of technological practice. The research confirmed that the label of ‘Food Technology’ is perceived significantly and substantially different between schoolteachers and the wider, relevant food profession. The paper concludes with the proposition that Technacy Genre Theory offers a new method for comparing and clarifying many combinations of technological typologies of practice.

Key Words: Technology, Food, Technacy Genre Theory

INTRODUCTION
What do we mean when we say ‘Food Technology’ and its practical manifestation? While dictionary definitions may appear to be the obvious source for resolving the meaning of Food Technology, in practice the task is far more complex given the considerable systemic investments different stakeholders have made in the field of food technology studies. Additionally, the need to clarify and classify all forms of technology knowledge and practice emerges as significant given the plethora of materials, tools and techniques school students, school teachers and food professionals each need to navigate in differing context and purpose.

This paper draws on Turner’s 2012 Doctoral dissertation which critically analysed Food Technology in schooling and how well their form of practice aligned with that of the professional food technologists. In this context, the professional food technologists were identified as the reference group while the food technology and secondary teachers were identified as the comparative group. The study revealed

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Nutrition, healthy lifestyle and nutrition related adolescent food issues are the most obvious aspects of food content included in the curriculum. Many educators consider food preparation and safe handling essential life skills. Stakeholders report that students generally respond favourably to this aspect of the subject and utilise the experiences as a useful background to part-time employment and perhaps a later career. Students generally do not view food production and food processing in the same light and generally equate food technology with the hospitality industry (KPA, 2003, p. 40).

The study aimed to clarify a long-standing problem between two groups using the same label, each claiming their version as correct for Food Technology, and establish the best way to identify the forms of technology practice to facilitate best practice in Food Technology education. Yet, little theoretical work was evident that sought to assert a universal and transferrable foundation to the ontology of technological knowledge itself. Literature surrounding the study and form of technological knowledge suggested the field remains essentially disaggregated but there are associations of durable value proposed (Barlex & Rutland, 2003; Barlex & Trebell, 2008; Compton, 2009; Dakers, de Vries, Custer, & Martin, 2008a; de Vries & Ilja, 2006; Dugger, 2010; Elshof, Keirl, McLaren, & Seemann, 2010; Feenberg, 1991, 2006, 2009; Ihde, 1979, 2009; Jideani & Jideani, 2010; Keirl, 2009, 2010; Misa, 2003; Owen-Jackson, 2001; Petrina, 2007; Rutland, 2009; Seemann, 2003, 2009, 2011; Slaughter, 1999; Williams, 2011). Yet common to contemporary technology education learning, independent parts tend to segregate rather than act as a whole system of integrated learning. A limitation of many school design-oriented frames for the study of technology is that the process approach is often formulaic with little reference to the technological form of the knowledge being studied. A risk with such approaches is that while design studies may enable higher order thinking in the process of designing, very little of the same is offered to the form of technological knowledge itself. This dominant focus on design at the expense of technology studies, can introduce an element of risk with the task of technological judgement and choice.

Furthermore, in terms of formal technology education, the diverse ways society seek to conceptualise technology practice suggests that while we may all see intuitively some aspects of technical knowledge linking together, we equally struggle to clearly articulate it all into one whole universal model. Technacy Genre Theory referred to hereafter as TGT, offered a way to value a proper place for both a cogent examination of technological understanding as well as the role that design plays in the educational process. The universal structure of TGT contains an interrelated outside genre system (knowledge, tools and ingredients, materials and ecological elements) that define the purpose and context parameters and as such provide a lens to identify different types of technological practice and knowledge. One of the
key ideas underpinning TGT is that the form it takes as an explanation of technological knowledge, is that it repeats upon itself as well as links to other forms in a ‘fractal’ relationship. This proposition makes TGT scalable and offers a way to see how complexity may arise out of simple relationships between people, tools and ecology when they are combined to meet a purpose in an applied context setting. In concert with this theory, historical western proponents for a schema that integrates social, cognitive and material experiences have been identified through the literature and writings of Dewey (1938); Hegel (1989); Marx (1974,1967).

METHOD
A mixed-method design using a triangulation approach was chosen to compare historical literature with contemporary knowledge and understanding between teachers and non-teachers. A cross-sectional survey instrument was designed so that a systematic investigation of relationships between two variables could be compared and to what extent two groups differed on the outcome variable: Food Technology. Although the research contained a particular focus between the two groups, sub-groups containing the same characteristics (used to create the strata related to the dependant variables) were built into the research design. Perception grids, Likert and Ranking scales were used to measure items in the instrument. The questionnaire, validated by four pilot surveys prior to distribution, involved a multi-mode method using both paper and electronic format. Participants were previously informed about the nature of the survey, as well as their voluntary and confidential participation. The validity for using both qualitative and quantitative research within the same framework incorporated the strengths of both methodologies and responded to the need for clarification across multiple issues, thereby providing a complete picture of the analysis of findings in a single study (Creswell, 2003; Johnson & Onwuegbuzie, 2004). This allowed for pragmatic assumptions that sought improved reasoning for educational policies and arguments concerning social and human factors.

The overarching umbrella question that addressed this research was:
1. To what extent is Food Technology in schooling well placed to meet emerging policy and economic demand for food innovation expertise as innovative and sustainability informed Food Technologists?

The two sub-questions were:
2. What is the evolution of policy and industry knowledge in Food Technology?
3. How can forms of technology practice be identified in Food Technology education?

The theoretical framework, the methodology for this research was structured around contextual and goal orientated aspects of practice through three phases: 1) Historical and contemporary literature review, 2) Scoping study (interviews and discussions; classroom & fieldwork observations), and 3) Data collection and analysis (survey instrument). For each phase, the key elements of TGT, human agency, tools and materials, and ecological aspects of practice were of a specific interest. This allowed for meaningful dimensions in the study to be collected in different ways and patterns identified.

DATA SOURCES
A stratified random sample method was used to collect data. Both Teacher Training (the comparative group) and Non-Teacher Training (the control group) equaled 191 participants each. Four groups and three consecutive sub-groups for each group were classified as:

A) Teacher Training: Food Technology (n=78)
   • Secondary food technology teachers; undergraduate students training as teachers in food technology; academics
B) Teacher Training: Areas other than Food Technology (n=58)
   • Secondary wood, metal and computer teachers; undergraduate students training as teachers in Industrial Technology; academics
C) Teacher Training: General Secondary (n=55)
   • Science teachers; undergraduate students training as teachers in the sciences; academics
D) Non-Teacher Training: Food Scientist Technologist (n=191)
   • Food technologists and scientists; undergraduate and post graduate students; academics

THEORETICAL FRAMEWORK
TGT was used to guide the direction for collecting, analysing and mixing qualitative and quantitative aspects for the various phases in the research process. It was hypothesised TGT could empirically measure a high degree of precision between two different types of technology genre and thus articulate their specific form of knowledge, technique, tool and material elements. The classes for this study included food technology as a science index and food hospitality as a vocational index. Therefore, the stronger the participant was in choosing food science or hospitality, the clearer the participant was about the technology genre they practiced. The weaker the participant was in choosing food science or hospitality, that is, alternates between the two, detected confusion about their technology genre. Science was allocated a higher score, while hospitality was allocated a low score. The genre instrument was able to detect where a participant was positioned in genre.
For example, a high Technacy Genre Index approaching 1.0 suggests a strong science, innovation and food design orientation; a low index approaching 0.0 suggests strong vocational, cooking-skills, conservative orientation to the purpose and practice of Food Technology. \( (\alpha = 0.05, n=382) \).

Diagram 2: Framework to classify forms of Food Technology knowledge and practice (Turner, 2012)

TGT provided a robust frame of reference and organisational guide to gather and examine data and information of the perceptions and values between the teacher-training group and the non-teacher training group for food knowledge, tools, material and ecological elements of food technology practice.

KEY FINDINGS

Conventional standards were used for the reporting of statistical tests where the significance level was stated \( (\alpha) \), and degrees of freedom (df), probability value \( (\rho \text{ or } .\text{sig}) \) and type of test \( (T-\text{Test}: ANOVA-F \text{ or Correlation-N}) \) declared. Where a statistic was declared as significant, \( (\rho) \) was less than or equal to \( (\alpha) \).

Understandings of, and expressions common to food science and technology, were compared between the teacher training and non-teacher training groups using perception matrices. This technique was adapted from a single grid method used in a similar study designed to discern psychology student views about the nature of human knowledge by Provost, Martin, Hannan, Bath & Lipp (2007). In Turner’s study, three matrices of twenty-five questions contained mixed ‘food’ related phrases used in food technology and hospitality settings under TGT headings 1) Knowledge and techniques, 2) Tools and equipment, and 3) Materials and Ingredients. Participants were asked to circle up to 10 phrases they had used or that best described their understanding in knowledge and techniques, tools and equipment, and ingredients used in Food Technology. Data was analysed through a scatterplot matrix to identify relationships or differences between three variables: 1) Knowledge and techniques, 2) Tools and equipment, and 3) Materials and Ingredients. It was hypothesised that two different forms of Technacy Genre practice would be evident: food science and vocational operational skilling. The stronger participants were in choosing either of the two, the more determined the clarity of their technology genre. The Pearson’s 3x3 correlation matrix shows a very strong three-way interdependent pattern, as predicted in Technacy Genre Theory. Knowledge-Tools \( (n=382, r=.823, p < .000, 2\text{-tailed}) \); Knowledge-Ingredients \( (n=382, r=.742, p < .000, 2\text{-tailed}) \); and, Tools-Ingredients \( (n=382, r=.790, p < .000, 2\text{-tailed}) \).

Figure 1: Correlation matrix for Food Technology priority systems

A Technacy Genre index score of 3-4 was applied to seven questions out of fourteen questions in a four point Likert Scale. These indicated a strong science, innovation and food design orientation theme. The remaining seven questions were indexed as indicating strong vocational cooking-skills and conservative orientation in theme (Alpha=.05; n=325). Table 1 and Figure 2 display group mean scores from question bank 2 in the Likert Scale. In this question, participants were asked for degrees of agreement for the purpose and practice of Food Technology as a learning area for self-sustainable cooking skills. There was a significant difference between the teacher training and non-teacher training groups. Teacher Training (n=164; Teacher index=4.11) vs. Non-Teacher Training (n=125; Food Technologist index=3.06); (df=1, t=8.593, p<.000, 2-tailed).

Table 1: Food Technology as self-sustainable life skills and cooking

ANOVA data analysis revealed teacher perceptions of Food Technology were strongly skewed toward vocational cooking-skills and conservative orientation in

Theme. This suggests the Food Technology 7-10 syllabus may not provide an adequate lead into the senior Food Technology syllabus as well as what it was designed to do or perhaps teachers are misinterpreting the syllabus. Teacher Training: General secondary index=4.25 (n=48); Food teacher index=4.09 (n=68); Areas other than Food Technology index=4.00 (n=48). Non-Teacher Training: Food scientist technologist index=3.06 (n=125); (df=3, F=25.061, sig.=.000).

![Figure 2: Food Technology as self-sustainable life skills and cooking](image)

In addition, qualitative data was tested and compared in purpose and context of written and verbal feedback with the quantitative data. Although smaller in sample size, nonetheless Figure 3 further substantiates a heavy emphasis toward cooking and food processing (Teacher Training group, n=54). In comparison, the Non-Teacher Training group display a small mean score for cooking (n=19), yet this overlap suggests not all food industry processes occur in a laboratory or a processing plant, but often cooking is a process undertaken during preliminary food design and development in a domestic style kitchen. The small response for food experiments by the teachers suggests that some in the teaching collegiate engage in the science of food through experiments to better understand food-processing outcomes. Figure 3 suggests a heavily skewed view toward nutrition. Although nutrition is an important element, marginalising other elements constitutes an uneven outcome in technological learning, thinking and practice. Closer parallels were evident for food safety and quality and food sustainability, but given much less importance (n=92). The food profession also valued nutrition the highest (n=56) and for both groups this shows an interest to maintain healthy food choices. However, ecology and food sustainability were noted as the lowest for both groups and this suggests the importance to raise the bar in training to link eco-footprint more deeply into teaching and learning and the expertise and purpose of food research.
CONCLUSION
The results from this research identified a perpetual problem of a flawed knowledge base in curriculum representation and teacher interpretation that has affected rigorous study in food technology. While it could be argued that the differences are too great and not in agreement between the school view of Food Technology and the wider professional view of the same, the point of concern is that the subject has not evolved due to the curriculum writers and teacher’s historically acculturated view of the subject. Consequently, this has had a major impact in ‘supplying’ people into professional studies towards a career as a food technologist in the agri food industries. The research established two contrasting and emergent themes that may contribute to the disparity in teacher training and non-teacher training contexts – Teacher training is humanities oriented, emphasising ‘food technology’ as a general education while non-teacher technologists training is sciences oriented, emphasising ‘food technology’ and ‘world food demand challenges’ as a scholarship in innovation. These opposing background disciplines between the participants present disagreement due to generalist knowledge rather than specialist knowledge for discipline content.

The research highlights the importance of purpose and context, which plays in technical activity as the association with human agency, determines the type of experience learnt and the material and environmental interconnections that may be valued. This paper asserts the empirically tested Technacy Genre Theory underpins conceptual and praxeological understanding of technology as a universal framework for all its forms. While the research uses Food Technology education as an example of a contested field of knowledge, the ideas and methods presented in this research make a case to be transferrable to other forms of contested technology knowledge and practice.

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