The Ethnomathematics of Financial Planning

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Drawing from a critical perspective on the discourse of mathematics the aim of this study is to explore an 'ethnomathematics' evolving in advanced capitalist society in an area that impacts on the lifeworlds of its members - savings and investment. The focus will be on the literature produced by the superannuation, insurance and unit trust industries for the purposes of client communication. Implications for mathematics education will be considered. This paper provides a summary of the theoretical underpinnings of the study.

Background

The gap between school mathematics and 'real life mathematics' is most often described in terms of concepts. The gap can also be described in terms of the differing cultural values associated with mathematics, the explicitness versus the implicitness of the mathematics, the extent and nature of the social uses of mathematics in the classroom in comparison with society in general and the degree of 'match'.

My interest in how mathematics is used by the financial planning industry stems from having been a high school maths teacher for nine years before beginning a six year position as a financial planner with a national company. Until that time I had been very knowledgeable of one corpus of mathematics - school mathematics. As a teacher I had accepted its code, its language, its structure, its culture. As a maths worker in a different context i.e., that of money management, I was confronted with another corpus of mathematics - familiar in many respects but very different in others.

In the latter context the mathematics was often so deeply embedded in other discourses that it was sometimes almost invisible; other times, it appeared as 'surface mathematics' with accuracy forfeited for the sake of its power to persuade. On the one hand, mathematics provided the structure for almost every aspect of the process from investing to recording; on the other, very little mathematics seemed to be required in servicing clients. This contrasted dramatically with the clinical presentation of mathematics in class, unadulterated by the real life issues of choice, risk and values. I became interested in the gap between the mathematics used in the two sites - the classroom and the financial planner's office.

Research problem

The aim of the project is to develop ways of analysing mathematical texts that will reveal the mathematical knowledge in the social practice of financial planning, how it is being transformed by the 'knowledge society' (Stehr & Ericson, 1992) and how it is used to position the consumer. Mathematical texts are the written material containing either explicit or implicit mathematical content produced by insurance and superannuation companies, fund managers and financial planning organisations for communicating with consumers or potential consumers. Texts are drawn from the prospectus, advertisement, report and newsletter genres. Using Bishop's conceptualisation (1988, p. 82), the mathematics is described in terms of activities, the symbolic technology of language and symbols and the incorporated values. It includes both explicit or visible mathematics and implicit mathematics which is the mathematics 'embodied' or 'frozen' in the objects, systems and structures of society (Chevallard, 1988; Keitel, 1989; Noss, 1994).

Questions framing this study draw on Skovsmose's critical mathematics approach (1994) of 'mathematical knowing', 'technological knowing' and 'reflective knowing' to the field of financial planning rather than to his locus of interest, mathematics education. Mathematical knowledge refers to mathematical skills and algorithms; technological knowing refers to the application of mathematics to the models that provide the blueprints for the technologies that structure society; and reflective knowing is about reflecting upon and evaluating the use of mathematics from the perspective of the individual and the community.

Major questions framing the study are:

1. How do the 'universal' mathematical activities of 'counting, measuring, locating, designing, playing and explaining' (Bishop, 1988, pp. 22-23) or 'ciphering, measuring, classifying, ordering, inferring and modelling' (Borba, 1990) present themselves?

2. As a semiotic system how are language and symbols used to convey mathematical meaning?

3. What are the 'implicit' and 'explicit' mathematics?

4. What assumptions are being made about mathematics?

5. How is the discourse of mathematics embedded in other discourses eg, those of technology, consumerism, the expert client relationship (Stehr, 1992), advertising, regulation?

6. What is the implied role assigned to mathematics and technology in financial texts?

7. What assumptions are being made about mathematics by the producers and consumers of the texts?

8. How is mathematics used to position the consumers as readers of the text?

Theoretical Background

Underpinning this study is the understanding of mathematics as cultural and social constructs. The underlying epistemological perspective is that knowledge, including mathematical knowledge is 'culturebound, value-laden, interconnected and based on human activity and enquiry' (Ernest, 1991, p. 197). Hence 'knowledge, ethics, and social, political and economic issues are all strongly interrelated' (Ernest, p. 197). A philosophical basis legitimates conceptualising mathematics as a cultural product.

Until the second half of this century foundationist philosophies defined mathematics as a static body of externally situated knowledge to be transmitted from the teacher to the learner. Its claim to objectivity and infallibility made it superior to any other form of knowledge. Underpinning this perspective were the ontological and epistemological positions of a fixed reality and a theory of knowledge that included a foundationist basis as justification.

Developments in philosophical thought in the second half of this century offered the opportunity to reconceptualise the nature of mathematics. In response to inadequacies in classical philosophies, nonfoundationist epistemologies emerged that maintained that knowledge could not be justified by appealing to any ultimate base because no such bases existed. Furthermore, the soundness of the 'logical' methods employed to prove the truth of beliefs was also questionable. Philosophers now argued that there is no absolute truth because knowledge is a product of a particular historical moment that has been shaped by cultural and social forces. The possibility of multiple knowledges with their 'correctness' being determined by criteria other than the vain attempt of 'absolute proof' was now considered.

Mathematics, albeit one of the last bodies of knowledge to redefine itself, also moved from the world of the abstract ideal to the worlds of human practices.

The process of knowing as well as the product of knowledge came under philosophical scrutiny and the social and cultural aspects of mathematics become matters for philosophical considerations. Its claim to being value free was discredited and it was recognised to be the carrier of certain values that benefited some members and groups of society more than others.

Mathematics viewed as socially, culturally and historically grounded validates a sociology of mathematics. In addition to looking at how human interests are involved in the construction of knowledge, sociology also explores concepts fundamental to how we construct reality. Two concepts essential to an understanding of the relationship between money and value are time and space.

In broad terms, 'the sociology of mathematics is the study of mathematical work as a sociocultural activity and process' (Restivo, 1991, p. 163). In a sociology of mathematics, mathematics can be spoken about with reference to 'social power, social structure, social class, culture and values' (Restivo, p. 161). Mathematics then is 'domain-specific, context-bound, and procedurally rooted' (Stigler & Baranes, 1989, p. 258), and sociologists of mathematics take mathematics to be a generic term for a number of social practices - e.g., that of the pure mathematician, that of the school mathematics teacher, that of the engineer, that of the accountant, that of the student. In this study it is the mathematics of financial planning. Restivo (p. 170) comments that as a valued system of knowledge mathematics tends to 'develop and change in ways that serve the interests of the most powerful groups in society' with an ensuing relationship between mathematics, class and power. A significant arena in which this relationship is played out is in the industry of wealth creation.

Interpreting mathematics as social and cultural constructs offers a philosophical basis for ethnomathematics. D'Ambrosio (1985, p. 45) provides the standard definition of ethnomathematics as 'the mathematics practised among identifiable cultural groups, such as national-tribal societies, labor groups, children of a certain age bracket, professional classes, and so'. Borba (1990, p. 40) defines mathematics as both knowledge and a way of knowing and describes ethnomathematics as the mathematical knowledge 'expressed in the language code of a given sociocultural group ...tightly linked to its reality and being expressed by a language .... umbilically connected to its culture, to its ethnos'. In these terms, one can speak of the ethnomathematics of the financial planning industry.

The ethnomathematics perspective has provided the scope to study the mathematics of different cultures (Lancy, 1983; Zaslavsky, 1979; Ascher, 1991; Harris, 1991) and the mathematics of particular groups or contexts within a culture such as carpet layer's work (Masingila, 1993) or supermarket shopping (Lave, 1988). Much of the theory development and actual studies have occurred in third world countries (D'Ambrosio, 1985; Gerdes, 1988) and have included a strong social justice theme. This study attempts to apply the theoretical background developed in this research to the description of an ethnomathematics produced by capitalism.

The dialectic relationship between the mathematical knowledge of the financial planning industry and society will be explored within the framework of the five constitutive elements of advanced capitalist society. It is a **consumer** society, a **technological** society, a **risk** society, a **regulated** society and it is a **knowledge** society.

A brief description of the investment advisory industry indicates how it typifies the new structures evolving in such a society. The development of the advisory industry is a logical development as the centre of the economic system, the financial system, develops. The financial system is made up of a large number of institutions which together supply the finance necessary for the 'real' economy to function effectively. The household sector which includes individuals and family units constitutes the major saving sector and therefore the major supplier of surplus funds. Most of these savings are held in financial institutions such as banks, building societies, credit unions, life insurance, pension funds, and investments like unit trusts. The role of saving and investing is important in providing the finance needed by the business and government sectors. Compulsory superannuation is one factor contributing to almost all adult Australians being either active or passive investors.

The financial planning industry owes its existence to technology especially computers which has allowed it to establish structures and systems to deal with millions of investors. Using the 'expertise' and mathematics specialisations of economists, financial analysts and accountants, it has generated products and services marketed by 'expert' financial planners to 'the masses'. Investment and insurance products epitomise the nature of consumer products in modern society as described by Qualter (1991). The products are not made by the people who consume them and rarely do investors know how the product such as an insurance bond or a unit trust was made and by whom. Often the only interaction is the transaction with the seller who in most cases is not the producer. In our case, cash money is exchanged for another form of money. There is no relationship with the actual products and workers of the businesses in which the funds are ultimately invested. The only representation of the product purchased is the original certificate testifying ownership and ongoing statements reporting value in terms of figures. Qualter goes on to argue that the lack of connection between the consumer and the production process results in the consumer having little control over consumption. The role of advertising then becomes redirecting people 'from production to consumption by promoting a vision of a commodity rich way of life' (Qualter, p. 40). Mathematics is a significant resource used in the advertising of financial products.

In this context, technology refers to more than hardware such as machinery and computers. Developing Ellul's interpretation of technology as a fundamental social structuring principle, Skovsmose (1994) refers to technology in terms of 'technological megastructures of society' (p35). Keitel (1989, p. 8) adopts Luhmann's definition of technology as 'the science of the causal relations which underlie practical intentions and which have to be acknowledged if these intentions aim at success'. She then describes the principles that shape technology as being:

'*causality* (presupposing the aptness of chronological, linear, regular order), *rationality* (following the scheme of means and ends) and *sociality* (since the ends of actions are determined by social subjects)' (p.8).

Both Skovsmose and Keitel describe the role of mathematics in the development of the technology. Skovsmose claims that mathematics becomes the 'basic principle for technological design' (p36). It formats society in the sense that mathematics produces the algorithms for the mathematical model which will determine the design of the technological structure. The model forms the basis of a system and so freezes it. Keitel (1989) observes that once the technology is installed it's outside its original limited realm of significance. Savings plans offered by insurance companies and many fund managers are one example. With the client's authorisation, the direct debit system allows the company to debit the client's bank account. Each month on the same day, the same amount of money is withdrawn and invested. The investor has limited or no flexibility in changing the amount or the day. Hence 'reality is rearranged according to mathematics' (Skovsmose p. 50).

This prescriptive function of mathematics is recognised by Davis and Hersh (1988) when they give examples of 'prescriptive mathematisations' as being the measurement systems of time, space, income tax and life insurance. Unitisation of investments is another prescriptive mathematisation that is fundamental to the financial planning industry. Keitel (1989) provides further examples of mathematisations: the clock, the double entry bookkeeping system and the 'balance of trade' technology of economics.

Mathematics then is an essential precondition of technology but not the only one. Referring again to the principles of causality, rationality and sociality Keitel states that

'one can only partly be introduced to an understanding of mathematical technology by referring to mathematics itself, since the means-and-ends-relation stringently requires knowledge about both the objective and subjective contexts of the interference as well. Hence an introduction to the understanding and evaluation of technology ..... cannot be restricted to mathematical techniques or theorems but must constantly refer to a broad understanding of the subject of the context'(p.8).

In viewing mathematics as integral to a social and cultural context, the ethnomathematics perspective provides the scope to describe the relationship between mathematics, technology and society.

Western advanced capitalist societies then are shaped by high technology that is designed and controlled by 'experts' (Frankenstein, 1987; Stehr, 1992). In uncritically accepting the era of the expertise in life management practices ranging from health to wealth, consumers risk falling victim to a 'massified consciousness' (Frankenstein, p. 200) whereby they fail to appreciate the disempowering potential of the systems and services supposedly put in place to help them. Frankenstein argues that convinced of their own power of free choice consumers do not appreciate the power inherent in technology that structures and manipulates many aspects of their lives. Management of money is one such aspect. McBride (1994, p. 36) argues that even maths text books 'suggest to students that they are autonomous, rational thinkers impervious to cultural influences'. Texts do this by presenting mathematics stripped of cultural, social and historical context an thus having no connection with the values and experiences of everday living.

Relevance to mathematics education

The aim of this study is to offer an interpretation of the ethnomathematics of the financial planning industry. Accepting the notion that school mathematics which has been described, analysed and critiqued extensively, is also an ethnomathematics, then this study provides the opportunity for comparison of two ethnomathematics coexisting in, and produced by, the same capitalist culture. Comparisons of maths textbooks with financial mathematical literature may be in terms of mathematical concepts, language, values and the positioning of the consumer, i.e., the student or the client. Such comparisons may afford opportunity for further consideration of the relevance, significance and influence of the role of school mathematics curriculum in terms of its goals, content and pedagogy and culture.

In the education context, ethnomathematics is consistent with the ideology of the 'public educator' Ernest (1988, p. 197) as it favours a 'critical mathematics education that enables the students to reflect about the reality they live in and empowers them to develop and use mathematics in an emancipatory way' (Gerdes, 1994, p. 20). This necessitates a critical consciousness (Frankenstein, 1987) or what Abraham & Bibby term as 'conscientisation ... the process by which people become aware of how their experiences are structured and conditioned' (1992, p. 187). Understanding the relationship between mathematics technology and the individual is part of this process.

The exploration of the relationship between technology and mathematics in the field of financial planning also goes towards answering issues posed by Skovsmose (1994) concerning student awareness of the impact of technology on society, the role of mathematics in the technological development and the conditions and consequences of living in a technological culture.

Ethnomathematics reconceives mathematical knowledge in terms of its relationships with the cultural and social contexts in which it is embedded. The causes and consequences of an increasingly mathematised society requiring comparatively less and less mathematics of its members for day to day living (Chevallard, 1988; Keitel, 1989; Noss, 1994) can be studied in terms of the ethnomathematics of the society. Given the industry's focus on the relationship between money and the individual, the ethnomathematics of financial planning is likely to exhibit many of the salient features of the ethnomathematics of advanced capitalist societies. If the goals of education are to empower the individual and to educate for social change (Ernest, 1991, p. 199) then an ethnomathematical approach to the construction of mathematics should be able to inform pedagogy.

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