Chapter 20: Adults and Mathematics (Adult Numeracy)

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ABSTRACT

This chapter investigates the current state of knowledge of teaching and learning involving adults currently or potentially participating in educational activities where mathematics (or numeracy) is involved. It addresses relevant educational issues from socio-economic, technological, and personal perspectives of participants, educators and the general community (including business and industry). These include the complexity of defining the concepts of numeracy and mathematics education, the state of adults' knowledge and understanding of mathematics in both cognitive and affective domains, and the organisational structures (courses, curriculum, teachers, participants, teaching-learning processes) prevalent in further education. The heterogeneity of the field makes it impossible to provide a comprehensive overview, but the chapter provides a range of perspectives, and attempts to identify gaps in our current knowledge. This burgeoning field is resistant to definitive categorisation, but is being recognized as one of increasing importance to all stakeholders. We have suggested but a few of the substantial array of directions for future research, which could be informed by the disciplines of history, philosophy, psychology, and sociology, to name a few. Information was gathered from a literature review, comprised mainly of journal articles, books and conference proceedings, as well as authors' own collective experience.

1. INTRODUCTION

1.1 Numeracy and Mathematical Education – Two Terms for One Subject

The attempt to describe basic features of the field 'adults and mathematics' leads primarily to realising the great heterogeneity of this field: Heterogeneity is the very term for its description. Scholarship shows, of course, diversity within the field 'children/young people and mathematics' – especially when international comparisons are made. There is, however, a unique term used to specify the subject: It is always mathematics, or the children's relationships to mathematics. This is not the case with adults, where two main terms are

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used to describe the subject: mathematics and numeracy; other variations include mathematical literacy and critical numeracy. Whether the topic of interest is adults' relationships to mathematics, or adult numeracy, probably depends on the socio-cultural surroundings in which the research takes place. It is difficult to know which factors will determine the label of the subject. On one hand, the peculiarities of the school or learning place – and the educational system as a whole – may play a role, on the other hand, special cultural features may be important; for instance, the extent to which more pragmatic approaches are pursued in relation to those which are more theoretically-oriented and sophisticated.

In the German-speaking countries, for example, only the term 'mathematics' is used in scholarship and in public discussion – the questions are: how well adults are educated in mathematics, the extent of their mathematical knowledge, the requirements this knowledge should meet, etc. It is not clear what being mathematically well-educated really means. There are different interpretations of this term, and the following adopts a very broad perspective. According to this, being mathematically well-educated firstly means to have a sound mathematical knowledge, i.e. to know important concepts and methods and to be able to apply them in an appropriate way to various problems. Secondly, a mathematically well-educated person has acquired knowledge about concepts and methods typically utilized in mathematics – about their power, and about their limitations. Such knowledge about mathematics is very important; for instance, when results gained by mathematical means have to be evaluated, such as forecasts of the economic situation, or the outcomes of opinion polls. Having knowledge about mathematics implies knowing about the limits of the application of mathematics, too. Underlying a narrow concept of mathematics this kind of knowledge is called meta-knowledge. Thirdly, being mathematically well-educated includes having a clear picture of, and a critical, yet not too critical – in the sense of disapproving mathematics as a whole – stance on mathematics. Such a person has thought about his/her subjective experiences with mathematics and all the emotional involvement entailed, and about its value of utilization and of its meaning in our society as well.

In the Anglo-American area, however, the subject often is termed 'adult numeracy'. The meaning of numeracy also varies greatly (see, for example, Gal 1993; Galbraith, Carss, Grice, Endean & Warry 1992). In the Crowther Report (1959), where the term was used for the first time, it means 'the minimum knowledge of mathematics and scientific subjects which any person should possess in order to be considered educated' (quoted in Withnall 1994, p. 11). Nowadays too, being numerate means having developed certain basic mathematical skills applicable to various situations in everyday life. Within this framework, however, distinct aspects are stressed.

Firstly, there are differences with regard to how the subject is perceived. On the one hand, there is a societal focus: Numeracy is primarily related to socio-economic change and the technological development of society: It should correspond to these and serve the progress of society as a whole. On the other hand, numeracy is linked to the individual's life: The focus is on the individual. This approach is given great importance in the Cockcroft Report where the value of numeracy for a person's everyday life is the crucial aspect:

> We would wish the word 'numerate' to imply the possession of two attributes. The first of these is an 'at-homeness' with numbers and an ability to make use of mathematical skills which enables an individual to cope with the practical mathematical demands of his everyday life. The second is an ability to have some appreciation and understanding of information which is presented in mathematical terms, for instance graphs, charts or tables or by reference to percentage increase or decrease.
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> (Cockcroft 1982, p. 11)

Another difference in the understanding of the term 'numeracy' refers to the role emancipation has within this concept. On the one hand, numeracy is understood as a means of helping people cope with their life-situations. Withnall (1994) calls 'functional numeracy' a concept of numeracy which emphasizes its role for people's functioning according to the needs of the given society. On the other hand, numeracy is considered a means to gain insight into the structures of society and to enable people to take an active part in political decision-making. This aspect is stressed in particular by Evans in his concept of 'critical citizenship' which means 'engagement with discussions and debates about individual, family and public well-being, and about describing, appreciating, evaluating, deciding on future directions of public policy' (Evans & Thorstad 1994, p. 65). Other scholars taking this view are, for example, Webber (1988), and Yasukawa, Johnston & Yates (1995). Webber built on the notion of developing a critical stance. According to her, numeracy means 'developing the ability to grapple with a problem until we come to a critical understanding of it' (Webber 1988, p. 7).

A third aspect which is seen differently by scholars is the question as to whether numeracy is context-bound or not. Is numeracy a set of skills that can be separated from the practical situations in which they are used, or is numeracy always linked to the everyday context in which it occurs? Evans and Thorstad (1994) in particular, but other scholars too, argue that the numerate aspects of everyday activities cannot be separated from the general purposes and goals of these activities, nor from the social dimension of acting. The situation as a whole has to be taken into account. This implies that numeracy

can be learned and developed within specific contexts only. Besides, the question arises as to whether it is possible to transfer numerate ideas and skills rooted in one context to another. In any case it is open to question as to what purpose would be served by teaching numeracy concepts in isolation, even if they could be taught that way.

Finally, it should be mentioned that there is no agreement as to whether numeracy includes attitudinal factors. (This is also a question which has arisen in discussions about mathematical education in general.) On the one hand, scholars argue that education always covers attitudes, or even has to comprise them because cognition and affect cannot be separated from each other; on the other hand, some stress the differences and argue against their integration (McLeod & Adams 1989).

1.3 Numeracy and Mathematical Education – Is There Really a Difference?

Considering the fact that the use of the two terms – numeracy and mathematics education – has become customary, it is somewhat surprising that it is unclear where the dividing line between numeracy and mathematical education should be drawn. Protagonists of the duality often argue that numeracy is a restricted mathematical education – it is seen as a low-level mathematics, often taught by non-mathematicians, to people who have no aspiration to be mathematicians. At first sight it seems obvious to reduce numeracy to 'elementary' skills or abilities, and in practice numeracy is often understood in this way – that is, as having a good command of the four rules, fractions and percentages, being familiar to some extent with statistical description, or with the interpretation of (cartesian) graphs. But numeracy is not necessarily to be restricted to the skills or abilities mentioned above. If the thesis of its dependence on the context is taken seriously in certain cases, even an understanding of differentiation might be classed with numeracy – when it is helpful in the given context. For example, in discussions about economical issues certain facts, such as marginal rates, can be described exactly by the use of the concept of the derivative.

A second argument in favour of the duality of mathematics and numeracy is that numeracy means quantitative, spatial, etc. ideas in the context of a practice other than school mathematics or professional mathematics. The problem with this separation is that it is counterproductive to all efforts aimed at producing an understanding of mathematics where its use in everyday situations is an essential part. Besides, it is not always possible to discriminate between the context of school or professional mathematics and other practical contexts. Finally the question arises as to whether it is sensible to differentiate between numeracy and mathematics in further education; present day ethnomathematicians do not do so.

1.4 Differences in the Approach to the Subject

There are differences as well with regard to the general framework in which the scholarly discussion about adults and mathematics (or numeracy) takes place. There is a culturally oriented approach which understands the relationship of mathematics as a part of the manifestations of the mind and which is interested in the analysis of this relationship as far as it provides insight into our culture. The other approach to adults and mathematics (or numeracy) is motivated more by educational issues and perceived educational deficits. It is differentiated within itself: Positions vary from a general interest in adults' education, to a more pragmatic approach which deals with the subject within the context of development and organization of courses in further education in mathematics, to a focus on the role of mathematics in our society and on combating inequalities through advocating adequate mathematical education for all. The last position is held very strongly by adult educators who wish to see society change, and use this emancipatory approach to guide the curriculum (see, for example, Frankenstein, 1990).

The complexity of the field 'adults and mathematics' and of the scholarly approaches to this field is mirrored in this review. Hence, it is not possible in a chapter such as this to provide an overall perspective, or a definite focus.

1.5 Reasons for the Relevance of the Subject

Before going into the main aspects of the field 'adults and mathematics (or numeracy)' we want to deal with the question as to why this subject can claim to be relevant. Actually, mathematics didactics does not pay as much attention to adults learning mathematics as to the relationship of children to mathematics. This can be seen easily from the respective numbers of publications. We hold the opinion that it will be necessary in future to take more notice of the relationship of adults to mathematics, especially with reference to the structure of our society and the role mathematics plays in this society. We are aware that society and the (relative) importance of mathematics may be, and actually are, perceived and commented on quite differently; yet we think that the following description will be shared widely and therefore we base the argument for the relevance of our subject upon it.

The German philosopher Huelsmann (1985) calls western industrial society the 'Technological Formation'. This means that it is a dynamic system, in which an integrative structure works, combining government, capital, labour, and research – to name some of the most important factors of society only. This integrative structure is technology; in contrast to former ones, present society is constituted by the technology being produced and applied in it. Mathematics is a basic structure of the Technological Formation. This holds all the more if a broader concept of mathematics than usual is taken as a basis.