

# Numeracy in New Times: Implications for Youth, Work and Employment

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Current policies – educational and employment – focus on the importance of literacy and numeracy among young people. Simultaneously, new theorisations of education and society suggest that contemporary times are symbolic of radical changes in knowledge, work and leisure. Within these juxtaposing views, consideration needs to be made of what might be the new numeracy skills required by young people and employers in these new times. This paper reports on a large-scale survey designed to access young people and older people's views of numeracy demands of contemporary workplaces. Differences and similarities in perceptions suggest support for theorising numeracy in New Times.

## Work and New Times

Current educational and social theories suggest that times are changing. Patterns of work are radically different and are likely to change even more. The Australian Bureau of Statistics shows that more than 1 million Australians are self-employed and that the trend is increasingly upwards; and that more people than ever before are engaged in part-time, casual work. Unlike patterns of work in the past where the self-employed controlled the means of realising their labour (such as farmers, fishermen, etc); contemporary work is vastly different. Job creation is a key term; service industries and knowledge industries are key industries in the new work order; and contract employment (over permanent) is more common than before (Glenday, 1997). These are just a few of the increasingly different patterns of work in contemporary society. Simultaneously, the role of technology is seen to be central to much of the reformed work patterns. Working from home (rather than an office); using website and internet to sell or buy within a global economy are central to new work. With these changes, questions need to be posed as to the preparedness of young people for work in these times. Are youth prepared for these new work orders? How do schools and society prepare youth for work in these New Times? What are the core skills that youth need for New Times?

With a workplace and society radically different from the modernist society of the past, the implications for school mathematics needs to be considered. What forms of mathematics are going to be needed for most young people as they exit from school? Does school mathematics cater for the changes occurring in the wider society? This paper reports the perceptions and experiences of two diverse groups – young people in work, looking for work, or in school engaged in part-time work; with those of older people who are employers, job placement officers and teachers<sup>1</sup>.

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<sup>1</sup> This project is funded through a Australian Research Council Linkage Grant. Industry partners include The Gold Coast City Council, Gold Coast Institute of TAFE, SCISCO, Centrelink, Queensland Schools Authority, Adams Consultancy and Employment National. The views expressed in this paper are those of the authors.

## *Numeracy and Work*

A substantial body of research already exists that documents the numeracy practices across a range of workplaces and everyday sites. These include carpenters (Millroy, 1992); reception areas in hotels (Kanes, 1996); pool builders (Zevenbergen, 1997); street vendors (Carragher, 1988) and shoppers (Lave, Murtaugh, & de la Rocha, 1984). These and other studies of a similar kind have been useful in highlighting the numeracy practices within sites and the difference between such situated numeracy practices and those of school mathematics.

More recent theorising of mathematics education has brought forward a number of ideas about new forms of numeracy and mathematics for New Times. As changes occur in the workplace and society so too do numeracy demands. With the supersaturation of information, often presented in statistical formats, young people need to have a more acute sense of statistics than in previous times. Steen (1999) has argued strongly for what he has termed “statistical literacy”. This attribute refers to the capacity to critically read and interpret statistics. Other forms of new numeracies include business numeracy brought about the move to self-employment being experienced in most countries (Zevenbergen, 2001); and technological numeracy (Gowland, 1998) where new ways of thinking mathematically arise from the use of calculators and computers. How these new forms of numeracy are manifested in current school practices; how well schools prepare youth for these new demands is not well known; or how these positions resonate with the workplace is unknown.

Young people, characterised as Generation X or Generation Y, have been described as having particular characteristics including expectations of immediacy and relevance (Mackay, 1997). This attitude towards knowledge and learning can have implications for pedagogy and what is seen as important for both teachers and youth. It is particularly important to school mathematics where for many years students have bemoaned “why do I need to learn this” thus making such comments even more poignant than at any other time in history.

## Method

This data reported here is part of a three-year study funded by an Australian Research Council Linkage Grant. The industry partners have provided advice as to what are the key issues relevant to their industries and, in concert with the research team, had developed and trialled a survey to ascertain the numeracy demands across a range of industries in a region within South East Queensland. This region represents a post-modern society where there is minimal industry base and a reliance on tourism, service and leisure industries. A survey was distributed across the region where 6 cohorts of participants were sought. These included young people in schools undertaking part time work; seeking work; and employed. Participants representing the various sectors working with young people represented the other three cohorts and involved teachers in schools and other educational sites (e.g. TAFE, training industries); employers and supervisors in industries employing young people; and job placement officers across a range of providers in the region. Sample sizes varied depending on their relative representation across the region but in all cases other than employment placement, samples were between 55 and 380 with a total sample size of 880 participants. This paper draws on the combination of the data from the young people and compared against the combined data from the employers, teachers and job placement officers.

Using a five-point likert scale, participants were asked to rate various aspects of literacy, numeracy, general skills and ICT in terms of agreement with general statements as they related to the importance of the particular skill or knowledge to the person's work environment.. The rating scale used was 1 = strongly agree, 2 = agree, 3 = disagree, 4 = strongly disagree and 5 = not applicable. It was decided that a neutral position would not be made available thus compelling participants to take a definitive position on the statement but with the proviso that they would be able to indicate if they thought that the statement was not relevant. Quantitative data were analysed using SPSS to identify areas of significant difference. A range of analysis were undertaken using SPSS in order to identify key discriminating variables from the 50 questions posed. Participants were asked to rate the importance of various aspects of literacy, numeracy, ICT/computer use and general skills in the workplace (from their experiences). Examples of the particular skill were provided to clarify the particular variable. This is shown in Figure 1.

Numeracy Skills	Strongly Disagree	Disagree	Agree	Strongly agree	Not applic
Number work <i>counting,</i>	<input type="checkbox"/>				
Calculating <i>adding, subtracting, multiplying, dividing</i>	<input type="checkbox"/>				
Calculating proportions, fractions <i>Mixing foods, working out percentages, deposits</i>	<input type="checkbox"/>				

Figure 1. Extract from Survey demonstrating questions and scaling system.

In analysing the data, we wanted to identify areas of similarity and difference. It was our contention that New Times would impact on how participants saw the demands of the workplace. Young people, having grown up in a technology and information drenched society may be more prone to thinking within parameters where technology was integral to their conceptualisations. In contrast, it was thought that older people might be more prone to thinking within frameworks governed by old basics. We sought to identify, through the quantitative data and supplemented through the qualitative comments, whether this were the case.

## Results

The data collected and collated into the two cohorts yielded some interesting outcomes. A step-wise multi-variant analysis shows the weighted multiple linear combinations of the predictor variable best distinguished between the two groups. In step-wise order, the following variables were found to be statistically significant at less than  $p \leq 0.001$ .

- Computers for general use
- Statistics
- Industry-relevant technology
- Non-verbal communication
- Computer technology
- Number
- Industry-specific technology
- Volume
- Location

These results suggest that computers, and aspects of numeracy, are key variables in the differences between older and younger people in this study. While there is a concerted focus on literacy in contemporary debates about employability of young people, this study only identified one aspect of literacy as being a critical variable.

It would appear that older people (teachers, employers and job placement officers) saw number skills as being important learnings for young people. They consistently ranked these items as more important for work than did younger people. In contrast, younger people consistently ranked applied areas of numeracy – that is measurement (*vis a vis* location and volume); and statistics as being important variables. Indeed, statistics was seen to be the second key discerning variable in the differences between older and younger people.

### *New Numeracies*

One of the perennial questions in mathematics in the current context centres on definitions of numeracy. It is not uncommon for it to be seen as being related to number and number study (including operations). Such a view is more likely to be held by older people across the community due to the focus in school mathematics in the early to mid part of the 20<sup>th</sup> century being focused on arithmetic. In this study, it was found that older people identified number as a key variable in work. This is in line with many of the reports by employers and members of the wider society who bemoan the inability of many young people to undertake calculations and other aspects of number work. As one employer noted in the qualitative comments:

Employer: Young people do not seem to have the ability to mentally calculate things like we use to. They need to use a calculator to work out change when the cash register does not work. They do not know when the change they are giving is incorrect.

Employer: It gets frustrating when young people can't work out percentages. If they don't know how much petrol and oil is needed for the engine, then they will blow it up and that costs me a lot of money.

Both employers were seeing numeracy as related to number work. In the first example, the employer saw numeracy as being related to calculating money in a purchasing context, whereas the second example saw numeracy as relating to the calculation of ratios for petrol mixes. In both examples, processes related to the context were not considered, only the calculation of numbers.

In contrast, young people identified applied areas of mathematics - volume and location – as key variables. They rated these aspects of numeracy as being key variables. Considering the example above where the employer saw numeracy as being calculating “percentages”, it may be that young people see this type of example in an applied context. In this context, it may be volume. So, it may be that the differences observed may be due to definitions of how the participant interpreted the question. However, we would contend that it is more than interpretation of the questions. Rather we would suggest that young people are more likely to see numeracy as an applied notion. In part this is due to their familiarity with technology so that the cash register example cited above has demathematised the activity in the sense that the work with numbers has been reduced but other aspects of numeracy become more important. Such aspects would include number sense so that incorrect (and correct) amounts would be known intuitively. Estimation would be critical whereby the young person is able to

validate the amount to be tendered through guessing what the amount should be and then comparing this against the amount being shown on the cash register.

Shop Assistant: When it is peak time, you get people through all the time and some of them are really nasty. You have to be nice to everyone. One day I had this grumpy old man come through and I rang up his stuff wrong. Well he ripped right into me. Told me I was dumb and I needed to go back to school and that the company should give my job to an intelligent person. I got upset, but when I looked at his docket, I could see that I rang up one item twice and that's where the mistake was. I called my supervisor over to alter the till and he was going mad. I started to cry and my supervisor asked him to come over to the inquiry desk to fix it up. It is so hard when it is busy and it is easy to make a mistake but I could see what I did wrong, he just wouldn't listen.

Problem solving is integral to these skills so that the young person is able to apply their number sense and estimation skills effectively in a given situation rather than rely on technology to provide answers. The pressure to process customers quickly and efficiently is immense as identified by this young shop assistant, but it is also apparent that she could identify her mistake and was able to rectify it. But as she indicates, the older person was intolerant of what he perceived as her "innumeracy". The differences in the perceptions of the participants are commonplace and may well be due to different ways of perceiving the demands of the task. The shop assistant saw the task of addition of the items being the domain of the cash register and her role was to ensure that items were scanned effectively. In contrast, the older man saw the task of the shop assistant as adding the items and ensuring correct addition. When the cost of the items did not correlate with the purchaser's expectations, the young person was seen as being cognitively inferior. These differences in how numeracy is being lived through the activity supports the trends identified in the data set of the survey.

### *Statistics*

Young people identified statistics as a key skill in their work. This was an important variable using the analysis cited in this paper. This finding supports the general contention of this paper and its theoretical position that young people, having grown up in an information-rich society are surrounded by data so that statistics are an integral part of their lives. New Times are characterised by the supersaturation of information but how this is lived out in the workplace is unclear. There was no evidence in the qualitative comments to shed light on how young people were seeing the role of statistics as being important in their work lives. Further investigation in Phase Two will seek to identify how this variable is perceived and/or enacted in the workplace.

These two variables, as identified through the step-wise multi-variant analysis, support the contention that what are seen as key numeracy skills may be influenced by the society within which one lives.

### *The Importance of Technology*

As a key factor in theorising New Times is the role of technology, a series of questions were included to ascertain the impact/importance of technology in the workplace. As with the numeracy questions, examples were provided to clarify the questions posed. When considering the data related to the series of 8 questions posed, it was found that four variables were identified as being significant in the step-wise analysis. It was found that collectively older people saw the role of ICTS in the workplace as being very important, whereas younger people did not rate them as being

important. Furthermore, when asked about the use of ICTs in the workplace, older people were more likely to indicate that they were used often whereas younger people were more likely to indicate that they were used infrequently. This finding seemed incongruous with our expectations in that it would seem that young people would identify ICTs as being a key variable in the workplace. Some insights into why this may be the case can be drawn from the limited qualitative comments that were offered by participants. For example, in a comment offered by an employer in the retail industry, sheds some insights into the differences identified:

Employer: Young people come into the workplace unafraid of technology. They don't have the respect for it that older people do. They see it as something they take for granted. As we get more technology here, I can see that we will need to employ more young people. They rush into learning with the new cash registers and don't really want to listen when we are training them. They are quite happy to play with them and make mistakes. Sometimes, this can create huge problems when they push wrong buttons and customers get angry but they don't seem too worried about the mistakes – only that the customers are yelling at them.

This comment indicates a number of features, including the disposition of young people towards the use of technology, but more importantly, the way in which the employer sees technology. Here he indicates that a cash register is a form of technology. In the context of the discussion, the theme was around the use of computers and high-end technology. Interesting for this research is the ways in which 'technology' and 'ICT' may be conceptualised by younger and older people. This may have an impact on how technology is seen and used within the workplace. This different interpretation of technology can be seen in the comment below made by a student undertaking a traineeship in a cabinet making workshop:

Student in school-based traineeship: We learn all this computer stuff at school but when you get into the workplace, there is not a lot there. I mean, we have some stuff in the factory, but not a lot. There are some machines that you have to set things with [settings for drills] but that is about it.

In this comment, the student is working in a cabinet making factory where machines are used to cut timber, drill holes, and other tasks previously performed manually. This machinery allows for greater accuracy. Here the student is required to enter data via a touch pad to set the drill depths. The language used is that of a "machine". Such terms, historically, have a connotation of something mechanical whereas the student is referring to something that is computerised. The factory floor is very different from previous times where tradespeople were expected to undertake considerable measurements, but with the computerised machinery, this is substantially reduced and new skills are needed. The shift in discourse suggests that the conceptualisation of this young person in relation to mechanical to digital is a qualitatively different conceptualisation to that of the employer above.

These comments provide insights into how technology is being conceptualised, the older person seeing cash registers as highly technologised whereas the young person taking for granted the technologised workplace. Such comments, however, cannot be assumed to be justifications for the differences. They do, however, suggest avenues for further investigation, particularly in terms of what is seen as technology and ICT in the workplace.

## Conclusions

The data presented here suggest some support for the idea that numeracy in New Times may be very different from numeracy in old times. The quantitative data suggest that there are statistically significant differences between younger and older people when they are asked about the importance of various forms of literacy, numeracy, ICT and general skills for work. Numeracy and ICTs were identified as being key discerning variables among the two cohorts with 8 out of 9 variable being related to either of the two categories.

It would appear from the data, that older people are more likely to see numeracy vis a vis number as being a key determinant variable for work, whereas younger people are more likely to see statistics, or some applied areas of numeracy as being key variables for work. These differences align with the literature on New Times where there is a sense that the patterns and demands of work are changing considerably and in so doing so too are the numeracy demands. The limited qualitative comments offered through the survey support this general contention. Furthermore, the differences in views with regards to technology and ICT indicate that older and younger people potentially hold very different views as to the importance and role of technology in workplaces in New Times. Older people were more likely to identify it as being important than younger people. The differences in perception offer support to the notion that technology is a key aspect of New Times.

As this is the first phase of a three-year project, the data yielded in this phase provides some valuable areas for further investigation. As noted, further investigation of the role of technology needs to be undertaken. It becomes important to investigate whether or not the differences noted in this paper are due to how younger and older people define technology, or whether younger and older people use technology differently.

More importantly, it would be of value to investigate the numeracy practices of worksites to determine the literacy, numeracy and ICT practices across a range of sites. Through investigations of sites, it would become apparent as to how young people and older people perceive and use numeracy and technology in the workplace. This study highlights that there are statistically significant differences between older and younger people in their perceptions of the variables identified. What is less well established is the extent to which such variables are lived out in the workplace. If, indeed, there are different forms of numeracy being used and needed within workplaces in New Times, then there are ramifications for school mathematics.

Job Placement Officer: Time for educators to get real! Education lags behind industry and community needs. Attitudinal shift is long overdue. Educate for jobs, not just for those who make tertiary level.

Teacher: If we could get a better idea of what part of maths is needed for various jobs, we could then stress the relevance to students. Currently the most common phrase in maths lessons is “when will we ever use this?” and unfortunately for most kids the answer is “never”. If it was relevant they be more motivated to learn.

Employer: Teachers need to come into the workplace to see what we do so that they can then take that back to the schools so that they can show students what and why they need to learn maths. There are so many great things happening in work but I don't think any of it is ever seen in a maths classroom. Young people might then see the reason for why they need to learn maths.

In contrast, one teacher suggested that there is no need for changing school mathematics, as it is not the domain of school education.

Teacher: I don't think we should [change maths to enhance students' understandings of mathematics in relation to employment], Student numeracy develop at school should be for all aspect of life in general and not aimed at employment.

The data presented in this paper suggest that there is support for the theorising of schools, knowledge and society in New Times and the implications this has for school mathematics. The comments offered by participants in this study support the need for school mathematics to take a more applied approach to teaching mathematics for New Times. While there is not consensus on this aspect of mathematics education, the data presented here suggest that there are a number of ways in which school mathematics may need to be adjusted to cater for the demands of workplaces. The role of technology seems to have some importance – whether perceived or real is not yet clarified. However, it would still suggest that consideration of the role of technology/ICTs in school mathematics is important. Similarly, the areas of applied mathematics and statistics seem to be more important to younger people than older people. Further study needs to clarify why such differences occur and how relevant they are to school mathematics but it is clear that the implications for school mathematics should be recognised. The comments offered by participants suggest support for the overall notion of new numeracies for New Times. Making links between the world beyond schools and the school curriculum is recognised consistently across all cohorts in this study with the proviso that there is a concern by some sectors of the teaching community that such an approach is not the domain of school mathematics. This paper and the data presented questions if such a response can be considered viable in these New Times.

## Acknowledgement

Our thanks to Dr Phil Harker for his analysis of the quantitative data.

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